Translation and Web Searching

Vanessa Enríquez Raído

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The book presents a comprehensive study of various cognitive and affective aspects of web searching for translation problem solving. Research into the use of the web as an external aid of consultation has frequently occupied a secondary position in the investigation of translation processes. The book aims to bridge this gap in the literature. Beginning with a detailed survey of previous studies of these processes, it then focuses on web search behaviors using qualitative and quantitative analysis that presents a multifaceted overview of translation-oriented web searching. The book concludes by addressing the implications for the teaching of and research into translators' web-searching skills. With regard to teaching, the book's didactic discussions will make it a valuable tool for both translator trainers and translation students who want to familiarize themselves with the intricacies of web searching and to reflect upon the pedagogical implications of the study for acquiring online information literacy in translator training.

Vanessa Enríquez Raído is a Senior Lecturer in Translation Studies at the University of Auckland, New Zealand.

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Preface

The use of the World Wide Web as a source of information is part and parcel of the professional lives of modern translators and translation students alike. Online dictionaries, terminological databases, and electronic corpora all represent integral components of translation-oriented documentary research, yet, somewhat surprisingly, translation studies research, until very recently at least, has rather neglected this important aspect of translator behavior. Research into the use of the web as an external aid of consultation has frequently occupied a secondary position in the investigation of translation processes. Moreover, there are hardly any studies addressing the information behavior of (student) translators within other relevant domains, such as documentation, user studies, and information literacy.

Translation and Web Searching, which is a revised version of my doctoral thesis originally presented in 2011, aims at bridging this gap in the literature. The monograph represents the first book-length empirical exploration of web-searching processes for translation problem solving. In doing so, it represents an interdisciplinary endeavor at the interface of translation studies and information science.

The book starts with a detailed survey of previous studies of translation and information search processes, paying particular attention to methodological aspects of cognitive research. The book then moves onto describing a multiple-case study carried out to explore the web search behaviors of a small group of participants comprising four postgraduate translation students in their first year of study and two translators with three and fifteen years of experience, respectively. The qualitative and quantitative analyses that follow present a multifaceted overview of translation-oriented web search behaviors embedded in the translation of two popular science texts. The book concludes with a summary of the main findings of the study, where I will also discuss implications for the teaching of and research into the web-searching skills of (student) translators.

Given its strong focus on methodological aspects of translation process research, this book will be particularly useful for advanced postgraduate students and doctoral students, as well as for researchers with an interest in cognitive aspects of translation in general and in web searching for

translation problem solving in particular. Here, scholars will be able to benefit from the transferable nature of the study's research design, as well as from the in-depth discussion of data collection tools and the new categories of translation and search actions that I developed for this study. With regard to teaching, the book's didactic discussions will make it a valuable tool for both translator trainers and translation students who want to familiarize themselves with the intricacies of web searching and to reflect upon the pedagogical implications of the study for acquiring online information literacy in translator training. This comprehensive book represents the first study of its kind in the emerging and exciting field of research into translation-oriented web searching and will, I hope, contribute to research into the overall topic of translators' online information literacy.

Acknowledgments

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1   Introduction

To say in today's knowledge society that information and communication skills are at the very core of any professional activity involving a critical and informed approach to decision making is almost superfluous. That translation is one such activity, which is foremost knowledge based (Austermühl 2001) and "which constantly requires information," as well as decision making (Pinto Molina and Sales Salvador 2007: 532), cannot be emphasized enough. The global demand for knowledge dissemination, as well as the development of new information and communication technologies (ICT) have largely contributed to shape translators' role as "information users, processors, and producers" (Pinto Molina 1999, 2000). The multilingual, multicultural, and technological environment within which many of these professionals operate thus strengthens the role that documentary research plays as "a vital instrumental link in the chain of mediation and knowledge transfer that makes up translation, [i.e., as] an indispensable part of translational know-how" (Pinto Molina and Sales Salvador 2007: 532).

Translators' documentary competence is typically situated within the broader notion of translation competence. The importance that the former is given within the latter varies according to different multicomponent models of translation competence (e.g., Kelly 2002; PACTE 2005; Göpferich 2009a), which, in turn, draw on various notions of translation. For Mayoral Asensio, for instance, "translation is above all a problem of documentation" (1994: 118). From the perspective of documentary research applied to translation, Palomares Perraut and Pinto Molina define documentary competence as translators' specific abilities to manage any sources of information available in any format, quickly and with precision (2000: 100).

A notion similar to documentary competence is that of "information literacy." This concept, however, is more widely used within the area of higher education in connection with the instruction of information skills that may form the basis for lifelong learning. That is, it is a concept common to all disciplines and all types of learning environments. Pinto Molina and Sales Salvador remark that the "most frequently cited definition [of information literacy] is probably that provided by the American Library Association [ALA]" (2008b: 415). For the ALA, information literacy involves "a set of

abilities requiring individuals to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information" (ALA 1989, cited in Association of College and Research Libraries 2000: 2).

Like information literacy, the term "information behavior" (IB) is only starting to be used in the translation studies literature. The term is commonly used within the disciplines of library and information science (LIS), information studies, user studies, and documentation. Although IB, like documentary research, is not necessarily linked to the instruction of information skills, it does involve "those activities a person may engage in when identifying his or her own needs for information, searching for such information in a way, and using or transferring that information" (Wilson 1999: 249). Similarly, Pettigrew, Fidel, and Bruce conceptualize IB as "involving how people need, seek, manage, give, and use information in different contexts" (2001: 44). Furthermore, IB, like documentary competence and information literacy, is a rather broad concept that may apply to a wide range of information sources (in various formats) and formal channels, such as traditional libraries or the Internet, among others.

Although external sources of consultation in nondigital format are available to, and indeed are widely used by translators, today the Internet is probably the resource most frequently used by these professionals. Palomares Perraut and Pinto Molina's (2000: 111) survey on the information needs, habits, and resource use of professional translators shows that as early as 1999 the Internet was the most frequently used source of consultation, following translators' personal archives. The impact and penetration of the Internet have indeed dramatically transformed the way translators carry out their documentary research and address their information needs. Among other benefits it has eliminated previous constraints of time and space regarding the acquisition of information. However, its ubiquity and structure, along with the dispersed and dynamic nature of the information available on the web, pose a set of challenges for the critical evaluation, selection, and use of credible sources of information. As Pinto Molina and Sales Salvador point out, "today the problem is not so much accessing as locating the information needed to resolve a concrete problem or take a particular decision relating to one's work or daily life, realizing the needs of quality, rigour, suitability, depth and specificity" (2007: 534).

With the increasing global demand for translation and the critical role that the Internet and, in particular, the World Wide Web play as a source of consultation for translation problem solving and decision making, "the time is opportune to study information needs and behaviors of professional translators" (White, Matteson, and Abels 2008: 576). The study described in this book makes such an attempt. Given its pedagogical interest, this study focuses primarily on the web search behaviors of a small group of four student translators—as well as of two translators with different levels of expertise who took part in a pilot study—with the ultimate goal of

drawing implications for teaching. To this end, a multiple-case study was implemented within a real pedagogical setting that was facilitated by an introductory course on scientific and technical translation (with English and Spanish) offered within a postgraduate translation program in an English-speaking environment. This setup is in line with the views of Pinto Molina and Sales Salvador, who point out that "in order to improve instruction regarding the management, processing and use of information, it is now vital to obtain an in-depth knowledge of the users, their information requirements in given situations, the circumstances and contexts in which their information needs arise, the action[s] users take to resolve matters, and the use they make of the information once found" (2007: 534). The importance of developing information skills that can be used both for problem solving in domain-specific translation and knowledge acquisition in a number of fields of expertise is visible not only in the professional activities of modern translators but also in the translation curriculum of tertiary institutions worldwide. In Spain, for example—a country with a significant number of translator training institutions[1]—the acquisition of information literacy takes place within a core course called "Documentary Research Applied to Translation" (Documentación Aplicada a la Traducción) that has been part of the four-year undergraduate degree in translation and interpreting ever since it was first introduced in 1991. Credits corresponding to both the core and optional courses are distributed within this four-year degree across a two-year first cycle followed by a two-year second cycle. Documentary research applied to translation is mostly taught in the second year of the first cycle and is typically worth four credits (out of 240 credits needed to complete the degree). Although universities can vary slightly the number of credits in each specific area, the core content in translation and interpreting degrees remains practically the same throughout the entire Spanish university system. Despite the apparent rigidity of this system, additional instruction aimed at developing information skills may also take place within optional courses that make up the curriculum, such as "Computer Science (or IT) Applied to Translation," "Terminology," and "Electronic Tools and Resources for Translation."

Instruction in information skills via optional courses (as opposed to a specific course on information science and documentary research) seems to be the general case in most undergraduate translation and interpreting degrees across Europe.[2] It also seems to be the case in countries—especially in Anglo-Saxon countries—where translation and interpreting studies are only offered at the postgraduate level. In postgraduate programs of translation, such as the one-year program providing the research framework for the study presented here, course availability and time restrictions may not always allow for a core subject exclusively dedicated to the development of information skills. Integration of these skills in specialized translation courses (in addition to optional courses) would allow compensating for these restrictions.

Nevertheless, despite the obvious need of teaching translation students how to critically search, use, and manage various online information sources, there is, a bit surprisingly, very little research done on how students search for web-based information. Indeed, as Massey and Ehrensberger-Dow remark, "the relative weight accorded to information literacy by translation practitioners, trainers and scholars has yet to be underpinned by a significant body of research" (2011a: 194). A look at previous research into translation processes, where one would expect to find empirical studies addressing the (online) IBs of (student) translators, confirms that in this field of research there are indeed hardly any such studies. This is not to say, however, that translation-process research has not produced a wealth of studies concerning the use of translational aids as external sources of consultation. It is above all the study of dictionary use (as well as other types of resources) that represents a significant area of research in our discipline (e.g., Atkins and Varantola 1988; Varantola 1998; Mackintosh 1998; Livbjerg and Mess 1999, 2002, 2003; B. Nord 2002; Ronowicz et al. 2005; Prassl 2011). A thorough review of think-aloud protocol (TAP) research (Chapter 2) shows that there are, in fact, a number of empirical studies that have examined to some extent the use of reference material in translation (e.g., Krings 1986a, 1986b; Jääskeläinen 1987, 1989; Gerloff 1988; Kiraly 1995; Luukkainen 1996; Dancette 1997; House 2000). However, as these studies were mostly carried out in the 1980s and 1990s, their focus is primarily on the use of printed dictionaries and other reference material as opposed to electronic or web resources, despite the fact that the latter have been available to translators since the early 1990s. This phenomenon is most likely related to the type of data-collection tools available at the time in combination with TAPs, such as video cameras and retrospective interviews.

Nevertheless, as the review of studies using alternative methods and tools for research into translation processes (Chapter 4) shows, even in the first decade of the twenty-first century we find almost no process-oriented studies that combine more sophisticated methods and tools such as Internet logs, keystroke logging, screen recording, and eye tracking. These methods would be more appropriate to examine the use of electronic or web resources in translation. The various empirical studies that do examine the use of these resources (e.g., Lauffer 2002; Asadi and Séguinot 2005; Pavlović 2007) do not address the IBs of (student) translators as their main object of research. Massey and Ehrensberger-Dow are among the few researchers who "have only recently begun to systematically examine information behavior in the translation processes of students and professionals to determine how information literacy develops" (2011a: 193).[3] Their preliminary findings on translators' IBs are part of a longitudinal and ongoing research project called *Translation Tools in the Workplace* (Massey and Ehrensberger-Dow 2010a). This project, in turn, is part of a larger-scale project named *Capturing Translation Processes*, which, since 2009, has been conducted at the Zurich University of Applied Sciences with the aim of exploring translation processes

and the development of translation competence. Similarly, the University of Graz's *TransComp* project, which was launched in 2007, explores translation processes and competence acquisition, including the use of both online and offline resources for translation problem solving (Göpferich 2009a; Göpferich and Jääskeläinen 2009). Another ongoing research project—called *Observing Uses of Language Technology* (OPLT, or *Observation des Pratiques Languagières Technologisées*)—is the joint project carried out by researchers from the National Research Council (NRC) of Canada and translation studies researchers from the Université du Québec en Outaouais. As part of this project, which "aims at better understanding the technological practices and needs of professional translators" (Désilets, Barriére, and Quirion 2007: n.p.), research on the attitudes and work-related practices with regard to translators' use of wiki resources has been conducted by observing and interviewing professionals in their own workplaces (see Désilets 2007, 2010). Furthermore, a growing number of conference papers on the (online) IB of translators (e.g., Salmi and Chevalier 2010; Ehrensberger-Dow and Massey 2009; Massey and Ehrensberger-Dow 2009, 2010b; Hofer and Ehrensberger-Dow 2010) testify to the growing interest in this field of research. At the same time, we seem to be witnessing a shift away from solo researchers to research teams—a consequence of the application of multimethod approaches to the study of translation processes and the explosion of data resulting from these approaches.

A cursory look at previous studies within the areas of LIS, user studies, and documentation (Chapter 3) shows a wealth of research into the IBs of various user communities. While translators are not a major target group of research within these areas of study, there are a number of studies addressing their IBs. These include Palomares Perraut and Pinto Molina's (2000) survey mentioned previously; Pinto Molina and Sales Salvador's (2007, 2008a) case studies; and White, Matteson, and Abels's (2008) focus group study. In particular, Palomares Perraut and Pinto Molina address the information needs and information-seeking behaviors (ISBs) of a sample of ninety-six professional translators who completed an electronic questionnaire. Pinto Molina and Sales Salvador's case studies are part of a broad research project aimed at describing "students' conceptions of information needs, search and use (that is, their information behaviors), and also the views of both the community of professional translator trainers and interpreters" (2008a: 47). To this end, the authors collected their research data via an expert panel (carried out by e-mail) consisting of eight teachers in translation and interpreting. The data were then used to design a first questionnaire completed by 193 translation students and a second questionnaire completed by 35 academic staff members in translation and interpreting across several Spanish universities. White, Matteson, and Abels's study, finally, is based on focus-group interview sessions with a total of nineteen professional translators.

All these studies make a highly significant contribution to the identification of translators' IBs. However, as Massey and Ehrensberger-Dow admit,

"any survey of self-reported practices leaves a number of questions unanswered. . . . We can only properly understand what is being done in the workplace by employing additional methods . . . to monitor what is actually being used, how and why" (2011a: 203). The selection of the research methods and data-collection tools used for the study described in Chapter 5 is based on the overview of previous cognitive-oriented research provided in Chapters 2, 3, and 4. In these chapters, particular attention is paid to methodological issues involved in researching translation processes using both introspection and observation—that is, the two main research methods available to study cognitive aspects of translation. As shown in Chapters 2, 3, and 4 all these methods have their own strengths and weaknesses, hence the need for methodological and data triangulation. Furthermore, the choice of methods for any translation process–oriented research is necessarily constrained by a number of factors, including the type of research questions asked, as well as the availability of research participants, equipment, funding opportunities, and so forth. Of course, the ontological and epistemological positioning of the researcher should also be considered. To this respect, the essentially exploratory and qualitative nature of the study presented here is informed by previous web-searching studies (e.g., White and Iivonen 2001) that follow a contextual approach to the study of information search behaviors on the web.

It should be noted that web searching (or web-based information search) is a notion that can be presented under different headings such as IB, information seeking (IS) or ISB, information search behavior (ISchB), information retrieval (IR), and interactive information retrieval (IIR) (cf. Wilson 1999: 263; Aula 2005: 5). Most important, it is a notion typically restricted to the use of IR systems such as search engines. In the study presented in this book, however, the notion of web searching is not limited to search engine use only. Rather, it refers to all kinds of online actions carried out to *seek* and *retrieve* information on the web. Hence, the notion of web search behaviors will be used interchangeably with other IB-related notions, such as online information behaviors, search behaviors and information seeking and retrieval.

As Chapter 3 shows, from the perspective of IB the theoretical framework developed here draws on previous information-seeking models that adopt a problem-solving approach to the understanding of IB (e.g., Kuhlthau 1991, 2005; Wilson 1999, 2005). From the perspective of translation studies, the study draws on the cognitive approach to translation, also conceptualizing it as a problem-solving activity. In Chapters 6 and 7, the web search behaviors of the study's participants are then modeled based on the notion of a "web search task," which involves (a) the formulation of a search need, (b) the specification of one or more search goals, (c) the implementation of a search process, and (d) the selection of a search outcome for translation problem solving. The data analyses provided in these chapters follow an iterative process that moves from the research questions to the research data and

then, in line with the principles of grounded theory, from the emerging patterns to the literature, back to the research data, and so forth. This iterative research process leads to the summary of findings presented in Chapter 8, where implications for the teaching and learning of information skills are also drawn. In this last chapter, several methodological observations are also made and possible avenues for future research into the online IBs of (student) translators are proposed.

2   Translation as Problem Solving in Process Research

Prior to the 1980s, translation theory was mainly concerned with the study of translation as a product resulting from a translation process. This concern was primarily driven by an understanding of translation from the perspective of contrastive linguistics, where comparative analyses of the original text and its translation were carried out to hypothesize about the equivalence relationship between the two texts. Studies on product-oriented translation also "led to more ambitious hypotheses about what happened 'in between' the two texts so to speak, i.e., what the translational process was like that linked source text and target text, and many different models of translation were set up, often" reflecting a translator's competence (House 2000: 150).

While some product-oriented models of translation have attempted "to delineate the sequence (or parallel occurrence) of operations through which a translation 'emerges' from an original text, these models have traditionally not been based on empirical investigations into the 'black box', the translators mind" (ibid.). Furthermore, the study of translation from a purely product-oriented perspective was considered to provide "a very incomplete and often misleading way into the translation process, hiding both successful strategies and problems" (Bernardini 1999: 179). Consequently, translation studies shifted its "interest away from prescriptive and rather anecdotal attitudes, towards more descriptive, scientific positions," leading to an increase in the empirical study of translation as a process (ibid.).[1]

In studying translation processes, researchers attempt to understand what goes on in the translator's head (as opposed to what might go on) between the comprehension of the source text and the production of the target text. As it is impossible to observe the human mind directly, a number of research methods have been developed to indirectly gain access to the translator's mind. One such method, known as introspection, originally developed within the field of cognitive psychology. The data-elicitation tool most often employed in introspective research into translation is thinking aloud (TA), which involves asking translators to verbalize "their mental processes in real time while carrying out a translation task" (ibid.: 179). As Jääskeläinen explains, the main goal of TA is to

elicit a spontaneous, unedited, undirected, stream-of-consciousness type of account from the subject. To accomplish this, subjects need to be familiarised with the method by warm-up tasks prior to the experiment proper. The resulting data are messy, but it is the researcher's task to make sense of the mess; the translating subjects are *not* expected to analyse their performance or justify their actions, i.e. thinking aloud as a research tool is not, strictly speaking, a 'mode of reflection'. The subject's task performance is recorded (on audio- or videotape) and the tapes are later transcribed into *think-aloud protocols*." (2002: 108)

One should keep in mind that in any study aiming to make inquiries into cognitive processes, introspective methods such as TA do not give access to mental processes per se but to the products resulting from such processes (Nisbett and Wilson 1977; Kiraly 1995; House 2000). Thus, as cognitive (translation) processes are, as mentioned previously, not directly observable, translation process researchers have primarily "adopted the methodology of problem-solving studies in cognitive psychology to produce interpretable data" (Séguinot 1989a: iii).

Most of the process-oriented studies referred to in this chapter do indeed conceive of translation processes as problem-solving activities. These, in turn, have been monitored through two major categories or units of analysis: (a) the source text (ST) elements that translators work with—commonly referred to as SL (source language) segments, units of attention, and translation units, among others (the latter adopted here); and (b) the strategies they employ to translate said elements into the target language (TL). Given that my study also adopts a problem-solving approach to the investigation of translation-oriented web search behaviors, I will briefly discuss the nature of translation units and translation strategies in the following two sections, respectively.

2.1   TRANSLATION UNITS

The concept of the translation unit (TU) is, as Dragsted acknowledges, "far from being a well-defined" notion, despite the fact that it is an object of discussion "as old as the debate over translation equivalence and free versus literal translation" (2004: 11). Over the years, the discussion about the size and nature of the TUs translators *should* work with to produce good quality translations has been extensive. These considerations, aimed at determining the "ideal" TU, stem primarily from a linguistic and prescriptive point of view.

However, empirical studies of translation processes have looked at the different TUs translators actually *do* work with when translating; that is, they have examined "actual" TUs from an empirical and descriptive point of view (ibid.: 23–24; cf. Lörscher 1991: 92). In the following, I will only

refer to TUs as identified in empirical think-aloud protocol (TAP) studies that do explicitly address said units (and translation strategies) within a problem-solving approach to translation.[2] As further shown later in the next sections, these cognitive TUs can vary in size and nature, and might pose certain problems for translators.

2.1.1　Size, Level of Analysis, and Amount of Processing

Although it is not easy (or even desirable) to compare the results of studies carried out under different experimental conditions,[3] some of these studies report similar results regarding the length (i.e., number of words processed in each unit), level of analysis (i.e., the grammatical nature or linguistic rank of the units), and amount of units processed by different subjects (see Enríquez Raído 2011: 385 for a detailed discussion of these results). With regard to the length and level of analysis of TUs, for example, there seems to be a general preference towards the translation of shorter units at the clause, phrase, word, and group levels among both translators and nontranslators, especially among the latter (Dechert and Sandrock 1986; Gerloff 1986, 1987; Lörscher 1986, 1991; Kiraly 1995). Some professional translators, however, have been found to work with larger units (mainly at the discourse and sentence levels) than those used by nontranslators (Gerloff 1988; Séguinot 1989b; Lörscher 1996; Lorenzo 1999a). Malmkjær, for example, claims that "studies that have compared translation and source text pairs produced by novice translators with pairs produced by experienced translators show that the units formed in novice-translator pairs are smaller in extent and generally are of a lower linguistic rank (word, phrase) than are those (clause, sentence) formed in pairs produced by experienced translators" (2006: 92). Kiraly (1995), however, did not observe major differences in either the size or the level of analysis of the units processed by the subjects of his study, that is, novice and professional translators.

As far as the amount of units processed is concerned, it seems that professional translators tend to process more units than nontranslators (Gerloff 1988; Jääskeläinen 1987) and that high-volume processing, in turn, contributes to the production of more successful translations among different subjects (Gerloff 1986, 1987, 1988; Jääskeläinen 1990). That is, with the exception of Kiraly's (1995) study, the research results reported in the studies referred to previously appear to suggest not only that professional translators process more and larger units than nontranslators but also that both unit volume and unit length seem to correlate with translation quality.

Notwithstanding the different correlations established between unit size and level of analysis on the one hand and subjects' levels of translation expertise on the other hand, "some research suggests that the verbalization process of TAP studies has a shortening effect on translation units" (Malmkjær 2006: 93). Jakobsen's research (2003: 69), for example, shows evidence suggesting that TA forces subjects to work on smaller text segments.

2.1.2   Types of (Non)problematic Units

In addition to size, level of analysis, and number of units processed, TUs can also be compared in terms of their more or less problematic nature. Although many problem classifications are of course possible and indeed available in the relevant literature, of particular interest here is the fact that several translation researchers seem to agree on the distinction between problem and nonproblem units in translation (Krings 1986a, 1986b; Lörscher 1986, 1991; Kiraly 1995; Mondahl 1995; Mondahl and Jensen 1996; Séguinot 2000a). While for these researchers only problem units seem to interrupt the automatic processing of translation, Jääskeläinen maintains that both problematic and nonproblematic, yet conscious, decisions interrupt said automatic processing (1993: 101). For her, automatic, or unmarked, processing refers to "effortless or uncontrolled processing, such as . . . producing a fluent, uninterrupted translation of a source text item or passage" (1993: 102). In contrast, marked processing involves consciously dealing with both problematic and unproblematic units of attention (ibid.: 101).

As mentioned previously, this view differs from traditional conceptions of marked processing as involving translation problems only. Bernardini, like Jääskeläinen, also views unmarked processing as involving unproblematic units of attention (2001: 249). Nevertheless, for Bernardini, marked processing "begins with a problem indicator and ends with a solution to the problem or an indication that the problem is temporarily abandoned" (ibid.). In this regard, Séguinot points out that "labelling all points at which the translation seems non-automatic in the same way has the disadvantage of investing the source text with difficulty" (2000a: 144; cf. Pavlović 2007: 30).

For Sirén and Hakkarainen, problems "do not necessarily refer to something serious or difficult" (2002: 77). Their view is somewhat akin to that of Jääskeläinen, for whom, as briefly indicated previously, strategic and deliberative behavior takes place not only when dealing with problems but also "when no problems in the traditional sense exist, for example, when the translator makes unproblematic decisions" (1993: 106). For these researchers, then, different subjects conceive of problems and their difficulty in rather different ways. Séguinot (2000a, 2000b) and Krings (1987), as well as Livbjerg and Mees (2003), also conceptualize problems as self-constructed entities. That is, for them the perception of problems and their degree of difficulty vary across subjects, a hypothesis that has also been corroborated in my translation-oriented web-searching study.

From the perspective of the data analyst, Lörscher (1991) explains that the process of data interpretation is not entirely unproblematic either. In particular, he takes a critical stand towards Krings's view that "problem indicators can be *read* from the thinking-aloud protocols and hence allow a consistent and widely intersubjective identification of translation problems" (ibid.: 65). Livbjerg and Mees also refer to Krings's (1986a) findings

to remark that "the interpretation of what constitutes a translation problem for a subject leaves us with a fuzzy problem/non-problem borderline" (2003: 133, quoted in Pavlović 2007: 32).

Despite difficulties associated with the interpretation of translation problems and their more or less problematic, as well as strategic, nature, there seems to be certain agreement that problems may be of a ST comprehension kind, a target-text (TT) production kind, or both (Krings 1986a, 1986b; Gerloff 1986; Lörscher 1991; Mondahl 1995; Mondahl and Jensen 1996; G. Hansen 1999a). Jääskeläinen (1987), however, rejects the latter category—that is, combined comprehension-production problems—on the grounds that "a problem's nature changes so considerably when a comprehension problem turns out to be a production problem as well, that there are really two separate problems connected with the same item in the source text, rather than one combined problem" (ibid.: 36). In this regard, Pavlović (2007: 84) states that she found "instances in which it was difficult to tell whether a dilemma constituted a single problem or two problems" in her study of the collaborative TAPs produced by several graduate translators.

For Lörscher, "a clear, intersubjective valid distinction between *reception problems, production problems,* and especially combined *reception-production problems* can often neither be made from the translations nor from the protocols of thinking-aloud" (1991: 95–96). He nevertheless considers that translation problems may be assigned in most cases "to either *reception-* or *production problems*" (ibid.: 96). So does Mondahl, who argues that problems can be receptive or productive (1995: 187). Gerloff also distinguishes between comprehension and production problems, thus remarking that all the strategies identified in her study "are potentially applicable to either comprehension or production goals" (1986: 252).

Furthermore, translators seem to focus more on production-related problems (or goals) than nontranslators, who seem to face mainly comprehension problems (Gerloff 1986, 1987; Jääskeläinen 1987, 1990; Lörscher 1991). Gyde Hansen (1999a: 57), however, reports opposing findings to those of Gerloff, Jääskeläinen, and Lörscher in her study of the translations produced by five advanced translation students, who were primarily faced with reception problems as opposed to production problems (possibly due to the specialized nature of the ST selected, the different tools used for data collection, and the variability in expertise across different subjects).

Finally, translation problems have been found to be of either a global or a local nature (Gerloff 1987; Lörscher 1991), thus requiring the application of macrostrategies and microstrategies for their solving (G. Hansen 1999a). As shown in the following section, these represent just one of the many types of strategies identified by process-oriented researchers adopting a problem-solving approach to translation.

2.2   TRANSLATION STRATEGIES

Just as the concept of the TU is far from being a well-defined one, so is the term "strategy" the object of ongoing terminological discussion in translation. Furthermore, the use of alternative terms such as plans, "methods," "procedures," "behaviors," "shifts," "techniques," "operations," and "actions" (the latter adopted in my study) only adds to the confusion arising from the lack of terminological homogeneity.

The notion of strategy as referring to the steps taken to solve a translation problem is perhaps most frequently found in cognitive studies of translation. However, as briefly mentioned previously, and as Lörscher points out, strategy "denotes highly different phenomena, and very rarely is it defined precisely" (1991: 68). Bernardini, for instance, claims that the researchers whose TAP studies she surveys in her 2001 article "have either avoided a terminological discussion of the term strategy (for which alternative definitions abound in linguistics) and used the term in a rather undefined, everyday sense, or endorsed the definition provided by Lörscher" (2001: 245). Others have adopted Lörscher's notion of translation strategy (see the next section) as a starting point to develop their own definition of the concept.

2.2.1   Definitional Criteria

Lörscher's definition of translation strategy is based on Færch and Kasper's notion of communication strategy, according to which "a strategy is a potentially conscious plan for solving what to the individual presents itself as a problem in reaching a particular goal" (1980: 60). Lörscher adapts this definition on the basis that it involves two key criteria: "problem-orientedness" and "potential consciousness" (1991: 74). He explains that Færch and Kasper consider the latter criterion "to be a secondary one, subordinate to that of problem-orientedness. It does not necessarily apply to the strategies themselves but rather to the situation in which strategies are used, i.e. to the realization of problems" (Lörscher 1991: 74). In other words, Færch and Kasper do not necessarily take consciousness to be a defining feature of strategies but rather of problem realization. So does Krings, who found that the criterion of consciousness, when applied to his own TAP data, "proved in fact to be inadequate for a clear-cut distinction between strategic and nonstrategic features of the subjects' translational procedure" (1986b: 268).

In contrast, potential consciousness for Lörscher "applies to the problem *and* the procedure employed for its solution" (1991: 77). This view is also shared by Scott-Tennent, González Davies, and Rodríguez Torras, who see translation strategies as "the steps selected from a consciously known range of potential procedures, taken to solve a translation problem which has been consciously detected and resulting in a consciously applied solution" (2000: 108). Their notion of strategy therefore excludes "(a) solutions found

without considering a range of potential solutions, and (b) solutions found without any conscious reasoning at all, i.e. 'intuitively'" (ibid.).[4] Dancette also views consciousness as a key feature of translation strategies, which she defines as "a series of ordered behaviors, *consciously* called upon to solve a problem. For example, a systematic or purposeful exploration of the text to seek a second occurrence of a given term implies a strategy, whereas behaviors leading to *a serendipitous result* that the subject was not actively seeking is not a strategy" (1997: 89, my emphasis). For Jääskeläinen, neither potential consciousness nor problem-orientedness constitutes useful criteria for defining translation strategies (1993: 106). Concerning problem-orientedness, she claims that Lörscher limits translation strategies to those used for solving problems in the traditional sense. As mentioned previously, however, for Jääskeläinen translation encompasses "both problematic and unproblematic processing" (ibid.: 119). With regard to potential consciousness, she argues that the use of this criterion as a defining feature of strategy involves a number of practical problems (ibid.: 108). First, consciousness-related issues have been widely questioned, among others, on the grounds that not all cognitive processes are available for direct access and hence for verbalization. Therefore, establishing "whether or not one is conscious of something can prove to be a very complex task" (ibid.). Second, Jääskeläinen criticizes Lörscher for claiming that plans that are always used unconsciously do not represent strategies and that these "are not open to empirical investigation" (Lörscher 1991: 75). She argues that unconscious processes can indeed be investigated by observing behavior and refers to Séguinot's (1989b) study as a case in point.

Although Jääskeläinen rejects the notions of problem-orientedness and potential consciousness as definitional criteria of translation strategies, she does adopt a third criterion put forwards by Lörscher. This is the criterion of "goal-orientedness," which Jääskeläinen (1993: 111) interprets in terms of van Dijk and Kintsch's (1983: 64–65) notion of "optimality," according to which strategies are the means for achieving a goal in the most effective way. Jääskeläinen argues that van Dijk and Kintsch's notion of optimality is to be understood as a subjective one—that is, as involving the actions taken by an individual to best achieve a certain goal.

Chesterman (1998: 141) also views strategies as often involving an element of optimality. For him, too, strategies represent the most efficient or appropriate ways of solving problems. Similarly, Zabalbeascoa conceives of strategies as "any conscious action(s) intended to enhance a translator's performance for a given task, especially in terms of efficiency and effectiveness" (2000: 120). For Lörscher, translation problem solving "is largely controlled by an expectation structure" that involves "separating SL forms from their meaning" on the one hand and "ideas about an 'optimal' TL text" on the other hand (1986: 286). However, as Pavlović points out, for others "the 'optimal' way of resolving a problem might be to abandon the aim of achieving an 'optimal' translation, such as in the case of

'playing-it-safe' strategies (e.g. Lorenzo 1999[a])" (2007: 35). Pavlović also refers to Tirkkonen-Condit, who argues that in translation "tolerance of ambiguity and uncertainty is needed . . . for reconciling the optimal with what is feasible" (2000: 123). Pavlović therefore concludes that the concept of optimality means "slightly different things to these authors—the best, or having the best cost-benefit ratio" (2007: 35).

So far, we have seen that due to their focus on problem-solving strategies, Færch and Kasper (1980), Lörscher (1991), and Krings (1986a, 1986b) adopt problem-orientedness as a defining criterion of the strategy concept. In contrast, Jääskeläinen (1993) rejects this criterion on the grounds that it does not account for "unproblematic" translation decisions. Given the pedagogical focus of my study, I also took an initial interest in problem-orientedness in the traditional sense. I nevertheless joined Jääskeläinen, as well as Færch, Kasper, and Krings, among others, in moving away from viewing strategies as being potentially conscious. Instead, I took potential consciousness to apply to the realization of problems from the perspective of the subject. That is, while consciousness applied to the translation problems identified by the participants of my study, it may not have necessarily applied to their problem-solving strategies, as they were not explicitly asked to explain or justify said strategies (only their adopted solutions to problems).

This approach contrasts with Lörscher's (1991) view described previously that potential consciousness applies to both problems *and* strategies. Furthermore, Lörscher (1991), like Dancette (1997), but in contrast to Jääskeläinen (1993), characterizes problems as requiring strategic processing. Krings (1986b), however, finds it impossible to clearly distinguish between strategic and nonstrategic features of translation processes. As Pavlović states, "teasing apart strategic vs. non-strategic behavior will present the researcher with a practical as much as a conceptual problem" (2007: 38). She therefore proposes "to take a step backwards and leave 'strategies' aside" (ibid.) and instead adopt Strauss and Corbin's notion of "actions/ interactions"—understood as "a series of evolving sequences . . . that occur over time and space, changing or sometimes remaining the same in response to the situation or context" (1998: 165).

Similar to Pavlović, as well as Strauss and Corbin, I also avoided dichotomies like strategic versus nonstrategic or conscious versus unconscious processing and adopted instead the more flexible notion of "behaviors" in my study. As defined by Dancette, the term "behavior" refers to "an action or a series of actions carried out by the subject, whether or not they lead to a result" (1997: 89). Thus, "there is always a result, whether nothing, positive, or negative" (ibid.). Unlike Dancette, however, behaviors in my study do not necessarily refer to actions consciously applied to solve certain translation problems (ibid.).[5] Consequently, both serendipitous and nonserendipitous solutions that may have resulted from certain web-searching actions were part of my data analysis. What matters is that, similar to what Strauss and Corbin suggest, web search behaviors involve the seeking of information in

relation to a goal and that the initial state of the information-seeking process relates to a "problematic situation" (Wersig 1971) or "anomalous state of knowledge" (Belkin 1980). Conversely, the goal state involves either the resolution of the problem in a more or less successful manner or its nonresolution (cf. Spink, Park, and Cole 2006).

Britta Nord, for instance, in her study of translators' use of human resources and printed reference material also views the "use of a translator's aid . . . as an action characterized, among other things, by its type, its frequency, the aim of the translator, the reasons for the action, its occasion, and its consequences" (2009: 204, drawing on Wiegand 1987). For her, the "main concept is that of 'usage action,' " which she defines

> as the use of one particular specimen of aid with which the translator wants to achieve one particular aim. If a usage action is not successful or is only partly successful, i.e. the translator doesn't get an answer to his query and therefore doesn't achieve his aim, he may perform a second usage action, a third, a fourth and so son. When a chain of these usage actions is linked by the same occasion, it is defined by the term "usage context". Thus, a usage context starts when the translation process is obstructed (and the translator decides to make use of an aid) and ends when the translation reaches his aim (or interrupts the usage action without reaching his aim). (ibid.: 205)

2.2.2   Categories of Analysis

Translation strategies, like TUs, have been the object of a number of classifications in process-oriented research. Any attempt at establishing a typology of translation strategies very much depends on the perspective adopted by the researcher. The most general classification distinguishes between global and local translation strategies (e.g., Séguinot 1989b, 1996; Lörscher 1996; Jääskeläinen 1993). The former (a.k.a. "macrostrategies") are typically taken to affect the processing of a whole text, while the latter (a.k.a. "microstrategies") generally apply to the tackling of individual text segments (cf. Zabalbeascoa 2000; Muñoz Martín 2000).

I discuss this and other types of translation strategies in detail in Enríquez Raído (2011: 62–71). Of importance here is that some researchers focus on global strategies only, sometimes referring to these as translation maxims (Mondahl 1995; Mondahl and Jensen 1996), translation principles (Krings 1986b), or global behaviors (Gerloff 1988; Jääskeläinen 1987, 1990). Other researchers focus particularly on local strategies—that is, those at the level of text segments (Krings 1986a, 1986b; Gerloff 1986; Lörscher 1986, 1991; Mondahl 1995; Mondahl and Jensen 1996; Séguinot 1996). Still others link both global and local strategies to translation processing (Kiraly 1995) and translation behaviors (Dancette 1997).

Furthermore, it appears that global strategies are not necessarily associated with problematic translation processing, while local strategies are. For Jääskeläinen (1993), however, both global and local strategies may be employed in both problematic and unproblematic translation situations. What seems to be more important for her is the fact that while some translation processes may be quite unproblematic, they are nevertheless strategic. Lörscher's (1991) categories of strategic analysis, however, refer to entities that occur within more or less problematic phases of the translation process.

Notwithstanding the more or less problematic and strategic nature of translation, one observation that is particularly relevant for my own study relates to the distinction between strategies that draw on internal resources and strategies that draw on external ones. For the majority of the researchers mentioned previously (i.e., Krings, Gerloff, Jääskeläinen, Kiraly, Séguinot, Dancette, and Pavlović), and as further discussed in the following section, internal resources relate to one's existing knowledge and past experiences, while external resources refer to dictionaries and other reference material. Given the focus of this book, previous pedagogically motivated research into the use of external resources for translation problem solving will be the main object of discussion in the following sections.

2.3   EXTERNAL SOURCES OF CONSULTATION

According to PACTE (2005: 615), the integration of research and knowledge into translation problem-solving and decision-making processes requires, as Prassl (2010: 57) puts it, "chains of [two] types of support," namely, internal and external support. The former "refers to the retrieval of knowledge from the translator's long-term memory" and the latter "to the consultation of external resources, such as dictionaries and parallel texts" (ibid.). While the existing body of research into cognitive skills for translation problem solving is considerable, less attention has been generally paid to translators' use of external sources of consultation. There are nevertheless a number of process studies, in particular early TAP studies that have examined to a greater or lesser extent the use of reference material in translation. As these studies were carried out in the 1980s and 1990s, their focus is on the use of printed dictionaries and other reference material as opposed to electronic or web resources, although the latter have been available to translators since the early 1990s. Ronowicz and others, while only examining the use of printed dictionaries in their own TAP study, make a similar observation, stating, "To our knowledge, all TAP and Translog studies of the use of dictionaries in translation done until the time of writing this paper have investigated work with paper-based dictionaries, even though in reality translators nowadays also use Web-based databases, dictionaries and corpora" (2005: 593).

Most likely, the fact that the use of electronic and online resources in translation is underresearched is related to the type of data-collection tools available at the time in combination with TAPs, such as video cameras or retrospective interviews. Nevertheless, even in the first decade of the twenty-first century, we find almost no process-oriented studies that combine more sophisticated methods and tools such as Internet logs, keystroke logs (e.g., those obtained in Translog), screen recordings, and eye tracking. These methods would be more appropriate to examine the use of electronic and online sources of consultation. The few exceptions, such as Lauffer (2002), Asadi and Séguinot (2005), Pavlović (2007), Prassl (2011), and Massey and Ehrensberger-Dow (2011a, 2011b), among others, will be discussed in Chapter 4. Furthermore, with the exception of Pinto Molina and Sales Salvador (2007), there are hardly any studies addressing the information behavior of translation trainees within the areas of documentation, user studies, and information literacy.

This lack of research is underlined by Pinto Molina and Sales Salvador, who state that "we find a huge research gap, because almost no previous research has been done dealing with the field of translators, apart from Alanen [1996] and Palomares and Pinto [2000], both of which studies centre on the professional translation community" (2007: 536). This is also the case with Britta Nord's 1977 study, which was published in the form of a PhD thesis in 2002. While Alanen's study focuses on the "working habits of some Internet-literate translators" (1996: n.p.) who completed an online questionnaire, Palomares Perraut and Pinto Molina's (2000) study focuses on the information needs, habits, and uses of the professional translators who also completed an electronic survey. Nord's 1997 study analyzes the information behavior of a total of thirteen professional translators who were observed "in *authentic* translation situations . . . using [both human and offline] aids normally available to them" (2009: 203). White, Matteson, and Abels's (2008) focus-group study also analyzes the information behavior of professional translators, albeit with regard to their dictionary use only. Pinto Molina and Sales Salvador's research does, however, "not just focus on [the information behavior] of the professional community but also [on that of] the teacher and student communities, with the last-named group constituting the object of [their] study" (2007: 537). Although, unlike my web-searching study, their findings are not based on direct observation but on data collected by means of a semistructured questionnaire from 193 translation and interpreting students at the Universitat Jaume I de Castellón (Spain), the results of Pinto Molina and Sales Salvador's (2007) study will be briefly discussed in Chapter 8 in relation to the results of my own study.

2.3.1   The Use of Reference Material as an Additional Object of Study

In many process experiments, especially in the early ones using TA, concerns for the conditions of the research environment led researchers to make

printed dictionaries and other reference material available to their subjects. The use of external aids would thus frequently be allowed to increase the *naturalness* of the experiments and therefore avoid interferences with the research data. Tirkkonen-Condit, for instance, argues that experimental conditions "can be made fairly natural by allowing access to dictionaries and other reference material and by allowing the subjects to make notes, to produce a written draft, and to change the manuscript whenever necessary" (1989: 73). Séguinot makes a similar observation and claims that there has been "a recognition on the part of some investigators that test situations should replicate as far as possible the natural environment of the translator. That means making dictionaries and other reference material available and, for studies of the pragmatic strategies of professional translators, taping translators in their offices working on their own texts on their own computers" (1997: 106). Although most of the researchers mentioned in previous sections have in fact allowed the subjects of their experiments to use dictionaries and other reference material, there are a few exceptions, most notably Gerloff (1986) and Lörscher (1986, 1991). In Gerloff's study, "no dictionary use was allowed, as it was believed that the absence of working aids would elicit more strategies for coding, thus enabling the development of a more complete coding scheme" (1986: 245; cf. Gerloff 1987: 138). Jääskeläinen therefore states that Gerloff had "good reasons for not allowing the use of dictionaries . . . [as] one of the purposes was to examine foreign language learners' text comprehension strategies" (1989b: 179).

Lörscher, like Gerloff, did not allow the subjects of his 1986 and 1991 experiments to use any reference material for translation problem solving. He did so hoping that the subjects would engage in more problem-solving activities, which, in turn, would be verbalized in their TA processes. As Bernardini points out, however, "[t]he environmental validity of this decision seems dubious, the extra processes triggered by the absence of reference tools being an obvious result of the experimental condition, and arguably of little descriptive value" (2001: 260). More importantly, the strategies involved in the use of reference material "remain unaccounted for" (ibid.). Similarly, Kiraly remarks that the fact that subjects "were not permitted to use dictionaries" in Lörscher's (1986) study represents a constraint, as

> the use of dictionaries and other reference sources is part of conscious translation strategy, and there is much to be learnt about the research aspect of translation. For instance, do translators uncritically accept translation equivalents proposed by bilingual dictionaries, or do they use collocations or connotation knowledge (if they have it) to evaluate the proposed equivalents? It might be interesting to determine whether professional translators and translator trainees use dictionaries in the same way and whether they have systematic strategies for retrieving translation equivalents with the help of dictionaries. How are such lexicographic retrieval strategies integrated with other translation strategies? (Kiraly 1995: 44–45)

Krings (1986a, 1986b), in particular, is one of the early process researchers who examined subjects' strategies of dictionary use in his extensive psycholinguistic study of translation processes. Like many other process researchers, he did so because said strategies became apparent in his subjects' (eight German students studying to become foreign language teachers of French) solving of translation problems. While four of the subjects were asked to translate a text into their second language (L2), the remaining four had to translate a different text into their first language (L1). All eight subjects were instructed to bring along "those reference books they were accustomed to use at home, such as monolingual dictionaries, bilingual dictionaries, grammars etc." to avoid having unfamiliar reference material interfere with the experimental data (Krings 1986b: 265). This resulted in a poor selection of reference material, with some subjects only bringing one bilingual dictionary. Nevertheless, all subjects had access to a monolingual dictionary in French that Krings had made available for them.

He found that his subjects used dictionaries as one of the main strategies for (a) solving comprehension problems, (b) retrieving equivalents, (c) monitoring equivalents, and (d) making decisions. He also found that the subjects resorted to their own cognitive resources (e.g., previous knowledge and experiences) for solving comprehension problems only after a dictionary search had failed for whatever reasons. In contrast, for solving production-related problems, recourse to internal cognitive resources seemed to precede dictionary searches. These findings would appear to have important consequences for translator training. One should realize, however, that (a) Krings's study is representative of advanced foreign language learners and that (b) Krings does not differentiate between strategies found in L1 translation and those detected in L2 translation (there seems to be, however, more examples of the latter in Krings's 1986b article).

In an effort to compare the research performance of foreign language learners to that of translation students (two first-year and two fifth-year students of translation), Jääskeläinen (1989) analyzed Krings's research results together with the findings of a series of experiments carried out in 1985 and 1986. Unlike in Krings's experiment, the text that Jääskeläinen chose for translation appeared to be relatively easy. It nevertheless contained "various difficulties, most of which [could] be solved with the help of reference material" (ibid.: 182). Also in contrast to Krings's experiment, Jääskeläinen did not ask her subjects to bring the reference books they normally used. Instead, she provided the students with several dictionaries (both monolingual and bilingual) and other reference material (encyclopedias and newspapers) (ibid.: 183). Although the subjects were told that they could ask the researcher for any additional material they might need, none of them did.

Notwithstanding the influence that Jääskeläinen's choice of reference material might have had on subjects' research behaviors, she obtained a number of interesting findings in relation to (a) the frequency and type of dictionary used, (b) the primary source of reference, and (c) the purposes of

dictionary use. With regard to the frequency and type of dictionary used, the difference in the number of items looked up in dictionaries was almost negligible between one of the first-year students and one of the fifth-year students. This difference was, however, rather extreme between the remaining two students. Both groups of students nevertheless used a variety of working aids, as opposed to Krings's language learners, who did not use any dictionaries they were not familiar with. Furthermore, the more experienced students in Jääskeläinen's study "showed a slight preference to use monolingual dictionaries" and other sources of reference such as encyclopedias and newspapers, while the less experienced students preferred to use bilingual dictionaries over other sources (ibid.: 186). Jääskeläinen therefore states that "the professional subjects engaged more in research type of work in their translation process than the non-professionals" (ibid.: 186–187).[6]

Concerning the primary sources of reference, Jääskeläinen analyzed the subjects' consultations " 'wordwise', i.e. according to the individual items that were looked up in a dictionary etc.," and obtained two main findings (ibid.: 187). First, the inexperienced students looked up items in dictionaries (as opposed to other reference material) much more frequently than the experienced students. The latter, however, conducted much more research and "looked up the same item in several dictionaries" (ibid.: 188). Jääskeläinen associates this type of behavior with that of professional translators, who tend "not to trust just one source, but to check the given information in other sources, too" (ibid.). Second, the first-year students resorted to bilingual dictionaries as their primary source of consultation, while the fifth-year students "showed a reverse tendency and clearly preferred using a monolingual dictionary first (particularly when trying to solve comprehension problems)" (ibid.). This difference appeared to be "even greater when the two groups, monolingual dictionaries and other sources, are combined" (ibid.). While the experienced students "used other sources than the bilingual dictionary in more than two thirds of the cases," the inexperienced students only used such sources in "one third of the cases" (ibid.). Jääskeläinen therefore claims that the first-year students of her study "resemble the subjects in Krings' study," who also used bilingual dictionaries to solve comprehension problems (ibid.). In contrast, the fifth-year students in Jääskeläinen's study "never used a bilingual dictionary to solve a comprehension problem" but resorted to a monolingual dictionary instead (ibid.: 189). The first-year students, however, used monolingual dictionaries or other reference material "only where the bilingual dictionary had proved useless in problem solving" (ibid.).

Another interesting feature of subjects' use of external resources is the purpose(s) for which each type of resource is used. While the experienced students in Jääskeläinen's study did not use the bilingual dictionary for solving comprehension problems (as opposed to Krings's subjects), they nevertheless used said dictionaries to solve production problems. However, they did so with "caution,"—that is, they did not use the bilingual dictionary "as

a resource of translation variants . . . [but] as a source of inspiration, when they own 'inner dictionary' suffered from a momentary malfunction" (ibid.: 191). The rather critical attitude towards the bilingual dictionary was explicitly manifested by one of the experienced students. Although this student "had no alternative for the equivalents offered by the bilingual dictionary," she rejected said equivalents for reasons of contextual inadequacy (ibid.: 192). This type of selective behavior is, according to Jääskeläinen, highly typical of the fifth-year students of her study. These students would also use source-language dictionaries as a source for solving production problems, while they would only look up items in the TL dictionary "to confirm their spontaneous tentative translation variants" (ibid.: 192–193).

Dancette (1997) obtained similar results to those of Krings and Jääskeläinen in a study of the text comprehension processes of three graduate students of translation (one with no professional experience and two with over two years of professional experience in translation and interpreting, respectively). Dancette detected two main types of strategies "that seem to be of paramount importance for solving comprehension difficulties, that is, the use of dictionaries and the use of extralinguistic knowledge" (ibid.: 101). Concerning the former, and from a quantitative perspective, Dancette found that "the number of consultations does not correlate with the quality of the translation" (ibid.). Gerloff, however, found that the best translation performers (both professional translators and bilingual speakers) of her study used dictionaries rather frequently compared to the weakest performers (foreign language learners), who only used dictionaries moderately (1988: 138–139).

Similarly, Jääskeläinen states that the results of her 1990 study "indicate that success seems to be associated to the intensity of research activities in the form of dictionary consultations" (1996: 65). Jensen (1999), however, found that nontranslators favored the use of dictionaries in her study of the effects of time pressure on translation quality. She also found that the use of dictionaries "decreased with increased experience, and when comparing the young professionals with the expert group we find that the experts had only half as many dictionary look-ups as the young professionals" (ibid.: 113). In addition, she noted that all the subjects used *only* bilingual dictionaries, "except [for] one of the non-translators, who used [a monolingual dictionary] as a supplement to the bilingual ones" (ibid.).

From a qualitative perspective, Dancette observed that, like Krings's language learners, the least experienced subject of her study (who produced the lowest translation quality) resorted to dictionaries "whenever she did not understand a term" (1997: 101). In contrast, the two subjects with professional experience (who produced better translations) used "dictionaries once a hypothesis on meaning [had] been formulated, to monitor a translation choice or an interpretation, or to find alternate equivalents or synonyms" (ibid.). As discussed earlier, Jääskeläinen (1989b) also detected this type of behavior in the more experienced students of her study, who used (bilingual) dictionaries as a source of inspiration for translation variants.

Like all the researchers mentioned previously, Kiraly (1995) also observed that in his psycholinguistic study of translation the "relatively controlled processes" included subjects' use of monolingual dictionaries to "gather information about either an interim translation unit (target language) or a word in the source text (source language)" (1995: 76). Said processes also appeared to include the "(a) identification of a problem followed by a bilingual dictionary search, (b) retrieval of a single bilingual dictionary equivalent followed by acceptance of the equivalent as the solution to the translation problem, and (c) identification of a potential translation solution in a bilingual dictionary followed by a monolingual dictionary search" (ibid.: 86). He found, however, no major differences among the research behaviors of the novice and professional translators of his study. Both groups of subjects thus appeared to consult monolingual and bilingual dictionaries for purposes similar to those identified so far—that is, to confirm a hypothesis on meaning, check or monitor the adequacy of a proposed translation variant, and find or inspire a new variant.

Pavlović detected similar purposes of resource consultation in her study of the directionality features found in the collaborative translations produced by twelve "novice" students of translation who had recently "passed their final translation exam" at a Croatian university (2007: v). Unlike all the studies described so far, external resources in Pavlović's experiments included both printed and web-based dictionaries, as well as other reference material, such as encyclopedias and parallel texts. Web resources also included the use of Google (admittedly a rather large and undefined resource). The subjects in Pavlović's study were allowed to use all these resources to collaboratively translate in four groups of three one text into their L1 and another one into their L2.

An interesting observation is that Pavlović's subjects, like the experienced subjects of the studies described previously, also used reference material only after their own cognitive resources had failed to produce a translation solution (ibid.: 189). Pavlović also detected a number of differences regarding the research performance of her four groups (A, B, C, and D) of subjects. These differences relate to (a) "the number of problems in connection with which external resources were consulted," (b) "the total number of consultations per task, comparing groups and directions," (c) "the use of particular type [*sic*] of external resource by each group and in each direction," and (d) "the total number of consultations and how often they resulted in finding the selected solution, or helped arrive at the selected solution" (ibid.: 136–137).

Concerning the groups' use of external resources in both directions of translation, "Groups B, C, and D consulted external resources in connection with more problems in L2 translation than they did in L1 translation" (ibid.: 140). Group A, however, consulted external resources in relation to almost as many problems in L1 translation as in L2 translation. In addition, both Groups A and B "made (a few) more consultations in their L1 translation task" (ibid.). In contrast, Group C "consulted external resources twice as often in L2 translation," while Group D almost twice as often (ibid.).

With regard to the type of external resources used, Pavlović found that the bilingual dictionary and Google were the two primary sources of reference in both directions. It also appears that "[t]he collocations dictionary was [predictably] more popular in L2 translation" (ibid.). Also in this direction, Group D appeared to refer to "printed parallel texts considerably more often than in the other direction . . . [and in connection] with style and formatting" (ibid.).

Finally, regarding the usefulness of the external resources consulted, Pavlović states that said resources "seem to have been more useful in L2 translation in terms of providing solutions that ended up being adopted as the selected solutions, or in inspiring spontaneous solutions that were used in the final product" (ibid.: 141). More specifically, "most of the selected solutions [in L1 translation] were found in the bilingual dictionary, while in L2 translation the other resources also contributed" (ibid.). In light of these results, Pavlović argues that

> it is very difficult to formulate anything but the most tentative of conclusions. The groups tended to rely more on external resources in L2 translation in the sense that they actually used the solutions found in those resources in their final product more often than they did in L1 translation. It also seems likely that resources other than bilingual dictionaries (especially the electronic resources) can provide more help in L2 translation, at least when the L2 in question is English. This can easily be explained by the abundance of materials in English on the Interned [*sic*], compared to the number of texts and tools available in a language of limited diffusion such as Croatian. When it comes to types of resources consulted, it seems that group profiles, or individual preferences for a certain type of resource, might play a more important role than does directionality (ibid.).

Despite differences found in the use of reference material in translation, there seems to be, not surprisingly, undisputed agreement that subjects tend to draw on internal resources, external ones, or both. In addition, subjects who have been found to use external resources in translation appear to do so for similar purposes: to confirm a hypothesis on meaning, check or monitor the adequacy of an interim translation solution, and find, or inspire, new solutions. Furthermore, some of the researchers mentioned previously have linked these purposes to different research variables, including translation problems (comprehension problems, production problems, or both); sources of consultation (monolingual and bilingual dictionaries, encyclopedias, and parallel texts); subjects (foreign language students, translation students, professional translators, etc.); level of translation experience (experienced vs. inexperienced subjects), translation quality (high-quality products vs. low-quality products), and translation performance (strong performers vs. weak performers); or any combination of the previous.

When comparing the results of the studies discussed previously, a number of features seem to characterize the use of reference material in translation. From a qualitative perspective, it appears that subjects with little or no experience in translation tend to resort to dictionaries first as opposed to their own cognitive resources for solving translation problems. This seems to be particularly true in the case of comprehension problems, where bilingual dictionaries are usually preferred over monolingual ones. In contrast, subjects with experience in translation tend to rely more on their own cognitive resources and generally consult dictionaries only when the former fail to produce a solution. Moreover, experienced subjects seem to favor monolingual dictionaries over bilingual ones in the solving of comprehension problems. Bilingual dictionaries nevertheless appear to be popular for confirming a translation solution and for retrieving or inspiring one. From a quantitative perspective, some researchers have suggested that the number of consultations does not correlate with translation quality. Others, however, have established a positive correlation between the frequency of dictionary use and the quality of the translations.

2.3.2   The Use of Reference Material as a Sole Object of Study

So far, we have seen that process experiments focusing on translation strategies often studied the use of reference material alongside a large number of variables. In studies that focus on resource consultation as the sole object of study, the main variable selected has been the use versus the nonuse of reference material in connection with translation quality. To control this variable (use-nonuse of reference material), some process researchers, in particular TAP researchers, have set up experiments in which subjects have been asked to translate under two different conditions—that is, with or without access to reference material.[7] These experiments, in turn, have typically involved different research scenarios in which (a) the same subjects translate two (comparable) texts, one under each condition (Luukkainen 1996); (b) the same subjects work on the same text under the two conditions (Livbjerg and Mees 1999); (c) the same subjects translate two different passages of the same text, one under each condition (House 2000); and (d) two groups of (comparable) subjects translate the same text under one of the two conditions (Livbjerg and Mees 2002, 2003).

Luukkainen (1996), for example, is one of the process researchers who aimed at comparing translation processes with and without the use of reference material. Building on Krings (1986a, 1986b) and Jääskeläinen (1990), she conducted an experiment with two first-year students and two fourth-year students of translation to test the hypothesis that, "in addition to slowing down the translation process, dictionary use may have a certain restrictive effect on a translator's creativity and result in poor translation quality" (ibid.: n.p.). Like Krings and Jääskeläinen, Luukkainen asked the translation students of her study to bring along their own reference material,

thus making a wide range of consultation sources available "to avoid influencing the subjects' choices too much" (ibid.: 24). Despite this experimental drawback, Luukkainen's research results suggest that the translation processes of the more experienced students did not seem to differ from one translation task to the other, that is, with and without access to reference material. In contrast, the translation processes of the less experienced students appeared to be affected by the use of reference material. In this regard, Luukkainen's findings "initially indicate that untrained translators rely more on dictionaries and omit preliminary processing and/or editing" stages in translation processes for which reference material is used (ibid.: 71).

In addition, the original hypothesis that the use of reference material slows down translation processes and restricts translators' creativity seemed to be supported in the case of the fourth-year students. Luukkainen therefore suggests that emphasis on the use of external aids in translator training may restrict students' creativity due to their "mistrustful" attitude towards reference material and the "fair amount of time [spent in] checking and crosschecking" (ibid.). This, in turn, may lead to students' "increasing inability to trust [their] own intuition in the presence of a wide variety of reference material" (ibid.). However, Luukkainen did not find any evidence supporting the correlation between the use of reference material and successful translation processes. Instead, sensitivity to context was found to play a more decisive role in the processes of both experienced and inexperienced translation students.

In light of these findings, which suggest that reference material negatively influences the time spent on translation processes but not necessarily the quality of translation, Luukkainen arrived at the conclusion that "translator trainees might be able to develop a more effective translation process by relying more on creativity and the context rather than on reference material" (ibid.).

Luukkainen's research results are somewhat akin to those obtained by House (2000) in her TAP study of the use of translational aids. House carried out two sets of experiments with ten advanced language students. The first experiment aimed at identifying the "subjects' individual preferences for, or abstinence from resorting to translational aids" (i.e., monolingual and bilingual dictionaries, as well as one grammar) to determine which subjects were "habitual under- and habitual overusers of such aids" (ibid.: 153). The second experiment aimed at having the subjects "engage in the opposite, non-routinized behavior, the hypothesis being that, given this treatment, subjects would be lifted up to higher levels of consciousness of the translational process in which they were engaged" (ibid.). Unfortunately, the data collected in this experiment were not enough for House to distinguish between underusers and overusers of translation aids; that is, all the subjects had used translational aids with almost the same frequency, an interesting result in itself (ibid.: 154). Consequently, House changed the nature of the second experiment and asked the subjects of her study "to engage in another

translation-cum-think-aloud session, continuing in their translation of the same text," but this time without access to reference works (ibid.).

The analysis of the data collected in both experiments (with and without access to reference material) yielded a number of significant results. First, while it was impossible to distinguish between groups of underusers versus overusers, two other groups emerged: "high-risk-takers" versus "low-risk-takers" (ibid.). The former, "while appreciating the opportunity of using the dictionaries and the grammar," were confident in their own translation capabilities in a way that they seemed to be able to tackle both translation situations—that is, with and without access to reference material (ibid.). In contrast, low-risk-takers seemed to "intensely miss the 'islands of reliability' (Dechert 1983) provided by the possibility of using a dictionary or a grammar" (House 2000: 155). Second, while all the subjects (in particular, the low-risk-takers) seemed to "feel insecure" when translating without the help of external aids, they displayed more confidence in their own translation abilities "because they were free to creatively delve into their competence reservoir" (ibid.). House therefore suggests that confidence seems to play a more complex role in translation than it at first appears.

Based on the findings obtained by Luukkainen and House, one might be tempted to conclude that the usefulness of consulting reference material for translation may be, at best, questionable. However, said findings are best interpreted with caution for reasons that I will explain shortly. The impression that reference material may be of limited help in translation is also gained, at least at first glance, in Livbjerg and Mees's (1999) study of the influence of dictionary use on the quality of the L2 translations produced by five postgraduate students of translation. Livbjerg and Mees designed a TAP experiment consisting of two working sessions. In the first session (referred to as "Experiment 1a" in the following), students were asked to translate a non-domain-specific text into their L2 without access to printed dictionaries or other reference material. In the second session (referred to as "Experiment 1b"), students were given the possibility of correcting their translations with the help of reference material (one usage book, one monolingual dictionary, and one bilingual dictionary), but they were not specifically asked to use said material (ibid.: 136).

Livbjerg and Mees's hypothesis was that "the possibility of consulting dictionaries would improve the product" (ibid.: 137). To test this hypothesis, they designed an "error-correctness scale" to (a) evaluate and compare the students' first spontaneous solutions with the ones opted for at the end of Experiment 1a and (b) compare the translation solutions at the end of Experiments 1a and 1b. There are thus three points of analysis. As the authors explain, "[b]etween any two stages [i.e., between points 1 and 2 and points 2 and 3], an error could be kept, corrected or changed into another error and, similarly, a correct solution could be retained, turned into another correct solution or changed into an error" (ibid.). The correction scale was used

to evaluate only those problem units that were identified by the students themselves, which amounted to a total of 74 (ibid.: 139).

The results of Livbjerg and Mees's study show that the students made very few changes to their translated texts after the introduction of dictionaries in Experiment 1b. In fact, "in 55 of the 74 cases (74.3%), a solution chosen at the end of [Experiment 1a] was retained. In a further nine cases (12.2%), a correct or erroneous solution was turned into another correct or erroneous solution, respectively" (ibid.: 140). This means that the quality of the translations did not change in 86.5% of the cases. Furthermore, only in seven cases was an error corrected (one of them without the use of dictionaries) "and in three cases the possibility of consulting dictionaries led to a correct solution being turned into an error" (ibid.). That is, there was only a net improvement of 3 out of 74 units that could be attributed to the use of dictionaries. Livbjerg and Mees also found that "in the case of 56 (75.7%) of all the units commented on by students, all the time spent on interpreting the meaning of the text, choosing between different translation possibilities, and looking up items in a dictionary, did not lead to major changes in the quality of the product" (ibid.: 142).[8] Nevertheless, the researchers observed that "the student whose final products were regarded by all evaluators as being the best was the one who took most time over the project and who had by far the highest number of dictionary consultations" (ibid.: 146). This is indeed the type of quantitative correlation that Gerloff (1988) and Jääskeläinen (1987, 1990) established between translation quality and the amount of (a) resource consultations and (b) time spent on the translation.

From a qualitative point of view, Livbjerg and Mees found that dictionaries were particularly used "to solve gaps in the students' vocabulary" (1999: 143). The dictionaries were also used to monitor collocations or to (try to) avoid false friends. In addition, many dictionary look-ups were related to reception problems (cf. Krings 1986b: 266), a finding that, according to the authors, contradicts "what seems to be the general assumption for source texts in the mother tongue" (Livbjerg and Mees 1999: 144). Livbjerg and Mees therefore suggest that in translator training greater emphasis should be placed "on strategies for understanding texts when the source text is in the mother tongue" (ibid.: 145). Their study also shows that in addition to "looking for information that . . . dictionaries cannot provide," the students of their study spent a large amount of time "pondering over, or checking, problems for which they had a solution from the very beginning" (ibid.). This is not surprising, as one of the purposes for using dictionaries or other reference material is, as shown in the previous section, to check or monitor interim solutions. Moreover, this particular use of reference material may become even more relevant in L2 translation where the level of insecurity is usually higher than in L1 translation. In fact, Livbjerg and Mees hypothesize that one of the reasons for spending a lot of time looking up items in dictionaries may be explained by the students' uncertainty "about their own level of linguistic competence" (ibid.: 147).

In a further study conducted by Livbjerg and Mees (2002), the authors reexamined the data of Experiments 1a and 1b described previously and compared the results of the new analysis to those obtained in an additional experiment (referred to as "Experiment 2") conducted with five different subjects. These new subjects were asked to translate the exact same text as the subjects of Experiment 1 but had access to the same reference works as the students in Experiment 1 right from the beginning of the translation process. The reanalysis of the data in Experiments 1a and 1b led the authors to recategorize the original 74 problematic units as 121, an increase explained by "the fact that spelling errors were now included, and that what had represented a single unit in the 1999 categorisation could now be subdivided into more, typically two (e.g. spelling/choice of word)" (2002: 149). Another major difference between the two studies relates to the different points of analysis used to assess the students' solutions to their problems. While in the 1999 study, three points of analysis were selected, a fourth point was added in the 2002 study. Livbjerg and Mees's reason for including an additional point of analysis (what they call a "snapshot") can be explained by the fact that the first spontaneous solution (Point I) "would typically be directly succeeded by thoughts about the pros and cons of that solution, or by alternative suggestions before the student finally settled for a solution. [The researchers] therefore decided to introduce an extra snapshot (Point II). The solutions produced at Points I and II are inextricably connected: they represent the beginning and end of the first *uninterrupted verbalisation of a unit*" (2002: 150). Furthermore, Livbjerg and Mees expanded their error-correctness scale to include "the notation ZS (= 'Zero solution') as a possibility in order to cover those cases where the students did not come up with any solution at all" (ibid.: 152). In addition to these more methodological changes, Livbjerg and Mees's (2002) study seems to focus more precisely than the previous one on the impact of dictionary usage. In particular, they were interested in assessing the differences between translation solutions arrived at with and without the use of reference works, assessing the role that the moment of dictionary usage (after vs. during the actual translation process) plays in terms of the overall quality of the translation, and in the frequencies with which students in both experimental groups consulted the reference works available. The reanalysis also took into consideration whether students felt that the use of reference works was helpful or not (independent of whether the use was successful or unsuccessful).

Based on the reanalysis of the data collected in Experiment 1, Livbjerg and Mees found that "70 of the units were handled without dictionaries (58%), [while] 51 were looked up (42%)" (ibid.: 158). Of these 51 units, "16 resulted in incorrect solutions (31%), and 35 in correct solutions (69%)" (ibid.). With regard to the usefulness of the dictionaries, students considered them to be helpful in 30 cases (59%) and to be "ineffectual in 21 cases (41%)" (ibid.). Furthermore, "of the 30 units where the dictionary was felt to be of help, 21 resulted in successful solutions (70%). Of the

units where the dictionary was felt to be ineffectual, 14 resulted in successful solutions (67%)" (ibid.).

When it comes to comparing Groups 1 and 2, Livbjerg and Mees state that the results show striking similarities. Regarding verbalization, "[i]n the second group, 120 units were verbalised, which is practically identical to the number verbalised by Group 1" (ibid.: 166). The parallels also extend to the number of errors and correct solutions. With regard to the final solutions in Experiments 1b and 2, the percentages of correct solutions were exactly the same, that is, 76%. The authors further state that "not only is the percentage of successful and unsuccessful solutions virtually identical in both groups, the percentage of solutions which remain unchanged after each point studied in the process is also very similar" (ibid.: 167). That is, the moment at which the dictionaries were used did not seem to have an impact on the overall number of correct and erroneous solutions. However, looking at the number of correct solutions at the end of Experiments 1a and 1b (i.e., 69% vs. 76%, respectively), it seems apparent that the use of dictionaries did have an impact on the overall quality of the product, as the number of errors in Experiment 1 was reduced by 7% through the use of dictionaries. Moreover, when considering the evaluation of the external assessors, "a comparison of the marks awarded for Group 1's products (without dictionaries) with those of Group 2 shows that translations of Group 2 are slightly better," an observation that leads Livbjerg and Mees to conclude that while "the value of dictionaries is rather limited, subjects still feel better with them than without" (ibid.: 169). Concerning the differences in the marks given by the external assessors, finally, the authors speculate that repeated "dictionary consultations in connection with units that are already correct" are indeed not a "waste of time," but might actually result in the replacement of one correct solution by another, which might, in turn, "account for the marginally better results [i.e., marks] obtained in the experiments with dictionaries" (ibid.: 171–172).

Notwithstanding the significance of the findings obtained in the studies described previously, there are, in my mind, five major reasons (all closely interrelated) why it would seem advisable to interpret the results with caution.

First, in all the studies subjects were asked to translate a nonspecialized text for which the use of reference material might be less relevant than for specialized texts. This seems to be particularly true with regard to subject-related searches for which reference works other than dictionaries could be very helpful indeed. I do realize, however, that having subjects translate a specialized text may constrain their research processes to the level of specialized terminology only. This may in fact be one of the reasons why some of the researchers mentioned previously, in particular Livbjerg and Mees, decided against having domain-specific texts in their experiments of resource consultation. Nevertheless, one could argue that choosing a nonspecialized text for examining the use of reference material might force subjects to focus on the language and grammar levels only and exclude other

relevant aspects involved in subject area research. In my study, one of the two STs used, while dealing with a specific subject matter, is still accessible to the average reader. The second text, however, requires a certain amount of specialized subject knowledge or the ability to research that knowledge. The selection of texts with different degrees of specialization stems from my belief that said degrees have an impact on subjects' types of translation problems, which in turn may influence their research behaviors for problem solving. This hypothesis has been corroborated in my web-searching study (cf. Chapter 8 for more details).

Second, except for Livbjerg and Mees's subjects, the subjects in the remaining studies were asked to translate into their L1, a direction in which the use of external resources may play a less significant role than in L2 translation. Pavlović, for example, found that the subjects of her study tended to "rely more on external resources in L2 translation than in L1 translation," which, in turn, "confirms what teachers of translation intuitively know, and that is the importance of research and documentation skills in L2 translation" (2007: 192). This seems to be one of the reasons why Livbjerg and Mees decided to study the role of dictionaries in L2 translation as opposed to L1 translation.

Third, as acknowledged by Luukkainen and House, the researcher's choice of reference material may influence the subjects' behaviors concerning their preference of certain resources over others. In Livbjerg and Mees's (2002: 147) study, the lack of a particular reference work (a collocations dictionary) was in fact lamented by one of the subjects.

Fourth, having different subjects translate the same text or having the same subjects translate two different texts may prove problematic as neither subjects nor texts can ever be directly comparable (neither quantitatively nor qualitatively). I am aware, however, that in experimental research this is 'as good as it gets' regarding comparative studies.

Last, and perhaps most important, all the subjects in the studies mentioned previously were asked to engage in nonhabitual behavior—that is, either to translate without access to translational aids (in Lukkainnen's and House's experiments) or to make corrections with the use of reference material to a text translated without the use of said material (Livbjerg and Mees 1999). Having subjects engage in nonroutine behavior is a concern also shared by House, who admits that she "gained the global impression that all subjects were forced into a heightened degree of awareness of what they were doing while translating" without access to reference material (2000: 155). This experimental condition thus appeared to force subjects to "become more aware of what they were doing, what they knew and did not know, [and therefore] they felt more active, more creative and more responsible for the decisions they were making" (ibid.).

In spite of what seems to be a number of experimental drawbacks, all the studies mentioned in this section have various pedagogically valuable outcomes. House, for example, suggests exposing both foreign language

learners and translation students to the use versus nonuse of external resources in different translation situations. This approach would, on the one hand, contribute to increasing students' awareness of their own translation capabilities and the "limits of their linguistic-cultural knowledge and translation competence" (ibid.: 159). On the other hand, it would make students aware "of the rich and rewarding possibilities of using dictionaries for testing hypotheses of various kinds that go far beyond using these aids as mere crutches for quick and superficial checking" (ibid.). For House, one the most "interesting and pedagogically useful consequences" of her study for translator training is as follows: "If the use of reference works is treated not as a substitute but as an enriching supplement for learners' own autonomous search strategies, and if systematic consultations of reference works do not precede but follow one's own creative translational strategies, the learners' translational competence may be developed more solidly and efficiently" (ibid.: 159–160). The results of Ronowicz and others' (2005) TAP study of the frequent lexis and dictionary use of three groups of subjects (i.e., novice translators, paraprofessional translators, and professional translators) seem to support not only the main pedagogical outcome of House's study but also what some of the TAP studies mentioned earlier have found out: that nonprofessional translators tend to use reference material (in particular, bilingual dictionaries) whenever they encounter a problem (which tends to be of a ST comprehension nature), while professional translators tend to draw on their own cognitive resources first and then use reference material (most notably, monolingual dictionaries and other sources of reference, e.g., encyclopedias and parallel texts) for monitoring, checking, finding, or inspiring translation solutions.

Like House, Livbjerg and Mees also "believe that by letting students translate texts under conditions similar to [their study], and then proceeding to discuss their translation behaviour and strategies with them, translation teachers can give advice to individual students, geared to their specific needs" (2003: 133). The authors further state that "students have insufficient confidence in their own linguistic abilities. They therefore overuse dictionaries for non-domain-specific translation tasks . . . [and] focus too narrowly on lexical units at the expense of other important factors such as situational and textual context" (ibid.: 131). Here, Livbjerg and Mees see significant potential of the research tools used in their study (TAPs and Translog) as a means to raise students' consciousness, stating that "[t]he outcome of our study is not that students should avoid using reference works, but that they should be taught to make better use of them. For instance, by making semi-professionals aware of their own processing, it is possible to show them how to distinguish between solutions that can be found in dictionaries and solutions that involve the use of other communication strategies such as paraphrasing or omission" (2002: 147). The pedagogical value of using process research tools as a means to increase students' awareness of their own processing styles is also acknowledged by Alves (2005) with regard to Translog;

Pym (2009) with regard to screen-recording software; and Gile (2004), G. Hansen (2006), and Scott-Tennent, González Davies, and Rodríguez Torras (2001) with regard to problem-solving reports. As further discussed in Chapter 4, I am also interested in this pedagogical aspect, particularly in assessing the didactic potential of screen recording and written protocols for raising students' awareness in the translation classroom.

3 Web Searching for Translation Problem Solving

The notion of web search behavior is, as noted at the beginning of this book, a broad concept that may apply to a wide range of phenomena within the larger domain of human information behavior (HIB). Web searching, or web-based information seeking and retrieval, thus needs to be seen in relation to other concepts such as information behavior (IB), information seeking (IS) or information-seeking behavior (ISB), information search behavior (ISchB), information retrieval (IR), and interactive information retrieval (IIR). I will briefly draw on these concepts to describe the theoretical framework that I developed for the study of web search behaviors embedded in translation problem solving.

From a web-searching perspective, this framework is perhaps best illustrated by Wilson's (1999) *nested view* of the different research areas within the general field of IB. According to Wilson, these areas

> may be seen as a series of nested fields: information behaviour may be defined as the more general field of investigation . . ., with information-seeking behaviour being seen as a sub-set of the field, particularly concerned with the variety of methods people employ to discover, and gain access to information resources, and information searching behaviour being defined as a sub-set of information-seeking, particularly concerned with the interactions between information user (with or without an intermediary) and computer-based information systems, of which information retrieval systems for textual data may be seen as one type. (ibid.: 262–263)

Wilson's view is taken on by Ingwersen in his proposal to develop a holistic conceptual framework that integrates several models of information seeking and information retrieval (IS&R), where IS&R is seen as "a process of cognition for the information-seeking actor(s) or team in context" (2005: 215). In this framework, IB comprises the "generation, acquisition, use, and communication of information. . . . Typical information-seeking behavior is acquisition of information from knowledge sources, for instance, from a colleague, through (in)formal channels like social interaction in context . . ., or via an IR system . . .; IIR involves information acquisition via formal channels

like the Internet, or from other organized sources. Information acquisition, use, and interaction are thus regarded central phenomena of IB, including IS&R" (ibid.: 216). Spink, Park, and Cole (2006) also propose an integrated HIB framework for the coordination and integration of the different HIB levels, or areas of research, albeit from a multitasking point of view. The relationship among these areas is naturally a close one: IB may inform the overall principles of IS, which in turn may inform the design of IR systems and users' interactions with these systems (IIR). Web searching is mostly associated with IIR, a field in which user-centered approaches taking both the information searcher and the IR system into account developed over time to counterbalance the strong system-orientedness of IR studies (Aula 2005: 6). Nevertheless, for the purpose of my study I primarily drew on the field of IS for two main reasons: (a) information searching is considered here a subset of IS, a process during which users may search for information via a computer system or the web, and (b) IS strongly emphasizes humans as opposed to systems. This is in line with Pinto Molina and Sales Salvador's view, who

> align [themselves] with the new paradigm which, since the 1980s, has arisen in this area of research within the field of documentation and has marked a shift from the traditional system oriented approach, focused essentially on the process of information search (the way users enter into contact with an information system or make use of particular information), to a user-oriented approach that is more concerned with users' individual knowledge. It follows that stress now starts to be laid on the observation of the context and circumstances that impel a user to require information, and on the individual features that influence how the information is sought and used. An active role is now, besides, being given to the user, with increasing stress being laid on the situational context. (2007: 533)

Unlike IIR studies, then, my web search study does not aim at understanding search processes to improve the usability of IR systems or users' interactive experiences with these. Rather, it seeks to understand information needs and information uses as a potential means to inform translation decisions that may in turn lead to translation problem solving. Nevertheless, the search context and the use of IR systems, in particular search engines, were of course taken into account for research purposes.

3.1   THEORETICAL FRAMEWORK

3.1.1   Cognitive and Problem-Solving Approach to Information Seeking

According to Spink and Cole, "the field of library and information science (LIS) has historically been a leading discipline in conducting research that seeks to understand human information-related behaviors" (2006: 3).

These behaviors have been primarily studied from cognitive, behavioral, affective, and, more recently, social perspectives. However, the predominant framework for the understanding of HIB has traditionally been what Spink and Cole refer to as the "information-seeking/problem-solving approach" (ibid.). The theoretical basis for my web-searching study was informed by this approach. I nevertheless also drew on and borrowed key notions from other cognitive, as well as affective-oriented, IS models such as the ones briefly described later in this section. These models, understood here as simplified representations of complex processes, are better seen as complementary rather than oppositional, therefore contributing to the conceptualization of HIB within the integrative framework referred to previously.

From a cognitive and problem-solving perspective, Brown (1991), for example, conceives of IS as a goal-driven activity aimed at satisfying needs through problem solving. This view is similar to Wilson's (1999) proposed model of ISB in which problems are considered the cause of uncertainty. Moreover, solutions to problems become people's goals and the resulting behaviors may be seen as goal-determined behaviors (ibid.: 265; cf. Wilson 2005: 35). More specifically, Wilson posits that

> *en route* to the goal, the individual moves from uncertainty to increasing certainty and that there are stages in the problem-resolution process that are identifiable and recognisable to the individual. These stages are: *problem identification* (where the person is asking the question, 'What kind of problem do I have?'), *problem definition* ('Exactly what is the nature of my problem?'), *problem resolution* ('How do I find the answer to my problem?') and, potentially, *solution statement* ('This is the answer to the problem', or, if a pragmatic rather than theoretically-based definition has been found, 'This is how we are going to deal with the problem.'). (1999: 266)

Earlier ISB models also view IS as problem-solving processes aimed at reducing uncertainty. In sense-making theory (Dervin 1983, 1999), for instance, ISB consists of four main elements: (a) "a *situation* in time and space, which defines the context in which problems arise"; (b) "a *gap*, which defines the difference between the contextual situation and the desired one (e.g. uncertainty)"; (c) "an *outcome*, that is, the consequences of the Sense-Making process"; and (d) "a *bridge*, that is, some means of closing the gap between situation and outcome" (Wilson 1999: 253). According to Wilson, Dervin, the main proponent of the sense-making approach to ISB, "presents these elements in terms of a triangle: situation, gap/bridge, and outcome" (ibid.).

From a cognitive and affective point of view, and similar to Dervin's sense-making theory, Kuhlthau's (1991) user-centered research on IS also views the information search process as involving

> the user's constructive activity of finding meaning from information in order to extend his or her state of knowledge on a particular problem

or topic. It incorporates a series of encounters with information within a space of time rather than a single reference incident. Uncertainty and anxiety are an integral part of the process, particularly at the beginning stages . . . The individual is actively involved in finding meaning which fits in with what he or she already knows, which is not necessarily the same answer for all, but sense-making within a personal frame of reference. (ibid.: 361)

Kuhlthau's model thus sees affective characteristics like uncertainty, anxiety, confusion, clarity, confidence, and (dis)satisfaction as being integrated within cognitive structures (ibid.; cf. Kuhlthau 2005). It therefore complements earlier models—like Dervin's sense-making theory and Ellis's (1989) IB model—by adding users' feelings and thoughts to the IS process. In my study, I also looked briefly at certain affective dimensions of IS processes embedded in translation. These dimensions concern the research participants' perceived levels of search goal *success,* search outcome *satisfaction,* and search task *difficulty* (see 5.2). Exploring these affective dimensions will, I hope, make a contribution, not so much within the field of information science (e.g., J. Kim 2008), but to process-oriented studies that have examined other affective factors in translation. These affective factors may be translators' personal involvement with translation tasks (Jääskeläinen 1999), their attitudes and self-image with regard to routine translation tasks versus nonroutine tasks (Laukkanen 1993, 1996, 1997), their professional self-image and subjective theories of translation (Tirkkonen-Condit and Laukkanen 1996), and their previous experiences and emotions (G. Hansen 2005), to name but a few.

A common feature of the ISB models mentioned previously—which have naturally evolved since the early days of their conception—is that they view IS as the purposive seeking of information in relation to a goal (Spink, Park, and Cole 2006: 138–139; Case 2008: 80). Moreover, the initial state of the IS process is one that relates to a "problematic situation" (Wersig 1971), an "anomalous state of knowledge" (Belkin 1980), an "information need" (Wilson 1981), a "gap" (Dervin 1983), or a situation of "uncertainty" (Wilson 1999). Conversely, "[t]he goal state is the resolution of the problem or cognitive state" (Spink, Park, and Cole 2006: 139). Here, ISB is also conceptualized as purposive IS in relation to a goal, a process characterized by Wilson's problem-solving stages outlined previously. In this regard, Foster (2004, 2005, 2006) claims that ISB models such as the ones mentioned earlier suggest (a) clear starting and ending points, as well as (b) the linear sequencing of stages in between. Concerning Foster's first suggestion, I agree with Case that information "needs shift stochastically as each relevant piece of information is encountered. One bit of knowledge may raise questions, lead to another fact or to a new conclusion, and so forth, which changes one's knowledge state and hence what one finds relevant and worth seeking" (2008: 79).

Case further states that a number of scholars "would agree that, however information needs are characterized, they are not something fixed and

long-lasting" (ibid.). The berry-picking model proposed by Bates (1989) suggests precisely this—that is, users' search needs and queries evolve throughout the search process as they encounter new pieces of information. Viewing information needs as dynamic and evolving entities throughout the search process is indeed particularly useful for understanding IS processes. Nevertheless, for analytical and theoretical reasons, in my study the initial and final states of translation-embedded IS processes were identified through the stages of translation problem definition and solution statement, respectively. Given that IS is originally envisaged here as motivated by the need to solve a (translation) problem, an activity that has "a clear-cut and short-term end" (Case 2008: 88), I adopted Wilson's (1999) problem-solving stages described earlier as indicators of the different IS process stages (see 3.1.3). With regard to Foster's second suggestion concerning the sequencing of IS stages, a discussion of the (non)linear nature of both translation and IS processes against the findings of the study can be found in Enríquez Raído (2011: 320–337).

3.1.2   Cognitive and Problem-Solving Approach to Translation

Like ISB, translation-related phenomena have also been studied from cognitive, behavioral, affective, and social perspectives, among others. If, however, as Sirén and Hakkarainen suggest, "we see translation as one kind of human information processing, [then] cognitive psychology is an obvious framework in which translation can be productively studied" (2002: 72). From the perspective of cognitive psychology, and as shown in Chapter 2, translation processes have also been regarded as problem-solving activities in process-oriented research. Tirkkonen-Condit, for example, argues that translation is a goal-oriented action where the solving of "an individual translation problem . . . will cause at least temporary *uncertainty* in the course of target text production" (2000: 123, my emphasis). Moreover, she states that "[p]revious research on translation processes suggests that proficiency in translation involves tolerance of ambiguity and uncertainty" (ibid.; cf. Tirkkonen-Condit 1997: 79). Angelone's (2010) process-oriented research also suggests that there are expertise effects in uncertainty management. Fraser's (2000) study, in particular, shows that professional translators tend to exhibit greater levels of tolerance for ambiguity and uncertainty than nonprofessional translators do.

Like Tirkkonen-Condit, Angelone and Shreve also view uncertainty "as a cognitive state of indecision, marked by a distinct class of behaviours occurring during the translation process" (2010: 108). These uncertainty behaviors are observable and "tend to arise when the translator encounters what Angelone (2010) has termed a *problem nexus*," or "the confluence of a given textual property and level . . . and some sort of deficit in cognitive resources" (Angelone and Shreve 2010: 109). When translators face a

problem nexus, they "ideally engage in *uncertainty management* (UCM), the application of conscious strategies for reducing uncertainty by solving the problems of comprehension, transfer or production that arise at these junctures" (ibid.). Indicators of uncertainty behaviors can be found in translators' verbal articulations, as well as "other non-articulated phenomena . . . , such as revising already generated target text, and online information search and retrieval of various kinds" (ibid.). Regarding the latter, and as Angelone and Shreve (ibid.) point out, PACTE's (2005) research "of the use of internal and internal support by novice and professional translators [indeed] suggests an association between uncertainty and specific information-seeking behaviors."

As we can see, in the cognitive and problem-solving approach to translation "the emphasis lies on the application of translation solutions—sometimes called strategies or procedures—to specific problems, on the discussion about what goes on in the translators' mind and on exploring what lies behind translation competence" (González Davies 2004: 14). A central discussion therefore inevitably revolves around what constitutes a translation *problem* and from *whose* perspective. Although this discussion is already provided in 2.1.2, I should emphasize at this point that "problems" in my study represent those particular source-text items that the research participants explicitly identified as somewhat problematic for translation purposes. This is in line with Livbjerg and Mees's view, who also "consider translation problems—and hence define 'translation unit'—from the perspective of the participating subject" (2003: 129; cf. Lörscher 1991; Krings 1986a, 1986b). For these authors, "[a] translation unit is any word or phrase in the text, or any aspect of such word or phrase, which is [identified] by any single participant and for which he or she expresses any degree of doubt about its proper translation" (2003: 129). It is from this perspective that translation problems are considered here self-constructed or idiosyncratic entities, as suggested by cognitive psychologists in general. As Séguinot explains, "[p]roblems, for the cognitive psychologist, do not actually exist 'out there'. It is our perception that identifies something as a problem. In other words, it is the construct of an individual" (2000b: 90).

Furthermore, as Sirén and Hakkarainen point out, "in translation studies, 'problem' most often refers to different textual elements which cannot be translated without deliberation, if at all. . . . 'Problem-solving', then, refers to such deliberation and rendering a textual element (or omitting it)" (2002: 76; cf. Pavlović 2007: 30). Consequently, translation problem solving is taken here to involve purposeful activities in relation to a goal, that of making a more or less problematic decision to solve a particular translation problem that may not be necessarily serious or difficult. In other words, self-constructed translation problems may vary in degree of significance and nature, which may in turn influence the type of "solution paths [taken] from the initial to the final state" (ibid.: 77) of translation problem-solving activities.

3.1.3   Translation Problem-Solving Stages as Indicators of Web-Searching Stage*s*

Drawing on the theoretical framework developed previously, I conceptualized web search behaviors as involving goal-driven actions aimed at meeting the research participants' information needs for translation problem solving. I monitored said behaviors through what I refer to as "web search tasks." A web search task may involve one or more online search sessions performed to address a *single* information need that is motivated by the desire to solve a perceived translation problem. While in my terminology, a web search task will always include a search session—that is, a temporal series of online actions aimed at satisfying a *specific* information need (cf. Jansen et al. 2007)—it is not limited to or synonymous with the notion of a search session. Rather, it is a more comprehensive concept that also includes the identification and formulation of a specific search need, the formulation of one or more search goals, and the selection of a search outcome.

A web search task is conceptualized as involving four main IS/problem-solving stages, or units of analysis (cf. 2.2 for a discussion of Britta Nord's term "usage context"):

- The *search need,* or recognition of an information need as perceived within the context of translation problem solving
- The *search goal(s),* or type(s) of information required to potentially satisfying a specific information need
- The *search process,* or online actions carried out within one or more search sessions that may address a single or multiple information needs
- The *search outcome,* or type(s) of information potentially selected or used to (a) satisfy a search need and (b) eventually solve a translation problem—that is, where the latter is not necessarily a consequence of the former.

These IS/problem-solving stages, which affect the translator's role as an information user, processor, and producer (Pinto Molina 1999, 2000), were taken to indicate when a web search task embedded in translation problem solving was initiated, processed, and completed. Many web search studies have addressed similar IS-related phenomena, albeit in connection with a wide variety of research foci, such as users' individual characteristics (e.g., gender, cognitive and learning styles, prior knowledge, and computer experience), types of subjects (e.g., students, academics, and professionals), and situations (e.g., work, educational, and everyday life settings) (cf. Martzoukou 2005). My own research focused on web search behaviors in connection with the user and translation task attributes described later in the following two sections, respectively.

3.1.4   Selection and Impact of User Attributes

The user attributes of my research concern the participants' levels of translation expertise, web search expertise, and domain knowledge—the latter sometimes referred to as "subject expertise" in both the translation studies and the ISB literature. According to Sirén and Hakkereinen, there are two main approaches to expertise: one that characterizes it by diverse criteria, thus focusing on "differences between novice and expert performance;" and another that focuses on "the process of acquiring expertise," thus emphasizing "differences between **experts** and experienced **non-experts**" (2002: 73, drawing on Bereiter and Scardamalia 1993: ix).

As shown in Chapter 2, this distinction has also been manifested in the cognitive approach to translation studies, where numerous researchers have examined expert translation processes on the one hand and processes of expertise acquisition on the other. Whereas the former type of studies tends to have a theoretical aim, the latter generally shares "a concern for transferring research findings to translation pedagogy" (Tirkkonen-Condit 2002: 5; cf. Sirén and Hakkarainen 2002: 71). Two major approaches to the study of translation expertise therefore dominate the relevant translation studies literature: (a) comparisons between professional and novice translators that aim at characterizing features of expertise (e.g., Tirkkonen-Condit 1989, 1990; Lörscher 1991; Jääskeläinen and Tirkkonen-Condit 1991; Jensen and Jakobsen 2000; PACTE 2005) and (b) developmental studies that aim to increase our understanding of the development of expertise, which in turn may help novice translators shorten their learning curves in becoming expert translators (e.g., PACTE 2002, 2003, 2009; Orozco Jutorán and Hurtado Albir 2002; Kiraly 2005, 2008; Scott-Tennent, González Davies, and Rodríguez Torras 2000, 2001; Göpferich 2009a, 2009b; Massey and Ehrensberger-Dow 2010a).

The notion of "translation expertise" nevertheless remains difficult to define and is still subject to controversial discussion (Pym 2003; Kiraly 2000a; González Davies 2004; Kelly 2005). In our discipline, expertise is often referred to as "competence," "proficiency," or "professionalism." In discussing translation competence, in particular, "the term is often linked to other concepts and qualities seen to be a requisite for the task of translation, most prominently the following: *knowledge, skills, awareness, expertise*" (Schäffner and Adab 2000: x). For the purpose of my study, I also took the qualities of *knowledge, skills,* and *awareness* along with that of *experience* to be indicators of translation expertise (cf. 5.5). Thus, expertise here involves translation processes "that are observed to result in good performance" (Tirkkonen-Condit 2005: 406). It follows that the study of "processes must be accompanied by an evaluation of product quality as well, if the aim is to pin down those process features that are found to be conductive to good quality" (ibid.). I will return to aspects of translation assessment for research purposes in section 5.6.

Furthermore, I did not take expert performance to equal professional performance or professionalism. The latter refers to a translator's ability to join and attain professional status within the community of full-fledged translators who earn their living by translating (cf. González Davies and Scott-Tennent 2005 for their notion of "full-time translators"), whereas the former concerns, as indicated previously, translation processes that result in good performance. This distinction is based on the premise that not all professionals are able to reach expert performance (Gerloff 1988; Jääskeläinen 1990; Séguinot 2000b). Kiraly's (2000a: 13) distinction of "translation competence" (the ability to produce acceptable texts in the target language) versus "translator competence" (the ability to join and participate in new communities) seems particularly useful to illustrate the differences between translation expertise and professionalism.

Kiraly's concept of translator competence has added a new dynamic dimension—that of socioprofessional ethics, norms, and conventions—to the apparent didactic persistence on componential models of translation competence (TC) (Torres del Rey 2005: 148). In these models (e.g., Kelly 2002; PACTE 2002, 2003, 2005, 2009; Göpferich 2009a), skills and knowledge are usually clustered around a number of interrelated subcompetences that make up the notion of TC. Among these, *subject, thematic, and domain knowledge* and *instrumental competence*—that is, the two additional user attributes of the study—are believed to have an impact on translation performance, thus allowing for the distinction of different levels of translation competence or expertise.

In particular, subject knowledge for PACTE is part of their extralinguistic subcompetence, involving "[p]redominantly declarative knowledge, both implicit and explicit . . . [and] comprises general world knowledge, domain-specific knowledge, bicultural and encyclopaedic knowledge" (2009: 208). Similarly, Göpferich's "domain competence . . . comprises the general and domain-specific knowledge that . . . is necessary to understand the source text and formulate the target text, or at least the sensitivity to recognize what additional knowledge is needed from external sources to fill one's knowledge gaps" (2009a: 21). Furthermore, both PACTE (2009: 209) and Göpferich (2009a: 13) consider instrumental subcompetence to be one of the three subcompetences that are specific to translation competence. For PACTE (2009: 208) instrumental subcompetence comprises "[p]redominantly procedural knowledge related to the use of documentation resources and information, and communication technologies applied to translation," and for Göpferich (2009a: 21), "the ability to use translation-specific conventional and electronic tools."

The theoretical views of these authors are shared by translator trainers and translation practitioners as well (cf. Massey and Ehrensberger-Dow 2011b: 2). The European Master's in Translation (EMT) expert group, for instance, highlights the significance of both thematic competence and information-mining competence in their framework for the competences

for professional translators. Information mining, in particular, concerns the ability of identifying information and documentary needs, "developing strategies for documentary and terminological research," extracting and processing "relevant information for a given task," developing evaluation criteria, using translation tools and search engines effectively, and archiving retrieved information (Gambier 2009: 6). Closely related to this competence, EMT's thematic competence involves "[k]nowing how to search for appropriate information to gain a better grasp of the thematic aspects of a document;" developing knowledge in domain-specific areas and applications; and developing curiosity, as well as analytical and summarization skills (ibid.: 7). Similarly, the European standard EN15038—developed to "establish and define the requirements for the provision of quality services by translation service providers"—stresses the importance of "[r]esearch competence, information acquisition and processing," including "the ability to efficiently acquire the additional linguistic and specialised knowledge necessary to understand the source text and to produce the target text. Research competence also requires experience in the use of research tools and the ability to develop suitable strategies for the efficient use of the information sources available" (CEN 2006: 6–7).

In the literature on ISB, subject knowledge and research skills are also considered two key factors that have an impact on users' web search performance. Concerning research skills, K.-S. Kim claims that "[a]nother factor that affects search behavior is *experience* or *expertise* in information searches" (2001: 235, my emphasis). Equating search experience with search expertise is a rather common phenomenon among web search behavior. Studies that establish the amount of experience a user has as a criterion to determine the user's level of expertise include, among others, Lazonder, Biemans, and Wopereis (2000); Palmquist and K.-S. Kim (2000); as well as Saito and Miwa (2001). According to Aula, this view is consistent "with the ideas of the information foraging theory . . . , which states that foraging strategies evolve over time toward the most effective and efficient ones" (2005: 25). Like Aula, I see, however, two main drawbacks in categorizations of expert versus novice searchers based on their levels of experience *only*. The first drawback refers to the fact that "in such a division . . . groups are internally heterogeneous," while the second concerns the lack of "consensus on what constitutes relevant experience" (ibid.).

In other web-searching studies, however, expertise has been characterized as involving the *knowledge* and *skills* required to use the web and other Internet resources successfully for IS (Hölscher and Strube 2000: 338). Similarly, in my study I took the qualities of *knowledge* and *skills* along with that of *experience* in web searching as criteria to determine the participants' level of web search expertise.

Despite the difficulties associated with definitions of expert versus novice users, web search studies "have generally proposed that experts are more

sophisticated in their searching than novices are" (Aula 2005: 25). What this means is that

> [e]xperts use longer and more complex queries, are better aware of the features of the system they are using, and sometimes employ imaginative strategies for searching . . . Novices, on the other hand, are known to have several misconceptions as how to search engines work. They believe that the authors of Web pages need to register their pages with search engines, they believe that search engines can extract semantic meaning from the pages, they use natural language in their queries, they try to express several searches at the same time, and they over-or under-specify their search requests . . . In their search performance, these misconceptions typically result in longer task completion times, a smaller number of tasks being completed and less efficient search strategies. (ibid.: 25–26)

In addition to web search expertise, domain knowledge (or subject expertise) also seems likely to have an impact not only on translation but also on web searching. As far as the latter is concerned, K.-S. Kim refers to Marchionini, Lin, and Dwiggins's (1990) study, which is based on a hypertext information system, to report that they "found that both groups of experts (search and subject experts) outperformed the novices. Although no difference between the two expert groups was detected on their success rate, their search styles differed. Subject experts tended to spend more time reading the retrieved information, whereas search experts spent more time on search-preparation and modification work" (K.-S. Kim 2001: 235–236). Foltz (1996) argues that domain knowledge is critical to comprehension, especially when dealing with hypertext as opposed to linear text. Some researchers have also found that "learners do not benefit from searching for information on the Internet when domain knowledge is low" (Desjarlais and Willoughby 2007: 3). In this regard, Willoughby and others' (2006) study suggests that low domain knowledge appears to prevent successful learning using the Internet, thus making it necessary to find ways to support less knowledgeable learners (in Desjarlais and Willoughby 2007; cf. Lawless, Schrader, and Mayall 2007). Conversely, "a user with more knowledge of the domain can be expected to utilize more appropriate terms in the queries and to know more terms (synonyms) related to the topic" (Aula 2005: 26). According to Aula, "[n]ot surprisingly, both traditional IR research and studies addressing web searching have found domain experts to approach search tasks differently from novices. Domain experts have been claimed to plan their search beforehand, to use more sophisticated queries, and to be more efficient and effective in performing search tasks" (ibid.).

Furthermore, web search expertise and domain expertise are known to have combined effects. For instance, some researchers have found that users

with "high domain expertise and low Web search expertise [are] reluctant to use advanced query formatting, but their domain expertise allow[s] them to compensate for this by being more creative in thinking about the query terms" (Aula 2005: 26, building on Hölscher and Strube 2000). This suggests not only that web search behaviors are influenced by domain knowledge and web search expertise but also that interactions between these two factors are highly intrinsic.

Similarly, Massey and Ehrensberger-Dow's (2011a) findings on the IB of translators suggest that translation *experience* correlates with successful IB. Exploring the performance of different groups of translators with various levels of experience "at certain source text (ST) segments containing translation problems," the authors found that, for a particular term,

> most of the beginners researched the term but only one-third were successful. All of the advanced students researched the term, most of them very quickly and successfully, although one (unsuccessfully) referred to online bilingual dictionaries rather than the resources that the other students accessed by using Internet search engines. Finally, all of the recent graduates researched the term and came up with a successful solution. We had hoped for a higher research and success rate as students gain experience, and that is exactly what we found. What we did not expect was that the advanced students and recent graduates would be faster and more successful than the professionals. (ibid.: 205)

Massey and Ehrensberger-Dow offer four possible explanations for their results. First, as the professional translators were working into their L1, the authors suspect that these professionals "may have been overly confident, whereas the students might have been cautious because they were translating into their second language" (ibid.: 205–206). Second, "the professionals were not translating at their customary workplaces," which may have affected the ecological validity of the study. Third, both the student and novice translators were younger than the professionals, and this suggests that the former "might be part of a generally more media-competent cohort." Finally, and perhaps most important, "the students and recent graduates had all participated in a course in research techniques as part of their undergraduate program and were accustomed to using Internet resources as part of their translation course demands" (ibid.: 206).

3.1.5 Selection and Impact of Task Attributes

According to Wildemuth and Hughes, "information behaviors are undertaken within the context of some purpose, goal, or activity. In other words, the person's information behaviors are situated within the context of some *larger task* or set of tasks" (2005: 275, my emphasis). However, the term "task" may sometimes be problematic as it is often used interchangeably in

the IB literature to refer to both (a) the *larger task,* or *context* in which IBs are embedded, and (b) the "specific *search goals* undertaken or the *search tasks* assigned to study participants" (ibid., my emphasis). Some terminological clarification is therefore required. On the one hand, I refer to the larger task of translating a domain-specific text as the "embedding task," a notion taken from Pirolli and Card's (1999: 644) theory of information foraging. In Preben Hansen's terminology, this notion is referred to as the "work task"—that is, "the situation in which a need for information emerges" (2005: 393). Hansen thus points out that the "rationale for developing a framework for work task information seeking and retrieval is grounded in a belief that IS&R should not be treated in isolation, but rather as embedded in a larger task context" (ibid.: 392). In other words, if one whishes "to understand the dynamic nature of IS&R processes, one needs to adopt a broader perspective, both situationally and contextually, which includes the tasks people perform" (ibid.).

In our discipline, over the past decades, translation tasks have provided the context for the study of translation behaviors. In the field of IB, however, the "tasks that form the contexts for information behaviors" are still an "under-studied phenomenon," despite the fact that they should be of a primary concern in IB-related research (Wildemuth and Hughes 2005: 275). Wildemuth and Hughes nevertheless refer to several IB theories that address the contextual nature of tasks, in particular Allen's (1997) person-in-situation approach to the understanding of information needs, as well as Dervin's (1999) and Savolainen's (1993) sense-making approach to IB. Similar to Wildemuth and Hughes, Vakkari states that some IS studies "start the analysis of information needs and seeking by scrutinizing the activity they are part of. Information seeking is seen as embedded in the activity that generates it" (1999: 822). However, "there are only a limited number of advanced attempts at analyzing empirically how information seeking is related to the various features of the activity (work) processes it supports" (ibid.). This is in line with Wildemuth and Hughes, who argue that, although the work of the authors mentioned previously "points in an appropriate direction, further investigation is needed to more fully understand how people's experiences of information needs and their information behaviors are embedded within their accomplishment of other tasks" (2005: 276). It is from this perspective that the translation tasks selected for my study were a point of consideration for the analysis of translation-embedded web search behaviors. I paid special attention to the source text types (in particular, their degree of specialization) and the task descriptions (or translation briefs) provided as part of the embedding tasks.

On the other hand and as previously indicated, I use the notion of web search task to refer to the participants' search needs, search goals, search processes, and search outcomes embedded in translation problem solving. Each of these constituent elements was treated as a unit of analysis for categorizing the study's research data. Several taxonomies have been proposed

for "classifying task types, users' types of information needs, or users' goals in information searches" (Aula 2005: 29). Taxonomies based on users' search goals, for instance, tend to distinguish between close-ended search goals that yield fact-finding or known-item searches (where the answer to a specific question is unambiguous) and open-ended search goals that yield exploratory, topic, unknown-item, or subject searches (where the search outcome is open and not known in advance). These taxonomies, which tend to adopt the form of dichotomies, include Matthews, Lawrence, and Ferguson's (1983) "known-item" versus "subject" searches; Marchionini's (1989) "closed" versus "open" tasks; and Navarro-Prieto, Scaife, and Roger's (1999) "fact-finding" versus "exploratory" tasks, to name but a few. Other taxonomies classify search tasks, questions, and needs according to their degree of specificity or complexity, such as Saracevic and Kantor's (1988) "specific" versus "broad" questions, Cutting and others' (1992) "specific" versus "general" needs, and Qiu's (1993) "general" versus "specific" tasks.

Most of the taxonomies mentioned previously are, however, based on users' searches on online database systems, online catalogs, or electronic resources. Taxonomies that specifically address searches performed on the web include White and Iivonen's (2001) "open" versus "closed" questions, as well as "predictable" versus "unpredictable" sources (the latter distinction involves searching for a known website as opposed to an unknown one); Broder's (2002) "navigational" web searches (the goal is to find a known website), "informational" web searches (the goal is to obtain information), and "transactional" web searches (the goal is to carry out an activity via the web); and Rose and Levinson's (2004) "navigational," "informational," and "resource" searches (where the latter involves finding something different from information). Furthermore, Jansen, Spink, and Saracevic (2000), as well as Spink and others (2001), have examined in depth the topics of users' searches and their queries (cf. K.-S. Kim and Allen 2002: 111; Aula 2005: 29–30).

Following this overview of web-based information searching from a theoretical point of view, I will, in the following section, provide a general discussion of fundamental web search knowledge and strategies from a translation-oriented perspective.

3.2   WEB SEARCH KNOWLEDGE AND STRATEGIES

Accessing information from the World Wide Web has become routine behavior for a large and diverse user population. This has been made possible by a dramatic increase in Internet penetration and impact over time. According to the December 2012 Pew Internet and American Life Project survey, in the United States alone 81% of the adult population use the Internet (Pew Internet 2013: n. p.). Similarly, 80% of adults in the UK had accessed the Internet within the three months prior to a survey conducted

by the British Office for National Statistics (2012: 1) as part of its "Internet Access—Households and Individuals, 2012" statistical bulletin. Of those adults, 67% used a computer every day (ibid.).

The growth of the network society (cf. Castells 2000), especially in Western countries, has led to an increase not only in Internet usage among users from all sorts of demographic backgrounds but also in the type of activities conducted online, including social, leisure, work, and educational activities. For over a decade now, "Pew Internet data has consistently shown that search engine use is one of the most popular online activities, rivaled only by email as an internet pursuit" (Purcell, Brenner, and Rainie 2012: 3). As the December 2012 Pew Internet and American Life Project survey shows, both search and e-mail top the list of most popular online activities, with 91% of the American adults using the Internet to conduct both activities. Of those adults, 59% perform these two activities online on any given day (Pew Internet 2013: n.p.). In 2004, this figure "stood at just 30% of internet users" (Purcell, Brenner, and Rainie 2012: 5).

Like most Internet users, the participants of my study (i.e., four translation students in their first year of studies and two translators with three and fifteen years of experience, respectively) also claimed to use the Internet mainly for e-mailing and informational searching. As Jansen, Booth, and Spink explain, the aim of informational searching is to "locate content concerning a particular topic in order to address an information need of the searcher . . . . The need can be along a spectrum from very precise to very vague" (2008: 1256, drawing on Rose and Levinson 2004). Informational searching differs from transactional searching, which aims at "locat[ing] a Website with the goal to obtain some other product, which may require executing some Web service on that Website" (ibid.). In my study, only the translator with the most web search and translation expertise among the research participants indicated explicitly using the Internet for transactional searching as well, yet I believe it is safe to assume that transactional searching was also part of the online (entertainment) activities of the remaining participants.

With regard to informational searching, 'online Americans' claim to be more satisfied than ever with search engine performance, in particular with the quality of search results. According to the Pew Internet and American Life Project survey in February 2012, 91% of search engine users state that "they always or most of the time find the information" they are seeking, and 73% believe that "most or all the information they find . . . is accurate and trustworthy" (Purcell, Brenner, and Rainie 2012: 3). Furthermore, 66% of American search engine users agree that "search engines are a fair and unbiased source of information" (ibid.). Regarding the quality of search results, 55% of users think that said quality has been "getting better over time," while only 4 % say that "it has gotten worse." Similarly, 52% state that "search engine results have gotten more relevant and useful over time, while just 7% report that results have gotten less relevant" (ibid.).

American search engine users are very confident not only in search engine capabilities and the quality of the information retrieved but also in their own search abilities. More than half of search users (56%) "say they are very confident" in said abilities, and another "37% of search users today describe themselves as somewhat confident, with fewer than one in ten saying they are not too or not at all confident in their ability to use search engines to find information online" (ibid.: 12). Due to "the largely positive view of the quality of information search engines yield, and their own search abilities, it is not surprising that many search users report positive experiences using these tools," such as learning something new or important that helps them increase their knowledge (ibid.: 14). Nevertheless, many search engine users "also report having experienced the downside of search. Four in ten searchers say they have gotten conflicting or contradictory search results and could not figure out what information was correct. About four in ten also say they have gotten so much information in a set of search results that they felt overwhelmed. About one in three have had the experience of discovering that really critical or important information was missing from search results they got" (ibid.). One should of course not underestimate the considerable demographic effects on users' own perceptions of search engine performance, search abilities, and types of experiences with search engines. As Purcell, Brenner, and Rainie point out, one particular group that stands out in terms of their perception of search abilities is "adults living in the lowest income households. This group is more likely than any other to say that they *always* find what they are looking for, with 37% reporting this" (2012: 13). The types of experiences that users have with search engines also vary according to other demographic data, such as educational background, gender, and age. Here, Purcell, Brenner, and Rainie state that "college educated search engine users are more likely than those with less education to report having all" the positive and negative experiences referred to previously (ibid.: 15). Moreover, for experts in specialized domains who are not primarily interested in *recall* (i.e., the ability of the IR system to retrieve *all* relevant documents) but in *precision* (i.e., the ability of IR system to retrieve *only* relevant documents), their search experiences are likely to be less positive than those of nonexperts in specialized domains.

For translators, who need to retrieve expert information from the web as part of their profession, understanding the process of information searching therefore becomes essential for successful web search performance, which, in turn, may lead to successful translation performance. Furthermore, given that translation is very much about knowledge dissemination, the translator's role as "an information user, processor, and producer" (Pinto Molina 1999, 2000, 2001) highlights the need for online documentary research skills in processes of decision making and problem solving. In the following, I will provide an overview of fundamental web search knowledge and strategies by addressing the three main stages involved in information searching: seeking and retrieving information, evaluating

information, and saving information for reaccessibility purposes. A more concrete discussion of web searching from the (student) translator's point of view is provided in Chapters 6 and 7.

3.2.1   Information Search and Retrieval

According to Austermühl, there are three main approaches to searching (translation-related) information on the web (2001: 52). These approaches to information searching—often referred to as "strategies" in the IB literature—are institutional searches (carried out via URLs), thematic searches (via subject trees), and keyword searches (via search engines). Institutional searches involve the finding of expert sites and valuable web resources, such as newspaper archives, international organizations' sites, commercial sites, and terminological databases. These searches are generally performed by guessing URLs "using the standard URL structure" (e.g., www, name of site, type of site, country of site) (ibid.: 53). Although this type of searching tends to provide generic information at first, detailed information can be retrieved by carrying out specific searches using the expert site's own resources, such as internal search features, databases, specialized documents, press releases, glossaries, and so forth (ibid.: 55). A thematic approach to information search and retrieval involves directory-based searches that allow the user to browse data through subject trees or thematic categories of information. Although this might be the least common and possibly outdated approach to information searching nowadays, information services like those provided by libraries through their online public access catalogue (OPAC) systems can be very useful in combining thematic searches with keyword searches. The latter involve the typing of keywords in a search engine box to find information on a particular topic, "to locate something to buy, or to simply find the shortest route to a site we already know exists (the practice of typing in a word you know so as to yield a site you wish to visit, also called a navigational query)" (Battelle 2006: 31; cf. Broder 2002). The purpose of a navigational query is therefore different from that of a regular keyword search. While a user would perform a navigational query to find *that which is known*, he or she would perform a keyword search to find *that which is not known*. The latter phenomenon would thus appear to cause what Battelle refers to as "Web blindness: a sense that we know there's stuff we want to find, but have no idea how to find it" (ibid.: 32).

Although the institutional and thematic approaches to information searching are considered efficient to identify key information, as well to find reliable sources, on the web—for example, glossaries, definitions, images, parallel texts, reference works, and online databases—the keyword search approach is generally considered the most powerful and comprehensive one for finding information online (Austermühl 2001: 59; cf. Alcina Caudet, Soler Puertes, and Estellés Palanca 2005: 224). This is mainly due to search engines' capabilities of scanning the entire contents of hundreds of millions

of web pages at a time. Both navigational and keyword searches are typically performed in popular search engines such as Google, Yahoo!, Bing, AOL.com, and Ask.com.[1]

Although, as stated previously, the keyword approach is considered the most powerful method for finding information online, the search process behind this approach is neither as straightforward nor as sequential as it would seem at first. As far as straightforwardness is concerned (I will briefly refer to the nonsequential nature of search processes in 3.2.2), search engines tend to be very powerful regarding the *retrieval of data* that are essentially factual and unambiguous (e.g., proper names, numbers, and addresses) and that provides an answer to closed questions such as "What is the population in Spain?" According to Abadal Falgueras, a powerful performance is possible due to the "highly structured" and "deterministic" nature of data retrieval (DR) (2004: 410, drawing on Blair 1990). In contrast to DR, search engines have a much poorer performance concerning the *retrieval of information* that is less factual and that may provide answers to open-ended questions such as "Which factors led to the current economic crisis in Spain?" The poor performance of search engines for IR is mainly due to the nature of artificial intelligence and the complexity of natural language processing, which make the relationship between questions and answers in IR systems a nondeterministic one (cf. Dreyfus 2001; Abadal Falgueras 2004; Torres del Rey 2005).

For Abadal Falgueras, the main problem of IR systems is their inability to directly link users' questions to documents that may contain satisfactory answers, which results from the lack of concordance between users' query terms and those included in the IR system used for indexing the web (2004: 409–410). Similarly, Carpineto and Romano claim that the

> most critical language issue for retrieval effectiveness is the term mismatch problem: the indexers and the users do often not use the same words. This is known as the *vocabulary problem* Furnas et al. [1987], compounded by synonymy (same word with different meanings, such as "java") and polysemy (different words with the same or similar meanings, such as "tv" and "television"). Synonymy, together with word inflections (such as with plural forms, "television" versus "televisions"), may result in a failure to retrieve relevant documents, with a decrease in *recall* . . . Polysemy may cause retrieval of erroneous or irrelevant documents, thus implying a decrease in *precision*. (2012: 2)

For Spink and Jansen, "[t]he issue of correctly matching the Web query with Web content is [also] one of the key elements in providing quality services for users of Web search engines" (2004: 78). Hence, the study of web queries is critical for developing "better Web search engines" and understanding how people use these IR systems (ibid.). To deal with the term mismatch problem, Abadal Falgueras suggests keeping strict control of the

terms used in IR systems for indexing the web, so as to bridge the gap between those terms and the ones employed by users for retrieving information (2004: 410). Other approaches that support not only information seek and retrieval but also search results evaluation include interactive query refinement (using terminological feedback from web searchers to offer search term suggestions), relevance feedback (using searchers' relevance judgments of previously retrieved documents), word sense disambiguation (identifying the sense of a word with multiple meanings), and search results clustering (grouping results by topics, subtopics, journals, dates, authors, etc.).[2] According to Carpineto and Romano, a highly promising technique is "Automatic Query Expansion" (AQE), which involves expanding "the original query with other words that best capture the actual user intent, or that simply produce a more useful query—a query that is more likely to retrieve relevant documents" (2012: 2).

While AQE is considered one of the most successful techniques for improving the "retrieval effectiveness of document ranking," thus being increasingly "adopted in commercial applications" (e.g., desktop and intranet searches), "it has not yet been regularly employed in major operational Web IR systems such as search engines" (ibid.: 2–3). Previous research in this area in fact shows that AQE in web search may not be sufficient for cases in which users are mainly interested in precision (ibid.: 5)—a phenomenon that, for various reasons (cf. Anick 2003), also applies to all the techniques mentioned previously when they are incorporated into large-scale web search engines. With regard to AQE—that is, the object of our discussion—Carpineto and Romano explain that

> [o]ne common problem affecting the precision of document ranking is that retrieved documents can often match a query term out of context with its relationships to the other terms. There may be several types of out-of-context matches causing false drops. In Bodoff and Kambil [1998], for instance, five types were identified: polysemy, ordered relationships among terms (e.g., "wars due to crises" versus "crises due to wars"), out of phrase terms (when a query or document phrase is not treated as a single unit), secondary topic keyword (e.g., "siamese cats" versus "cats"), and noncategorical terms (e.g., "tiger" is simultaneously an instance of "mammal" and of "operating system"). The problem of improper partial matching between query and document can be ameliorated by using AQE, to the extent that the additional terms favor a more univocal interpretation of the original query. (ibid.)

Nevertheless, as indicated previously, AQE has its limitations for web searching when it comes to favoring precision over recall. To this end, interactive query expansion (IQE) may be a better option than AQE. Both IQE and AQE offer suggestions for query formulation and refinement. However, with IQE it is the user who makes decisions about term selection. Google

Suggest is one of the most popular systems of this kind, providing "real-time hints to complete a search query as the user types" (ibid.: 8). This method, however, "generally requires expertise on the part of the user" (ibid., drawing on Ruthven 2003).

To better match queries to web content, search engines make use of Boolean operators (i.e., AND, OR, and NOT) along with other search operators (e.g., double quotes for exact phrase searches), as well as other techniques such as anchor text (i.e., text surrounding a link) and link analysis. From a user's vantage point, overcoming some of the limitations of IR involves the ability to construct effective search expressions that are directly related to and relevant for our search queries. It also requires knowledge about the web search engine(s) we use, their capabilities, limitations, and so forth. Most of today's commercial search engines provide their own advanced search features and operators, which offer numerous options to expand or narrow down users' search queries according to their information needs. Google Advanced Search, for example, lets the user search for all query terms, an exact query phrase, at least one of the query terms, or none of the specified query terms—the latter typically used to remove ambiguity, for example, in the case of polysemous words. In addition, users can search for words written in a given language; created in a specific file format; updated within a certain period of time; and contained within a specific range, domain, country, or site, among others.

Users can also improve their searches by using the previously mentioned search operators in combination with relevant keywords. As mentioned earlier, both advanced search features and operators typically modify the search in one way or another—that is, by expanding or restricting it. For example, the synonym ("~") and OR search operators are used to broaden a search, whereas the minus ("–" or NOT), plus ("+" or AND), and quote ("") operators are used to narrow it down. These operators are in fact the most commonly known ones among search users, including the participants of my study. Among them, only the most expert translator and web searcher of all was familiar with the proximity operators NEAR (to find documents where the query terms are in a short range of words) and ADJ (to find documents where the query terms are next to each other), as well as the alternative query type "define:" (to search for term definitions). Other, rather intuitive query types include "link:" (to find pages that link to a URL or pages within said URL), "related:" (to find pages similar to a URL), "site:" (to find information within a single website, top-level domain, e.g., .org and .edu, or country top-level domain, e.g., .es and .jp), and so forth.[3] Some search engines also allow users to construct more complex queries by grouping search operator statements using parentheses. This produces a "nested search"—that is, a type of query that uses parentheses to embed, or nest, a search statement within another. As nested searches can get rather complex—for example, (y OR (NOT x) AND z)—and hence become error-prone, parentheses should perhaps be used sparingly.

Queries are clearly an integral part of web searching. They are the "expression of a searcher's information problem" (Spink and Jansen 2004: 77) or, as Battelle puts it, "the loadstone of search, the runes we toss in our ongoing pursuit of the perfect result" (2006: 26–27). Users' ability to express information problems in a form that is understandable by search engines is therefore essential for successful web searching. From a user's point of view, and as briefly indicated earlier, successful search query syntax—that is, the statements or expressions used to transform search questions into search queries—depends on various factors, which, in turn, affect search engine performance. The factors that I took into account for the purpose of my study were *query complexity* (simple vs. advanced queries), *query length* (number of terms in a query, excluding prepositions, articles, and punctuation), and *query effectiveness* (the effect that certain terms over others may have for potentially obtaining relevant search results). I will return to these aspects in Chapters 6 and 7. Let me briefly refer to Carpineto and Romano here to point out that when a query contains "multiple-topic specific keywords that accurately describe [the] information need, the system is likely to return good matches; however, given that user queries are usually short and that the natural language is inherently ambiguous," IR systems are generally "prone to errors and omissions" (2012: 2).

Relating to the "reluctance and the difficulty of users in providing a more precise description of their information needs" (ibid.: 40), which represents one of the main limitations in current IR systems usage and generally results in short, underspecified queries, Battelle states that "[n]early 50 percent of all searches use two or three words, and 20 percent use just one. Just 5 percent of all searches use more than six words" (2006: 27). In early 2013, KeywordDiscovery.com claimed that single-keyword searches are becoming less common and that users predominantly used single-keyword searches followed by two- and three-word searches, except for American users, who primarily used two-word searches followed by single- and three-word searches. Similarly, Aula states that previous research has shown that "Web searchers use short queries (about two terms per query), [that] they rarely use Boolean operators or term modifiers, and that they often make mistakes with more elaborate queries" (2005: 17). From Battelle's point of view, the use of short queries can be explained by searchers' "poorly structured intentions" (2006: 273). Obviously, the more information we provide about a specific search need, the higher the likelihood of the IR system to retrieve better search results. However, as Aula points out, "providing more information is not as simple as typing in more query terms: the terms need to be highly relevant to the task, and they need to be entered in combination with system-specific correct syntax" (ibid.: 18). Battelle also points out that "focusing on the number of words in a search query misses the point: it's not the complexity of the search that matters [so much]; it's the complexity of our language" (2006: 25). Hence, the notion of "term selection"—which is directly related to the notion of query effectiveness—becomes highly

significant in web search. The underlying implication is that not all terms in a query are weighted the same or are of equal importance.

As Spink and Jansen explain, "[t]he idea behind term weighting is that the terms with the most importance should have more effect on the retrieval process" (2004: 56). Similarly, "[t]he idea behind the term co-occurrence approach is that the search engine or searcher can use . . . similar terms [to those specified by other users] to augment the current query and improve retrieval performance" (ibid.). Spink and Jansen nevertheless warn us that term co-occurrence "is a tricky area . . . because frequently occurring terms tend to discriminate poorly between relevant and non-relevant documents. If the identified terms occur too frequently they do little and often nothing to improve the effectiveness of the query" (ibid., drawing on Peat and Willett 1991), particularly so in the case of AQE. In my study, for example, all six participants chose terms that were relevant for their search topics—that is, terms included in and determined by search questions emerging from the source texts. The level of term co-occurrence was therefore high. However, differences in query length, query complexity, and structure (i.e., order of terms and operators)—in particular how the participants combined search operators or modifiers with keywords in order to expand or constrain their searches—meant that some queries were more effective than others in obtaining relevant results.

The relevance of the documents that search engines match to a specific query, however, depends not only on query terms and query structure but also on the capabilities of the search engine software used. Most current consumer search engines comprise four main modules: the web crawler (which combs through the pages found on the web to gather information on a particular query), the index (a database containing the pages gathered by the crawler), the search and matching algorithm (which connects a user's query to the index), and the ranking algorithm (which ranks the results of the query). As briefly indicated previously, one of the main rules that a ranking algorithm uses to determine a document's relevance to a query (i.e., to rank matches) involves the location and frequency of keywords on a given web page. Other document features that allow matching a relevant document to a query include the analysis of links, the date of publication, the length, the proximity of the query terms, and so forth. Nevertheless, not all search engines retrieve and rank results in the same way. The findings of Spink, Jansen, and others' study on the overlap in results returned by four top web search engines—MSN Search (now Bing), Google, Yahoo!, and Ask Jeeves (now Ask.com)—show that these search tools "have built and developed proprietary methods for indexing the web and their ranking of query driven search results differs greatly" (2006: 1389). In fact, the main finding of Spink, Jansen, and others' study is that

> [l]eading Web search engines rarely agree on which results to return on the first results page for any given search query. This finding confirms

previous research results in the up-to-date context of a large study of major commercial Web search engines. The study results highlight the fact that different Web search engines, which use different technology to find and present Web information, yield different first page search results. There is also a high degree of uniqueness in sponsored links between the major paid search providers. Web search engine's first page results are primarily unique, meaning the other engines did not return the same result on the first result page for a given query. The fact that no one Web search engine covers every page on the Internet and the majority of page one results are unique may contribute to the fact that almost half of all searches on the four major Web search engines fail to elicit a click on a search result. (ibid.: 1388–1389)

To mitigate this problem—that is, the lack of overlap in results—the authors suggest using metasearch engines (e.g., Metacrawler and Dogpile. com), which "harness . . . the collective content, resources, and ranking capabilities of . . . top Web search engines and can deliver Web searchers a more comprehensive result set containing potentially relevant results from the top Web search engines to the first results page" (ibid.: 1389). Due to the dynamic nature of web content, single search engines are incapable of "cover[ing] the entire Web all of the time;" hence, the importance of using metasearch technology that "leverages the search power of the top Web search engines [and that] may reduce the time spent searching multiple Web search engines while providing the top ranked results from the single Web search engines" (ibid.).

Other technologies that promise to leverage the power of search engines and improve users' web search and navigation experience are those used in the attempt to expand the web as we know it today—that is, a medium of documents for humans to read—into a Semantic Web that includes data and information for computers to process and manipulate. At its core, the development of the Semantic Web involves describing content for computers to "understand" and "express" meaning. Obviously, as Paul Ford points out, "what's going on is not understanding, but logic, like you learn in high school: If A is a friend of B, then B is a friend of A. Jim has a friend named Paul. Therefore, Paul has a friend named Jim" (2002: n. p.).

Creating a new form of web content that is meaningful to computers is not a new idea. Quite to the contrary, the concept has been around since 1994, when Tim Berners-Lee, the inventor and main proponent of the web, presented it "at the very first World Wide Web Conference. This simple idea, however, remains largely unrealized" (Shadbolt, Hall, and Berners-Lee 2006: 96). According to Berners-Lee, Hendler, and Lassila, the main challenge of the Semantic Web "is to provide a language that expresses both data and rules for reasoning about the data and that allows rules from any existing knowledge-representation system to be exported onto the Web. Adding logic to the Web—the means to use rules to make inferences, choose courses

of action and answer questions—is the task before the Semantic Web community" (2001: 37). Two main technologies for creating the Semantic Web have already been in place for a number of years now. These are eXtensible Markup Language (XML) and Resource Description Framework (RDF). While XML lets users create their own tags and add structure to documents, it does not explain what the structures mean. In contrast, RDF "provides the technology for expressing the meaning of terms and concepts in a form that computers can readily process. RDF can use XML for its syntax and URLs to specify entities, concepts, properties and relations" (ibid.: 38). In other words, using RDF language, it is possible to create and combine logical statements for items (e.g., users and web pages) to have properties (e.g., "is a friend of") with certain values (e.g., another person or web page). The relationships among concepts and the rules for logically reasoning about them are defined by "ontologies" or "collections of statements written in a language such as RDF" (ibid.). So-called agents—that is, software programs that run "without direct human control or constant supervision"—would then be responsible for collecting, filtering, and processing "information found on the Web" (ibid.). The impact that a Semantic Web of this kind would have on users' searches was already envisaged by Berners-Lee more than a decade ago when he stated that "if an engine of the future combines a reasoning engine with a search engine, it may be able to get the best of both worlds . . . It will be able to reach out to indexes which contain very complete lists of all occurrences of a given term, and then use logic to weed out all but those which can be of use in solving the given problem" (1998: n.p.). Although Berners-Lee's conception of the Semantic Web still remains unrealized,[4] some progress has already been made towards its achievement (see Shadbolt, Hall, and Berners-Lee 2006 for advances made in this direction; see also Webster, Sin, and Hu 2002 for an overview of the use of Semantic Web technology for example-based machine translation). For the time being, however, users will continue to search today's web, taking advantage of the type of search engine capabilities described previously. Search success will continue to depend largely on users' knowledge about how search engines work. In other words, knowing the rules of the web search engine(s) we use is crucial for constructing effective search queries.

3.2.2   Information Evaluation and Storage

Understanding search engines will not only help improve users' abilities to work with these tools to obtain satisfactory results but also enable them to know how to better interpret said results. The user's role in the evaluation of results is to decide which of the individual results obtained are worth inspecting in further detail—that is, whether a particular link should be followed or not, whether a query needs to be refined, or whether an entirely new query needs to be constructed. In other words, the user needs to evaluate the *relevance* of the documents retrieved, an evaluation process in which

the user's knowledge of the search domain and the particular search system, among others, play a crucial role. Relevance, however, as Aula points out, is "a complex concept to define," one that is both ambiguous and subjective (2005: 20). For example, while "a document may be relevant to the **information search task** or **query**," it may not be relevant to the user "because (s)he has already gained the necessary information from another document" (ibid.). In general, though, the relevance of a document is typically related to the search topic. This judgment is by no means a binary one; for example, a user may consider a document relevant, partially relevant, or not relevant at all (ibid.). Spink, Greisdorf, and Bateman suggest, for instance, that partially relevant documents may be particularly useful to searchers during the initial stages of their search processes by "facilitating the necessary development of a greater understanding of their information problem" (1998: 612, in Aula 2005: 20). Aula adds that "[i]n the Web environment it is also possible for the document itself to, while not relevant, provide the user with a link to a relevant document. Thus, the document is **useful** for the search task" (2005: 20).

Overall, the successful scanning and evaluation of individual results requires knowledge about search engine functionality, as well as various cognitive processes like perception, attention, recognition, interpretation, decision making, and so forth. The participants of my study, for instance, all claimed to be familiar with very basic search engine features. They knew that search engines retrieve information from a multitude of websites and rank results from the most to the least relevant one, and they knew how to interpret the basic structure of URLs. They also stated that they were aware of the impact that query syntax may have on search engines for retrieving different search results. Furthermore, the fact that different spellings of a search term can produce quantitatively different results was not regarded by the participants as a qualitative parameter in translation decision making. The screen recordings of the study, however, show that quantitative differences for choosing a term X over a term Y were indeed often taken as a qualitative indicator by the student participants, in particular by one of the two nonnative speakers of English. In fact, this student referred to frequency checks as a way of compensating for not being an English native speaker. Using frequency checks as a qualitative criterion for decision making in translation processes is a type of behavior that Gile also identified in the Integrated Problem Decision Reports (IPDRs) completed by some of his translation students. As Gile explains, a type of

> frequently occurring event [is] the choice of term A over term B simply because it [is] found many more times when performing a "search" operation on a search engine such as Google. It is interesting that this quantitative difference was taken by the students as a qualitative indication. On one hand, it showed that they had understood that their approach to terminological choices was supposed to be descriptive more

than prescriptive, in other words, that they had to find out what the sociolect of their target group was, and follow its usage rather than impose their own. On the other hand, it revealed that their analysis of the data obtained was still too superficial. For instance, they had understood that when writing for a French target group, their preference should go to French web sites, as opposed to Canadian sites, Swiss sites or Belgian sites, because of potential differences in the national varieties of French. What they did not take into account when basing their terminological decision on an overall quantitative indication given by their search engine was that Canadian sites were much more numerous than French, Swiss or Belgian sites, and that the large number of hits for one term may have come from a majority of Canadian sites, whereas a majority of French sites may well use another term. (2004: 14)

Regarding users' cognitive processes, it is of course useful to think of these when "considering how search engines could facilitate result scanning and evaluation" (Aula 2005: 25). As Aula points out, "the user first needs to **perceive** what information might be important in the evaluation [of a search engine's results pages] and to **locate** the information" (ibid). It is a well-known fact that visual aids such as colors, sizes, objects, forms, and textures facilitate these tasks (i.e., perception and location). Here, the field of cognitive psychology has proved particularly useful for the design of search interfaces. It is also important for users to be able to "quickly find the titles of the documents as they can provide compact and accurate presentations of the contents of the documents" (ibid.). The student participants of my study, for example, said they used titles as well as other information displayed on Google's search results pages (SERPs) to scan and evaluate individual results. In addition to the title of web pages (i.e., the first line of any search result), other important information includes the snippet (the short description of a web page, which may include an excerpt from the page) and the URL, or address of a result's web page (see Alcina Caudet, Soler Puertes, and Estellés Palanca 2005: 227–228 for other types of information that search engines may display on SERPs).

In addition to the information noted previously, one of the two students who are nonnative speakers of English referred to the ranking of search results as another parameter that she takes into account for deciding which links to explore further. For this student, the ideal search result should be ranked within the first five top results. This was also the case for the other nonnative speaker, who explained that for her having "to go into the second page of the search results . . . is like a total failure." Similarly, one of the two students who are English native speakers stated, "I don't normal check many sites, if, it's like I choose maybe one or two options that come up in Google and then if it didn't answer the question then I'll try something completely different." Interestingly, the screen recordings of the study show that all four translation students seemed to feel a need to click on at least one

or two result links—typically, from among the first five results ranked by Google—before further refining their search queries. In contrast, the most expert translator and web searcher among all six participants tended not to click on any results but instead refined his initial queries until he found a result that potentially satisfied his search need(s). As Aula points out, the process of refining a query by, for example, finding synonyms of the query terms or a new way of expressing the information need is "inherently difficult, as cognitive processes are much more effective in handling information about **what is** present than they are in dealing with information on **what is not** present" (2005: 19, building on Hearst 1991).

These general findings, which I discuss in more detail in Chapter 6, are very similar to those obtained in previous web-searching studies, which show that search engine users tend to look only at the first results page for each search query (Jansen and Pooch 2001) and that they tend to check the first and the second result before their initial click (Granka et al. 2004). Here, eye tracking has proved a useful method for studying users' result evaluation strategies—a method that has only recently started to be used in translation studies for the same purpose (see 4.2.5 for details). Sutcliffe and Ennis, for example, found three different "sampling strategies" among users: serial search (i.e., examining results one by one), scanning, and systematic sampling of the retrieved set of results (1998: 329). As Aula remarks, "[w]hen the number of results is large, scanning and sampling are needed, whereas smaller results sets render it possible to inspect the contents of the actual documents (2005: 21). As mentioned previously, Granka and others' study shows that users tend to spend more time fixating their gaze on the first and second result, with subsequent results obtaining significantly less fixation time. The study also shows that users scan results following a sequential order from top to bottom until they click on a result link. Klöckner and others' (2004) eye-tracking study suggests that searchers use two main scanning strategies: a "depth-first strategy," used to examine results one by one until a document is opened, and a "breadth-first strategy," which involves checking the entire search results page before clicking on any result. Their findings show that 65% of the searchers used the depth-first strategy, 15% used only the breadth-first strategy, and the remaining 20% used a mix of both strategies. Interestingly, the screen recordings of my study show that the student participants tended to use a mix of both strategies (above all, the depth-first strategy), while the most expert translator and web searcher of the two translators in the pilot study used only the breadth-first strategy. As indicated previously, he would first examine SERPs entirely and then refine his initial queries before opening a document.

Clearly, one of the main advantages of the Internet is that it allows for universal, fast, easy, and immediate access to a vast variety of documents on the web. The ubiquity of information has simply transformed the way translators carry out their documentary research and approach their information needs. However, as Palomares Perraut (1999) and Gonzalo García (2000)

point out, the main disadvantages of the Internet relate to the dispersed nature of the information, the changing or dynamic nature of the content, the structure of the Internet, and the lack of reliable sources resulting from what these authors refer to as the "democratization of information." As Sales Salvador puts it, "the Internet offers the translator an invaluable and inexhaustible source of information, a working medium and a means of communication which modifies the constraints of time and space. But, in view of what many critical voices have called 'infoxication' . . . on the Internet, we need to stress the importance of maintaining a critical perspective when handling sources and evaluating their credibility" (2006: n.p.; cf. Sales Salvador 2005: 6). In addition to the aspects considered previously (i.e., search engine knowledge and cognitive processes), searchers can rely on several indicators to evaluate web documents (e.g., authority; the accuracy, coverage, and currentness of information; and link information). The number of proposed models for determining the credibility and reliability of web-based content is rather extensive (e.g., Codina 2000a, 2000b; Austermühl 2001; Merlo Vega 2003; Gonzalo García and Fraile Vicente 2004; Alcina Caudet, Soler Puertes, and Estellés Palanca 2005; Pinto Molina and Sales Salvador 2008a). The same is true for criteria used in the evaluation of digital content in general. Table 3.1 provides an overview of both general and specific indicators for evaluating web content based on authors' credentials, document preparation and presentation, metainformation and links, accuracy and timeliness of content, coverage and consistency of information, objectivity, and intended audience (cf. Enríquez Raído 2008).

When I asked the participants of my study to consider the assessment parameters included in Table 3.1, they all agreed that the author as well as the accuracy and currency of web content are indicators that should be used for evaluating said content. Similarly, the host of the site—that is, the person or organization sponsoring it—was an important criterion for all of them, except for one student. Furthermore, all the participants agreed that certain aspects related to the presentation of information, in particular the design of the site and the number of graphs and multimedia elements, did not matter in assessing the credibility and reliability of web resources. For the two expert translators of the pilot study, the number of external and internal links did not count either. However, the two students who are nonnative speakers of English considered the quantitative dimension of links from and to related sites an important indicator for evaluating web resources. These participants did not regard the type of intended audience as a key parameter to assess the creditability and reliability of web content.

In addition to the criteria specified in Table 3.1, the most expert translator and web searcher of all referred to the "linguistics quality of the site" as a relevant evaluation criterion, one that could be linked to the accuracy of content in terms of grammatical and factual errors, misspellings, and so forth. The other translator specified an additional criterion, referring to "the public reputation or image of the organisation and its field. Any positive or

Table 3.1   Indicators for Evaluating Web Documents[5]

General Evaluation Indicators	Specific Evaluation Indicators
Authority	- Author's name and contact information - Author's biographical information - Author's affiliation details - Author's motivation for content publication - Author's reputation among peers - Person or organization sponsoring the page - Sponsor's legitimacy
Document preparation and presentation	- Type of site (e.g., organizational site, commercial site, online journal) - Source(s) of information and evaluation process - Bibliography - Structure and presentation of information - Links to related websites - Quality of related websites
Metainformation and links	- Reviews, summaries, commentaries, and ratings of web documents - Links from external websites - Quality of external websites
Accuracy of content	- Reliability of information (verification against other sources) - Type of errors (factual, grammatical, spelling, etc.)
Timeliness of content	- Up-to-date content (including links out) - Content publication date - Date of additional materials (charts, graphs, etc.) - Date when information was placed on the web - Date when the website was last revised
Coverage of information	- Topics included- Level of topic exploration (e.g., general vs. in-depth exploration) - Degree of information comprehensiveness - Degree of information coverage claimed by the site - Print versus online formats
Consistency of information	- Contradictions - Changing data
Objectivity	- Degree of bias - Type of perspectives (e.g., one-sided views) - Type of tone
Audience	- Intended users (e.g., experts, laypersons, students)

negative comments about the site or its contents made by users on other sites." Metainformation in the form of reviews, summaries, commentaries, and ratings of web documents is indeed another relevant criterion for evaluating candidate websites. In contrast to this translator, one of the two students who are English native speakers referred to search engines' capabilities to "find [information] and the importance they give it in ranking it in their search results"—that is, the student adopted a system-oriented perspective rather than a user-oriented one. She and the other English native speaker among the students also referred to the importance of author-related criteria for assessing the reliability of web resources. In fact, both these students showed a healthy critical attitude towards the reliability of certain types of resources and information found on the web. The two students who are nonnative speakers, however, showed a less critical attitude by considering commercial sites, as well as non-expert forums, reliable sources of information.

Another aspect that should be considered when using the web as a resource for seeking and retrieving information is the nonsequential nature of web searches—that is, the fact that users' search processes are *iterative* by nature, which indeed represents a major feature of users' navigational behavior in general. In evolving iterative web searches, we tend to start a new search while still evaluating a candidate web page. In other words, we often initiate a new search before completely evaluating the web page we are currently reading. This means that certain results prompt additional search results, with the user moving from one result to the other via links (web document discovery can in fact be highly structured via hyperlinks), new keyword searches, or a combination of both. This type of navigational behavior—that is, the movement actions linking one information node to another—has two major implications for search processes. First, it highlights the need for integrating evaluation criteria directly into users' search sessions. Second, it calls for effective navigational techniques that would allow users to reduce the cognitive load that is believed to increase substantially as we extend our web searches (Kirsh 1995, 2000), which in turn become less effective due to the number of simultaneously opened web browser windows (Lee 2003, 2005).

The very iterative nature of search processes also means that, in addition to the simultaneous seeking, retrieval, and evaluation of information, translators need to select and classify said information in a way that can be (re)used for various translation tasks. There are several procedures for saving and classifying information found on the web. The most common ones involve bookmarking web pages and saving said pages in dedicated folders on the hard drive. According to Aula, the browser history tool is, in contrast, "very infrequently used" for reaccessing information (2005: 23). This is most likely due to the fact this tool is nonselective (it retains all the steps along the way, despite the fact that only one web page may be important)

and "becomes inevitably cluttered" (ibid.). The participants of my study, except for the student referred to next, said they used bookmarks for saving web pages they may need to reaccess. Some of them further specified that they save and classify their search results in dedicated folders in the Favorites or Bookmarks menu. Bookmarks, while being an important tool for reaccessing information, can (like the history tool) generally be accessed from one computer only, can be difficult to organize (particularly so when the collection of bookmarks grows large), and "do not guarantee information re-access" (ibid.). The only student who did not refer to any of the procedures mentioned previously—possibly because she was not familiar with them—explained that she normally copied and pasted links into a Word file for saving and reaccessing information, which is indeed consistent with the screen-recorded data of the study.

The screen recordings also show that the Back button was another common tool used by the student participants for information reaccess. In contrast, the most expert translator and web searcher of all preferred to have multiple browser windows or tabs open simultaneously to explore different topics and reaccess information. This navigation style can in fact be more efficient than using the Back button, in particular when searching for multiple topics at the same time. This translator also said he normally downloads files and saves them into a dedicated folder in the hard drive. To this end, he specified the use of the "Save as" command, which allows for downloading and saving individual web pages (as opposed to entire websites at a time using bulk downloaders, e.g., HTTrack Website Copier or FlashGet). Most importantly, the fact that this translator saves individual web pages in dedicated folders on his hard drive suggests that he compiles electronic corpora that allow for the acquisition of specialized knowledge and the identification of text type conventions, as well as for phraseological, terminological, and collocation searches, among others (cf. Austermühl 2001; Adab 2002; Sánchez Gijón 2005). There are a number of tools available for text searching and analysis. WordSmith, MonoConc, and WordCruncher are, for instance, popular software programs that allow for concordance or Key Words in Context (KWIC) searches and provide frequency wordlists, collocation information, and so forth. In addition, dedicated term extraction tools such as MultiTerm Extract allow for the automatic extraction of terms from texts and the creation of project-specific glossaries.

Finally, I should note that none of the participants referred to either the browser history tool or more recent and popular tagging services used for classifying and sharing links. As briefly indicated earlier, in late 2004 a new tagging approach emerged based on a bottom-up hierarchy that allows users to bookmark web content by creating their own tags. This approach to web-scale tagging is known as "folksonomies" (folk + taxonomies) and appeared as an alternative to the ontologies developed to render the semantics for the Semantic Web. According to Shadbolt, Hall, and Berners-Lee, folksonomies "represent a structure that emerges organically when individuals manage

their own information requirements. Folksonomies arise when a large number of people are interested in particular information and are encouraged to describe it—or tag it (they may tag selfishly to organize their own content retrieval or altruistically to help others). Rather than a centralized form of classification, users can assign keywords to documents or other information sources" (2006: 100). Examples of software applications that allow for tagging on a web scale include Flickr (a photo management and sharing application) and del.icio.us (a social site for sharing bookmarks), which are "driven by decentralized communities from the bottom up" and are often referred to as "Web 2.0 or *social software*" (ibid.). Web 2.0 tools include blogs, wikis, social bookmarking, and social-networking applications, the benefits of which for teaching in general and translation pedagogy in particular have been the object of research in recent years. From the perspective of documentary research for online translation-related information, I particularly perceive social bookmarking as a highly promising platform for letting translation trainees engage in the discovery, tagging, and sharing of expert information to be (re)used in various collaborative translation projects.

4   Methods for Research into Translation and Related Information Behaviors

The diversity of research methods and goals in process-oriented studies has significantly helped improve our understanding of various aspects characterizing the translation process. Nevertheless, as Jääskeläinen remarks, this multiplicity of research approaches and interests is not entirely unproblematic (1996: 61). In her view, "the differences in the kinds of data collected, the kinds of analyses carried out, and particularly the overall goals of research have made it . . . difficult to test the methods employed in different studies" (ibid.). These methods, borrowed primarily from psycholinguistics and the cognitive sciences, include various types of (non)verbal introspection and direct observation. Verbal protocols, for example, were predominantly used (often combined with video recordings, questionnaires, and interviews) during the first decade of translation process research (i.e., from the mid-1980s to the mid-1990s). The use of different kinds of verbal protocols, however, made the comparison of results across several think-aloud protocol (TAP) studies particularly challenging. Furthermore, the methodological shortcomings associated with verbal reporting led to the development, in the late 1990s, of more rigorous methodologies by supplementing thinking aloud (TA) with other methods, such as keystroke logging. More recently, other sophisticated methods like screen recording and eye tracking have also found their way in the investigation of both translation processes and related information-search processes.

When conducting research on users and information systems, there is also a variety of methods and tools at the researcher's disposal. In the field of information behavior (IB), and especially in library and information science, "transaction logs and transaction log analysis [TLA] is one approach to data collection and a research method for both system performance and user behavior analysis that has been used since 1967" (Jansen, Taksa, and Spink 2009: 2). TLA is in fact "a common method of capturing characteristics of user interactions with IR [information retrieval] systems" (Jansen and Pooch 2001: 236). With the advent of the Internet, and as Jansen, Taksa, and Spink explain, we have to expand this definition to "include systems other than information retrieval systems" (2009: 2). TLA is nowadays considered

"a broad categorization of methods that covers several sub-categorizations, including Web log analysis (i.e., analysis of Web system logs), blog analysis and search log analysis (analysis of search engine logs)" (ibid.). A transaction log, then, "*is an electronic record of interactions that have occurred between a system and users of that system*" (ibid). These data log files can "come from a variety of computers and systems (Websites, OPAC [online public access catalogue], user computers, blogs, listserv, online newspapers, etc.), basically any application that can record the user—system—information interactions" (ibid.) (see Jansen and McNeese 2005 for their taxonomy of user-system interactions).

One of the main advantages of TLA—popular among librarians and IR system developers—is that it represents an unobtrusive way of collecting data on users' online searching behaviors involving large numbers of users and data sets. TLA therefore "enables macroanalysis of aggregate user data and patterns and microanalysis of individual search patterns" (Jansen, Taksa, and Spink 2009: 2). Similarly, for Jansen and Pooch TLA allows researchers to "discern attributes of the search process, such as the searchers' actions, the interaction between the user and the system, and the evaluation of results by the searcher" (2001: 236). The resulting logs are usually considered valuable sources of user information that can be analyzed quantitatively (via statistical analysis) or qualitatively (by examining queries for semantic information on search strategies).

TLA has nevertheless shown a number of limitations, especially with regard to the difficulty of data analysis and the identification of individual users as opposed to individual terminals (Kurth 1993: 100). In an effort to "move transactional log analysis away from 'hits' to users," some researchers have employed alternative "deep log methods to produce genuine user analyses which have highlighted the difference of information seeking behaviour" according to demographic data, such as age, gender, geographical location, and so forth (Nicholas, Huntington, and Jamali 2007: 629). Although studies based on log data make it possible to study a large number of users, this research approach is, as Aula, Jhaveri, and Käki point out, "weakened by an ignorance of the [search] context in use" (2005: 583). Jansen, Taksa, and Spink also acknowledge that, like with all data-collection methods, "trace data for studying users and systems has strengths and limitations" (2009: 6). They warn us that trace data must be interpreted "carefully and with a fair amount of caution, as [it] can be misleading" (ibid.: 6–7) for making inferences about the relationship between research variables. Furthermore, Jansen, Taksa, and Spink admit that "transaction log data is not nearly as versatile relative to primary data as the data may not have been collected with the particular research questions in mind" (ibid.: 10). Given the lack of detailed contextual information with TLA, some web search studies on users' search strategies have employed alternative observational methods with small sample sizes. As White and Iivonen explain,

> [m]uch that is known about Web users' behavior in looking for infor-
> mation is derived from qualitative studies that have followed searchers
> throughout the process on a few questions . . . or from studies that
> analyze [transaction] logs containing the strategies without the actual
> questions or the reasons underlying the strategies . . . In the first case, in
> using a holistic approach researchers have been able to identify relevant
> search factors, common practices, and styles of searching on the Web.
> In the second case, researchers understand specific search steps and
> errors in query formulations, but the detail lacks contextual informa-
> tion about questions or users that would make the analyses more useful.
> (2001: 722)

The essentially exploratory and qualitative nature of my own study is in fact
informed by previous web-searching studies that follow a contextual ap-
proach to the study of online search behaviors (cf. Chapter 5). Nevertheless,
I agree with Jansen, Taksa, and Spink that the recording of "behaviors via
transaction log applications on the Web opens a new era for researchers by
making large amounts of trace data available for use" (2009: 11).

Other means of collecting user-searching information are tracking-software
packages (e.g., Cyber Snoop and Pearl Software) that monitor users' activities
on the Internet, including e-mail, chat, web content, and so forth. Internet
monitoring and filtering software to spy on users' activities is usually targeted
at employers who want to track their employees' activities, as well as parents
who wish to monitor their children's interactions with the Internet. Obviously,
the ethical and legal implications of using tracking-software packages for re-
search purposes deserve serious consideration—especially since most of these
packages can even track users' passwords and take snapshots of additional
users' sensitive and confidential information.

With proper ethical and legal care, however, unobtrusive data-collection
tools such as transaction logs, tracking-software packages, and Internet
history logs allow researchers to analyze the search strategies of a large
and varied pool of users. Nevertheless, as stated previously, these solutions
by themselves do not provide access to relevant contextual information.
In particular, these tools would not allow us to observe web search pro-
cesses and translation processes simultaneously, therefore making it difficult
to establish tentative relationships between web searching and translation
performance. Conversely, research methods and data-collection tools spe-
cifically used for research into translation processes, such as retrospection
with replay (R+Rp) using Translog (G. Hansen 2006), would allow the re-
searcher to record and analyze translation processes but not the respective
web-searching processes. To compensate for this methodological imbalance,
a mixed-methods approach using some or all of the tools discussed later in
the chapter would allow for a more complete picture of both translation
and web searching in context. Although not all of these tools are related to
my web-searching study, I will briefly elaborate on the main advantages and

disadvantages of both introspective and observational tools in the following two sections, respectively. This discussion complements other recent contributions dealing with methodological issues involved in the cognitive exploration of translation, such as Pavlović (2007); Göpferich (2008); Mees, Alves, and Göpferich (2009); O'Brien (2010); and Shreve and Angelone (2010); as well as Alvstad, Hild, and Tiselius (2011).

4.1 INTROSPECTION

Introspection, usually in the form of TA, has been one of the main methods for investigating thought processes in translation. Despite much criticism of classical introspection as a method for observing oneself, all successive schools of psychology resorted to TA or verbal reports for eliciting data on mental processes. Furthermore, cognitive psychologists and other contemporary researchers in areas such as cognitive science, education, and second-language learning revitalized the use of introspection during the 1980s and early 1990s. Translation process researchers also borrowed this method from cognitive psychology where, as shown in Chapters 2 and 3, "it has been used to study various problem-solving and decision-making processes" (Jääskeläinen 2000: 71).

The use of TA and other verbal data-collection methods nevertheless continues to be a controversial issue due to three main methodological shortcomings. These relate to (a) the completeness of verbal reports, (b) their effects on the process of thinking, and (c) their ecological validity. Given that these limitations have been intensely discussed in the literature (e.g., Börsch 1986; Kiraly 1995; Jääskeläinen 2000; House 2000; Bernardini 2001; Tirkkonen-Condit 2002; G. Hansen 2005; Pavlović 2007, 2009; Göpferich 2008; Göpferich and Jääskeläinen 2009) and that verbal protocols bear no direct relevance for my study, I will only comment briefly on two alternative verbalization methods known as "retrospection" and "joint translating." The first method generates so-called retrospective verbal protocols and the second what Pavlović (2007) refers to as "collaborative translation protocols" (see Enríquez Raído 2011: 100–112 for a more detailed discussion of these methods).

4.1.1 Retrospection and Joint Translation

As indicated previously, there are a number of limitations that continue to challenge the suitability of verbal reporting as a reliable and valid data-elicitation method. The question of reliability typically concerns the completeness of verbal reports, as well as their effects on cognitive processes, while aspects of ecological validity tend to relate to the extent to which translation situations are subjected to experimental control and hence to the artificiality that may be caused by experimental manipulation. Ericsson and

Simon (1984/1993) extensively address these aspects in their discussion of the conditions under which the TA method is believed to generate reliable and valid scientific data. To assess these methodological shortcomings (i.e., completeness, interference, and ecological validity), one should differentiate first between concurrent and retrospective verbalization.

In concurrent verbal reports (i.e., talk-aloud or TAPs), information is verbalized at the same time that the subject is attending to it. In contrast, retrospective verbalization requires the subject to report on his or her cognitive processes after a task has been completed (ibid.: 16). Depending on the time delay between the completion of the task and the retrospective verbalization, the latter will be regarded as more or less complete: the greater the delay (as in "delayed retrospection"), the more challenging the recall of information, and hence the lower the likelihood of obtaining a complete retrospective report. Conversely, the shorter the time delay is (as in "immediate retrospection"), the less fallible the retrieval of information and the higher the likelihood of obtaining a more complete verbal report. Memory, recognition, and retrieval of information are therefore key factors in retrospective verbalization.

Unlike concurrent verbalization, then, retrospection "does not interfere with the actual translation process, but it is prone to memory failure, which affects its reliability" (Göpferich and Jääskeläinen 2009: 181). Immediate retrospection therefore seems to yield more reliable data than delayed retrospection. Ericsson and Simon nevertheless argue that both concurrent and retrospective verbal reports are the closest reflection of mental processes, but only concurrent—that is, think aloud reports—can claim not to modify cognitive processes, as long as certain conditions are provided for. These conditions, which involve the subject's verbal recoding of information and the instructions provided to generate verbalizations, have been widely criticized in the relevant literature (e.g., Séguinot 1996: 88; G. Hansen 2005: 517–518; Pavlović 2007: 43).

Although TAPs "are still [one of] the main tool[s] for gaining access to the translation process" (Kussmaul and Tirkkonen-Condit 1995: 180), the artificiality surrounding them led some researchers to have the subjects of their experiments translate jointly either in pairs (House 1988; Kussmaul 1991, 1995; Matrat 1992; Séguinot 1996; Barbosa and Neiva 2003; Bergen 2009) or in small groups (Hönig 1990, 1991; Schmid 1994; Pavlović 2007). Translating in pairs generates so-called dialogue protocols, while translating in small groups generates "group protocols," "joint translation protocols," or what Pavlović (2007) fittingly terms "collaborative translation protocols" (CTPs).

Collaborative modes of translating have naturally led to discussions revolving around the advantages and disadvantages of using CTPs over TAPs as a tool for eliciting data on translation processes. After all, as Bernardini points out, "[a] plea for environmental validity is unsustainable in this case: TAPs are either strictly monological or *not* TAPs at all" (2001: 243).

I nevertheless agree with Pavlović that "the very things that invalidate CTPs in terms of Ericsson and Simon's criteria may be the very things we would *like* to find out about the translation processes, for instance, how and why decisions are made" (2007: 48). Furthermore, CPTs have been reported to (a) be less artificial and (b) yield richer data than TAPs (e.g., House 1988, 2000; Séguinot 2000a; Barbosa and Neiva 2003; Pavlović 2007, 2009). While process researchers seem to agree on the latter claim, issues surrounding the less artificial nature of CPTs are still a matter of debate. Jääskeläinen, for example, points out "that asking two (or more) people to translate together is just as artificial a translating situation as a think-aloud experiment, since most translators (students and professionals alike) work alone" (2000: 78). Pavlović nevertheless remarks that "[i]n search of naturalness of one kind (talking to someone else vs. talking to oneself) the other kind of environmental validity (real-life relevance) [need] not be neglected," and that "[n]aturally occurring instances of collaborative translation . . . [could] provide a possible source of authentic data" (2007: 46). What appears to be clear is that at this stage of translation process research "it is impossible to determine whether thinking aloud or joint translating would be 'the' ideal method to investigate translating" (Jääskeläinen 2000: 78).

One way out of the dilemma is to view different research methods as more or less suitable to investigate particular aspects of the translation process. As Pavlović points out, "the choice of methodology to be used in examining translation processes depends on the aims of the project" (2009: 82). Clearly, the object of research is different in joint translation and individual translation, and so are "the variables that may account for the differences between the two experimental conditions" (Jääskeläinen 2000: 74). Given that in collaborative translation settings "subjects have to justify their suggestions and to argue in favour or against their partner's suggestions, this is an ideal method for didactic purposes, both for the subjects involved in the experiments themselves and for other student translators, who, by analyzing successful strategies which become obvious in dialogue protocols, can increase their own repertoire of strategies and thus improve their translation competence" (Göpferich and Jääskeläinen 2009: 172). Similarly, Pavlović stresses that "[t]he use of CPT as a research method seems to be particularly suited for studies aimed at improving translator education" (ibid.). The pedagogical value of joint translation was acknowledged by House as early as 1988, when she argued that "teaching translation (to advanced foreign language learners) in and as interaction . . . might be preferable to the still overwhelmingly popular practice of asking students to translate in splendid isolation" (1988: 96). In contrast, individual translation could perhaps be better suited to elicit data on the cognitive processes of professional translators working in their natural environment. Despite teamwork being an increasing practice among professional translators nowadays, it seems their working environment tends to be more representative of the solitary translation processes they typically engage in on a daily professional basis.

4.1.2   Written Reports and Translation Diaries

In addition to the verbal reports briefly described previously, the pool of available methods and tools in translation includes written reports used to elicit data on translation processes and products. These reports have been typically referred to in the literature as "problem reports" (Gile 1995), "control sheets" (González Davies 1998), "written protocols" (Scott-Tennent, González Davies, and Rodríguez Torras 2000, 2001; González Davies and Scott-Tennent 2005), or "Integrated Problem and Decision Reporting" (IPDR; Gile 2004). Despite the differences in terminology, all these reports have been developed with a common goal in mind: that of providing a systematic method for reporting on translation problem solving within the context of translator training. Problem reports aim at improving the teaching of translation by facilitating the analysis of introspective data on students' translation problems, the strategies applied to solve such problems, the type of sources and aids consulted, the final solutions adopted, and the rationale for these solutions. Different types of questionnaires (e.g., Orozco Jutorán and Hurtado Albir 2002), "translation diaries" (e.g., Fox 2000), "recording sheets" (Atkins and Varantola 1998), and "answer sheets" (Varantola 1998), for instance, have also been used to collect data on different aspects of translation with a pedagogical aim in mind.

Like verbal reports, all the methods and tools described in this chapter also have their particular strengths and weaknesses for research into translation and related information behaviors. Gile, for example, summarizes the main advantages of using problem reports for translator training as follows: (a) They "force students to think about what they are doing and about problems they encounter, thereby raising their awareness of such problems"; (b) they remind students of the two main phases involved in the translation process (i.e., the comprehension phase and the reformulation phase); (c) they "help the instructor identify the cause of errors that could otherwise be attributed to more than one source"; and (d) they "help the instructor monitor the progress of the group's awareness of methodological issues" (1995: 124). For González Davies and Scott-Tennent, written protocols also provide "a means for the students to make visible their translating and reasoning processes . . . [thus improving their] awareness of their thinking process and of their evolution in their acquisition of translation competence" (2005: 165). This is also true with regard to translation diaries that are kept to record translation processes (e.g., Fox 2000).

Raising students' metacognitive levels of awareness is clearly one of the main advantages, and indeed the primary goal of keeping translation diaries or problem-solving reports during the translation process. However, some researchers claim that these reporting tools threaten the reliability and the validity of the data collected as they "might make the translator or the translation student more aware of his or her problem-solving processes, etc., and thus change the process" (Göpferich and Jääskeläinen 2009: 181).

Another problem that affects introspective data collected by means of written reports is the degree of thoroughness with which subjects complete these reports. Gile, for example, warns us that "[w]ith students not familiar with the [IPDR] system, it generally takes a short while before compliance is achieved. Some students do not know what to report in spite of instructions received, and some ignore the reporting requirement" (2004: 7). It follows that written reports, like verbal ones, also provide an incomplete picture of the translation process. In fact, Gile argues that the main limitation of IDPR "probably lies in the non-comprehensive nature of the data spontaneously provided by the students" (ibid.: 10). To compensate for this, he suggests introducing "some more specific questions and/or instructions" (ibid.). González Davies and Scott-Tennent's written protocols, for example, have a particular reporting format consisting of a "standard sheet" with six columns: "[I]n the first, [students] write down the problems found in the source text, in the second, the range of possible solutions, in the third, the advantages of each solution, in the fourth, the disadvantages or reasons to reject some of them, in the fifth, their final solution, and in the sixth, a justification for their choice" (2005: 165).

Nevertheless, written protocols can, as González Davies and Scott-Tennent explain, also adopt a similar semi-open-ended format to that of IDPR to account for different student personalities. One should not ignore, however, the potential impact that different reporting formats may have on the type of data collected. All the written reports described so far, as well as the online search report (see 5.5) that I designed for my study, elicit data in a more or less structured way—that is, in a way that is biased by the researcher's own theoretical principles and understanding of the object of study. TAPs, in comparison, have the advantage of collecting data in a highly unstructured way. That is, TA "predetermines data collection far less than in other models with a more rigid structure . . . in which the range of results is considerably restricted by the data collection tools in direct proportion to the extent of their structuredness" (Krings 2001: 218, cited in Göpferich 2009a: 30).

In comparing IDPR with two retrospection methods—retrospection with replay using Translog (R+Rp) and retrospection with replay combined with immediate dialogue (ID) between the subject and the observer (R+Rp+ID)—Gyde Hansen found that IDPR requires more time and effort than R+Rp, which "does not take much of the subject's time . . . [and] is carried out at double or even triple writing speed" (2006: 10). She also found that "R+Rp is very easy for the subjects to carry out," which may account for the larger number of problems reported with this method than with IPDR (ibid.). Another reason for this difference may be, as briefly indicated previously, the degree of thoroughness with which subjects complete the reports (ibid.: 11). As Gile himself acknowledges, IDPR "does not claim to provide comprehensive information; reporting in writing about all the problems and decisions takes time and effort, and students cannot be relied on to do it

thoroughly" (2004: 8). Indeed, the students using IDPR in Hansen's experiments did not report all their translation-related problems though they were instructed to report all of them (2006: 12). In this regard, Pavlović points out that, no matter how well instructed subjects are, they "tend not to write down all the problems that come up in the verbal protocols" (2007: 56). Nevertheless, combining written reports with other data-collection tools such as screen recording can compensate for this.

Another aspect that deserves attention from a research perspective is the point in time at which subjects choose to complete written reports. In Gyde Hansen's study, for example, "subjects [chose] themselves when to write the reports of their problems and decisions—parallel to every act of problem-solving, after having finished the first draft, or after having written the final target text" (2006: 7). The participants of my study also freely decided when to complete the online search reports to describe the web searches they performed for translation problem solving. They choose to do so *before, parallel to, after* translation, or in *any* combination of these. Carrying out documentary research and reporting about it before starting a translation task would not seem to interfere *directly* with the actual translation process (although it may of course influence certain decision-making processes). In contrast, completing a report while the translation is still being carried out may indeed directly interfere with the translation process. In this respect, some of Hansen's students indicated that "they had felt disturbed by writing the reports and that they had sometimes forgotten their ideas and thoughts in relation to the translation itself" (ibid.: 15). And yet, as Pavlović argues, "if the report writing is left for after the translation is finished, the subjects are likely to forget what problems they encountered during the task" (2007: 56). Interestingly, both the disruption of the translation process and the memory-related aspects dealing with the recall of information were precisely the type of problems that my own translation students encountered when completing the online search reports of the study (cf. Enríquez Raído 2011: 320–337 for details on the interview data collected in this regard). While, as Hansen points out, with immediate "R+Rp the [reporting] process seems to be more natural, as it is not interrupted at all" (2006: 15), this method seems to be better suited to experimental situations than to the type of naturalistic research (embedded in regular translation classes) that I conducted as part of my web-searching study (see 5.1).

4.1.3   Data Sheets and Questionnaires

Most of the methodological issues described previously are also likely to affect the data collected with similar reporting tools, such as data sheets and questionnaires. These tools were used, for example, by Aktins and Varantola (1998), who, for their study of dictionary consultations, designed a questionnaire to elicit data on user profiles and a "recording

sheet" to register the details of every dictionary lookup. As subjects had to work in pairs—"one partner using dictionaries, and the other recording every step of this activity on the [sheets] designed for this purpose" (ibid.: 85)—and the recording sheets were used by the observing partner and not the dictionary user, one could naturally argue that the recording process did not affect the translating process. The study's experimental design has nevertheless a major drawback relating to the fact that participants were not asked "to produce a written translation, simply to look up any expressions they felt were necessary to allow them to translate the passage" (ibid.: 85). Aktins and Varantola explain that the reason for this is that their study focused "on the strategies of dictionary use and not on the dictionary users' skills in translation" (ibid.). However, as Mackintosh points out, "to get a true picture of how dictionaries are used in translation, the testing process should emulate a natural translation process as closely as possible" (1998: 127).

Varantola (1998) adopted a similar methodology in her study of the use of reference sources in translation, in particular the use of dictionaries. There are, however, two main differences compared to Aktins and Varantola's study. First, the subjects of their study were nontranslators whose dictionary lookups and search processes in L1 and L2 translation occurred within a non-translation task. In contrast, Varantola's subjects were advanced students of translation working on an actual L1–L2 translation task, "where the subject matter, while within a special field, [was] still familiar to the lay person" (1998: 179). Second, in Aktins and Varantola's study the dictionary lookups and search processes were recorded by observers, while in Varantola's study the student translators recorded their own reference needs and search processes in "answer sheets" that were a slightly modified version of the recording sheets used by Atkins and Varantola (1998).

This recording process may, as indicated previously, affect the reliability and validity of the data collected concerning the completeness of the reports and their effects on the translation process (again, a drawback that may be compensated for by using tools afforded by new technologies, such as screen recorders). An exception to this would be questionnaires, "which are answered completely outside the translating situation" (Göpferich and Jääskeläinen 2009: 181). Questionnaires are valuable sources of data to collect information on subjects' background variables, such as educational profiles, linguistic ability, and professional experience—information that some early TAP studies, for example, failed to collect in detail—to take into account in the analysis of subjects' translation performance. Nevertheless, questionnaires tend to elicit data in a highly structured way (except, of course, for those comprising open-ended questions only). In contrast, all the written reports (and eventually the recording sheets) discussed previously, while having a particular reporting format that guides the respondents' account of problem-solving activities, only elicit open-ended data.

4.2 DIRECT OBSERVATION

Direct observation is considered one of the most effective ways of collecting ecologically valid data on behavior (Dishion and Granic 2004: 143). Unlike in participant observation, the "direct observer" does not try to become part of the phenomena being observed. Instead, the researcher aims at reducing the degree of invasiveness "so as not to bias the observations" (Trochim 2001: 161). In other words, "[u]nobtrusive measurement presumably reduces the biases that result from the intrusion of the researcher or measurement instrument" (ibid.: 164). This is not to say, however, that observations are entirely bias free. From the perspective of the researcher, it would be naive to ignore the subjective value of human judgment embedded not only in social and cultural environments but also in research settings. From the perspective of measurement, most instruments simply tend to introduce a foreign element in the environment being researched. It follows that for purposes of direct observation, researchers should aim for the least invasive environmental conditions so as not to interfere with the research data. To this end, technological advances have, as further discussed in the next sections, significantly improved the possibilities of investigating translation and related information behaviors in the least unobtrusive way possible.

4.2.1 Note Taking

In addition to the research methods described previously, TA has also been combined with empirical observations of subjects' nonverbal behavior. These observations have been "usually conducted in two ways. Firstly, the researcher is present to take notes and observe the overall process. Secondly, the event is recorded with a video camera so it can be analyzed in closer detail at a later time" (Lauffer 2002: 62). Both methods have been used especially for observing translators' use of paper-based reference material. In this section, I will briefly report on studies that have employed note taking for this purpose. In the next section, I will refer to studies that have used a video camera to record subjects' research activities during translation.

Studies that have examined subjects' use of reference material via note taking include, as shown previously, those of Atkins and Varantola (1998), as well as Livbjerg and Mees (1999). Like the latter researchers, Mackintosh (1998) combined note taking with TA in his study of dictionary use in L2–L1 translation. He preferred direct observation "over indirect reporting methods, such as surveys by questionnaire, because direct observation allows the researcher to see what dictionary users *really* do, rather than relying on what users *say* they do" (ibid.: 126). Schneider also favors note taking over subject-generated data, mainly because having subjects record their own activities "casts some doubt on the reliability of the findings" (2001: 157).

Direct observation via note taking was also the preferred (and only) method employed by Künzli (2001) in his study of the reference sources used by three translation students in their first year of study and three translators who had between four and eight years of professional experience. Künzli observed these subjects in their natural work environment and with sources of information they were accustomed to use to overcome a number of methodological limitations found in other studies (e.g., Krings 1986a, 1986b; Jääskeläinen 1989, 1999; Kussmaul 1995) where, as shown in 2.3, the choice of reference material was sometimes determined by the researchers and where subjects were observed in a nonhabitual work environment.

Unlike all the studies of resource consultation described earlier, Künzli's research focuses on the use of nonprint sources of information, in particular electronic dictionaries, functions in text processing, and reference to human experts (2001: 510). The results obtained "show a correlation between the range of information sources used, expertise of translation and translation quality" (ibid.: 507). No correlation was found, however, between the "preference of a certain type of source (e.g. monolingual vs. bilingual dictionaries)" and translation quality (ibid.). Künzli concludes that his findings have a number of implications "for translation research methodology, as it should be reminded that correlational results do not permit the attribution of causal links, and translation pedagogy, where the criticism often expressed towards the use of bilingual dictionaries seems unjustified in the light of [his] data" (ibid.).

4.2.2   Video Recording

Notwithstanding the value of note taking for direct observation, one should not ignore the possibility that this method may elicit incomplete data and thus involve a "considerable margin of error" (Pavlović 2007: 52). Nevertheless, these drawbacks can be easily overcome by exploiting the possibilities afforded by technology. Video cameras, for example, can be used to supplement verbal reports with behavioral data. In this case, the position of the camera will determine the type of data collected. For instance, the camera may be directed at the translator to record his or her nonverbal behavior. This was the case in Lauffer's mixed-methods research, in which a video camera was set up "to record facial expressions and body language . . . [as] indicators of mental processes" (2002: 62). This, however, "leaves the researcher with the same problem of identifying non-explicit messages and classifying e.g. facial expressions, nods of approval and disapproval, etc." (Kovačič 2000: 102; cf. Pavlović 2007: 52).

Lauffer also used the video camera to record "the think-aloud verbalizations and the non-computerized tasks such as consulting with colleagues and using paper reference materials" (ibid.). Similarly, Dancette (1997) used a video camera to record subjects' nonverbalized behaviors, in particular their

dictionary lookups. In other cases, the camera may be positioned behind the translator to record his or her translation processes. Séguinot (1989b, 1996), for example, used a video camera for this purpose—that is, to capture subjects' translation-related activities carried out on a computer. Nowadays, and as further discussed later in the chapter keystroke loggers and screen recorders are typically used to register subjects' on-screen activities.

Although video cameras can provide useful information about what is going on during the translation process, they are often criticized for being invasive and creating unnatural environmental conditions. Subjects may feel anxious at being observed and hence change their behavior. This concern is echoed by Lauffer, who claims that a video camera "can definitely be a factor of intimidation that makes the set-up feel more like a laboratory than a natural translation setting" (2002: 66). The subjects of her observational study, for instance, admitted "that they had felt comfortable translating but had been aware of the camera recording them" (ibid.). To minimize this effect, Lauffer suggests replacing "a large camera on a tripod . . . [with] a very small camera that creates a video file directly into the computer. The researcher would then not have to run the camera, and could observe from a less intrusive position" (ibid.). Indeed, as Pavlović emphasizes, if a video camera is used to record nonverbal behavior, "it should be small and unobtrusive, and should be positioned out of the subjects' field of vision, such as at an elevated position" (2007: 54). Bernardini goes one step further to claim that if the least invasive environmental conditions are to be ensured, one should

> renounc[e] the wealth of information provided by video-recording so as to check the well-known tendency of subjects to monitor their verbal [and nonverbal] performance more carefully in this condition. Rather, alternative, much less invasive techniques could be used, such as eye-movement tracking and sound recording. It is also possible to write a simple macro to instruct the computer to record every single keyboard stroke and mouse-click performed by the subject. These can then be replayed in the same order and with the same timing, allowing the researcher to observe corrections, hesitations, movements backwards and forwards through the text, and so on (2001: 256).

Lauffer, finally, also believes that "combining the video recording with other methods of observation, especially Translog, minimizes the central role the camera once held in translation observation" (2002: 66). I discuss the main features of this and other key-logging programs in the next section.

4.2.3   Keystroke Logging

Keystroke logging has long been employed as a research method in cognitive studies of digital writing. As Spelman Miller and Sullivan explain,

"keystroke logging offers the opportunity to capture details of the activity of writing . . . [and of] how language users navigate through the task of producing or understanding text" (2006: 1–2). Due to the shortcomings of TA as a method for eliciting subject-generated verbalizations from writers, "observation that generates indirect but detailed information concerning the activity of writing has met favour with some researchers as an alternative method of data elicitation. Following the use of rather unsophisticated direct observation and video-recording methods . . ., the advent of computer-based technology has made available more versatile and discrete methods to record the progression of the writing event unobtrusively without the intervention of video recorder or researcher-observer" (ibid.: 4). During the 1990s, the need to improve the understanding of translation processes by supplementing the traditional qualitative TA approach with quantitative data became more pronounced in translation studies. Consequently, Arnt Lykke Jakobsen and Lasse Schou (1999) developed the key-logging program Translog. This program was first developed in 1995 to record and create a time log of every keystroke of all the editions and revisions (including changes, deletions, additions, and cut-and-paste operations), lookups in integrated dictionaries, and cursor movements made by translators during their text-production processes. As more process-oriented researchers started to use Translog, a new version was developed towards the end of 1999 to incorporate additional features, such as the linear representation of the writing process, the recording of mouse clicks, and a replay function, which can be used for immediate retrospection. In later versions of Translog, more features were gradually added, including the possibility of combining key-logged data with video and audio recording, screen recording, and eye tracking (the latter used to explore subjects' eye movement behavior and visual attention).

Unsurprisingly, Translog "has gradually found its way to research and teaching institutions throughout the world" (Schou, Dragsted, and Carl 2009: 40). Evidence of this worldwide dissemination is the vast number of "articles and conference papers, mainly in the area of translation process research, but also in the field of translator training" (ibid.). The first volumes reporting on studies using Translog in combination with TA (among other methods) are the ones edited by Gyde Hansen (1999b, 2002a) and Fabio Alves (2003). Later publications, particularly the volumes edited by Göpferich, Jakobsen, and Mees (2008a, 2009), also include contributions drawing on Translog, albeit mainly in combination with eye tracking. Furthermore, a dedicated volume edited by Mees, Alves, and Göpferich (2009) has paid tribute to the central role that Translog has played in our discipline for the past fifteen years now.

Overall, keystroke logging is considered a highly unobtrusive research method, as well as one of the most effective and accurate ways of collecting reliable data on text-production processes. Jakobsen, for example, claims that Translog is "a research tool by means of which we can increase the

power and accuracy of direct observation" and recollection (1999: 10). He further points out that the important research qualities of "[n]on-subjectivity, accuracy, and exhaustiveness . . . can be achieved with the help of a computer, which records data very reliably: automatically, accurately, comprehensively, and non-subjectively" (ibid.: 14). Mackintosh, however, claims that direct observation "is not without drawbacks" (1998: 126). For him, the most significant shortcoming is "the lack of access to important non-visual information, particularly cognitive processes" (ibid.). However, although key-logged data may not have "the rich suggestiveness often found in the qualitative data elicited by the TAP method," verbal reporting "is no more a direct description of the mental processes we are after than a *Translog* representation is" (Jakobsen 1999: 15). Both TA and key-logging data "are at best only symptoms of an underlying motivating mental activity. . . . Neither makes sense except in terms of some idea or theory of how translation happens" (ibid.). As such, the interpretation of data elicited by either method can hardly be nonsubjective.

In TA, the main indicators of cognitive processing in translation are silent pauses and hesitation phenomena. In writing processes, time delays (i.e., pauses), editions, and revisions offer indirect evidence of cognitive processing underlying text production. Nevertheless, the analysis and interpretation of key-logged data as evidence of cognitive processing is not as straightforward as it appears at first. As Lindgren explains, "[t]races, i.e. pauses, deletions, insertions and movements, can reflect cognitive activities, but their internal structure, interaction and functions are complex and cannot be directly interpreted from the log files" (2005: 14).

We should also note that key-logging programs only record writing processes and not translation processes per se. Given that the latter involve the complex relationship between two texts, identifying cognitive-processing activities may be even less straightforward in the case of computer-recorded data than in that of verbal protocol data. This seems particularly true when it comes to correlations between writing pauses and translation problems. Unless key-logged data is combined with other data sources for triangulation purposes, "conclusive distinctions between cognitive activities and traces in the log file cannot, currently, be made" (ibid.). Without additional data, it would be very difficult to know, for example, if a given pause refers to a problematic item that has already been processed or one that is about to be processed (see Spelman Miller 2006 and Wengelin 2006 for an overview of the pausological study of digital writing production).

Furthermore, determining the average time length for different types of pauses—for example, pauses that represent time delays at a macrolevel (e.g., between words, sentences, and paragraphs) and pauses that represent delays at a microlevel (e.g., within words, morphemes, and syllables) (Jakobsen 1998: 84)—can be a complex activity, as subjects' pause behavior may be affected by factors like writing speed and text type.[1] Wengelin, for example, argues that, "setting a pre-determined pause length for all writers,

independent of their writing speed is a strategy that should be treated with caution" (2006: 111). Göpferich, building on Wengelin (2006), further remarks that in addition to writing speed there are other numerous factors that influence pause length, such as the type of text to be produced (2008: 49). Nevertheless, as Lorenzo (1999b: 26) points out, key-logging programs like Translog provide a number of indicators (e.g., pauses, insertions, and deletions) that allow for the identification of problems that cause interruptions in the translation process.

In addition to the automatic analysis of pause length frequency, location of pauses, insertions, deletions, and revisions, keystroke-logging programs can generate different time statistics (Lingdren 2005: 12). Rothe-Neves, for example, used this option to analyze a number of temporal aspects in her study of the influence of working memory features on translation performance, namely, "fluency rate," "average keystroke time," "average production time," "average clause time," and "editing rate" (2003: 103).

Besides the difficulties in the analysis and interpretation of key-logged data, aspects surrounding the ecological validity of said data also deserve attention from a research point of view. While Jakobsen (1999: 15) claims that "experiments run with *Translog* have ecological validity," Neunzig considers the translation process in this program "rather 'unrealistic,'" mainly because Translog "cannot disguise the fact that the translation is embedded within an experiment, and . . . does not provide access to or record on-line Internet or CD-Rom help programmes" (2000: 96). Göpferich (2008: 41) also stresses the inability of key-logging programs to record online documentary research processes, as well as any note-taking activities, carried out during the process of text production. This problem—that is, the lack of data on research activities carried out both online and offline—can be resolved by combining keystroke-logging with screen recording, as well as video recording (ibid.). However, as Göpferich (ibid.) points out, the considerable difficulties involved in the synchronization of data obtained from different sources should not be ignored, which is, in fact, the main reason why I decided against the use of keystroke-logging software and opted for screen recording in my study (cf. 5.5).

For Lauffer another "potential setback with Translog is that translators have to translate into a program they do not normally use. Certain features such as spelling and grammar checks, italics, underlining and highlighting are not available" (2002: 67). Indeed, "the medium of the computer and the particular writing tool used affects and mediates the writing processes" (Spelman Miller and Sullivan 2006: 8). Although the three professional translators in Lauffer's study had all "tested [Translog] before using it, each translator ran into minor difficulties when attempting to use a feature that was not available" (ibid.). The computer program Proxy, in the development of which Neunzig was involved in, was designed to "overcome these deficiencies" (2000: 96). According to Neunzig, Proxy makes it possible "to operate in the natural working environment of the translator (Word,

WordPerfect), thereby ensuring ecological or situational validity, since the subjects need not even know that their work is part of an experiment, and it also allows for recording of all steps and use of on-line resources. In addition, these records, like TAPs, have teaching applications: they can be consulted by students with a view to learning from their mistakes or imitating procedures which lead to satisfactory solutions" (ibid.). While Proxy works as a key logger (Neunzig 2001: 103–104; PACTE 2005: 611–612), it also serves as a screen recorder, a type of program that I discuss in greater detail in the following section.

4.2.4   Screen Recording

Like keystroke-logging software, screen recorders such as Blueberry's BB FlashBack or TechSmith's Camtasia Studio record and create a time log of all the keystrokes, revisions, and editions (including changes, deletions, and additions), keyboard shortcuts, cursor movements, and mouse clicks made during the process of typing a text. The main advantage of screen recorders is that they capture *any* screen activity carried out on a computer. Unlike keystroke-logging software, however, some screen recorders like Camtasia or Catmovie do not "generate a log-file for later quantitative analysis" (Sullivan and Lindgren 2006: 157).

In our discipline, various research groups such as PACTE and PETRA in Spain, TransComp in Austria, and CPT in Switzerland have used screen recorders (combined with other tools) for research into translation processing and competence acquisition. Screen recorders are "particularly useful for analyzing the research activities which form an integral part of translation processes, as they provide a detailed account of which electronic sources or Web-sites the subjects are using during translation" (Göpferich and Jääskeläinen 2009: 173). Nevertheless, one should not ignore the fact that screen recorders do not show the exact (non)textual elements on which subjects focus their attention (Göpferich 2008: 54). Mouse movements and clicks can, however, serve as indicators of subjects' interactions with screen objects. Furthermore, the lack of accurate information on subjects' units of attention can be compensated for by combining screen capture with other methods, such as (non)verbal reporting or eye tracking.

Another aspect worth considering from a research point of view is that screen-recording software, like any other data collection tool, introduces a foreign element into the translation process and may consequently interfere with said process. As mentioned earlier with regard to the use of video cameras, subjects may feel uneasy being observed and hence may change their behavior. Screen capture programs are nevertheless highly unobtrusive tools, as they work "in the background and [are] invisible to the subject. [They do] not affect the translator's natural working environment, an important factor in maintaining the ecological validity of the data" (Asadi and Séguinot 2005: 523; cf. Göpferich 2008: 54). And yet there are, to my knowledge,

surprisingly few studies that have used these tools to investigate the online research activities of translators. Exceptions are the studies conducted by, for example, Lauffer (2002) as well as Asadi and Séguinot (2005). Lauffer, in particular, found that Camtasia Studio "was most useful in following the search paths and helping understand how and why the translators searched for information" (2002: 69). Asadi and Séguinot also used Camtasia Studio "to record a real-time account of the translation process . . . including all searches of electronic resources" (2005: 523). Nevertheless, as these studies only deal with research activities in passing, their accounts of said activities are understandably not very detailed.

   Other studies that report on the use of screen-recording software as part of a mixed-methods approach to translation and information process research are the longitudinal research projects TransComp (University of Graz) and Capturing Translation Processes (CPT, Zurich University of Applied Sciences). TransComp was launched in 2007 to explore "the development of translation competence in 12 students of translation over a period of three years and compare . . . it to that of 10 professional translators" (Göpferich and Jääskeläinen 2009: 183). Although, at the time of this writing, no results on translation-oriented information behaviors have yet been reported (see, however, the reference to Prassl 2011 in the next paragraph), it is worth noting that the subjects' use of Internet and electronic resources were screen recorded in order to be analyzed according to the following criteria:

(a) the type of problems that lead subjects to carry out searches;
(b) the type of information they search for (i.e., "lexical items, relationships between units of information, encyclopaedic information on aspects of the source text, etc.");
(c) the sources of consultation they use (e.g., the source text, their long-term memories, or external resources);
(d) the type of problems (comprehension problems, TT production problems, or both) they try to solve with the help of external resources;
(e) the type of reference works they consult "for the different kinds of problems (monolingual dictionaries, bilingual dictionaries, encyclopaedias, parallel texts, etc.);" and
(f) the extent to which subjects "only search until they have found an acceptable target-language equivalent or . . . they go beyond that, for example, to gain more comprehensive understanding" (Göpferich 2009a: 32).

   While, as indicated previously, results from the analysis of information behaviors within the TransComp project are not yet available, Prassl (2011: 29) states that research so far shows that both groups of subjects (i.e., student and professional translators) use the Internet as an external source of consultation in more than 90% of the cases. A more interesting result—one that

I also obtained in my own study—is that, while students primarily consult dictionaries and choose keywords originating from the source texts, professionals mainly search in parallel texts and do so using target-language keywords (ibid.). Prassl's own study of the "consultation and knowledge integration behaviors" of both groups of subjects thus shows that, although "professional translators resort to dictionaries in fewer cases compared to the high number of consultation processes among the students," the quality of the translations produced by the professionals "is not significantly higher than that of the students" (ibid.: 23). Furthermore, "[t]he majority of the consultation processes did not prove to be helpful for neither students nor professionals." Prassl claims that "[t]his was mostly due to a lack of proper perception of the source text and consequently of inappropriate knowledge integration" (ibid.).

The Capturing Translation Processes project, launched in 2009, also explores translation processes and the development of translation competence. Part of this "large-scale research project on translation processes" is the subproject Translation Tools in the Workplace, which is "designed to explore the impact of Translation Memory (TM) and research tools and resources on professional translation processes" (Massey and Ehrensberger-Dow 2011a: 195). The main goal of this subproject "is to ascertain how information literate student, novice, and professional translators in Switzerland actually are, which will then allow [the researchers] to identify problem areas and user needs in order to optimize information" (ibid.).

The project comprises three main research phases, the first of which "examines the self-reported resource use and information behavior of professional translators" via two surveys conducted among freelance translators and translation teachers (ibid.). This phase "was preceded by a pilot study of revision-related research practices among instructors . . . [at the Zurich University of Applied Sciences' Institute of Translation and Interpreting] and students at various levels of our undergraduate degree program in translation" (ibid.). The preliminary findings from this pilot study are presented in Massey and Ehrensberger-Dow (2010a). The second research phase combines the several research methods referred to above in order "to observe actual tool use and research practices in the workplace and gain insight into the cognitive processes involved in these aspects of translation" (ibid.). Participants in this phase include student and professional translators with different degrees of translation experience. The project's third phase, finally, focuses on the "evaluation and generalization, the behavior reported, observed, and described in phases 1 and 2 of the sub-project [that] will be used to identify problems and user needs so that we can optimize the way students, novices, and professionals are trained to acquire information literacy" (ibid.).

At the time of this writing, "the sub-project is," as Massey and Ehrensberger-Dow explain, "in its first phase, with the pilot study and the first of the two main surveys—of freelancers—having been completed" (ibid.). I

will draw on the preliminary results obtained in this phase—which, given its focus on translators' information behaviors, bears significant importance for this study—throughout the data analysis provided in Chapter 6.

4.2.5   Eye Tracking

Another method that has only recently started to be applied to translation research is eye tracking. This is a method used to explore subjects' eye movements and visual attention as a representation of their cognitive processing. Visual attention, according to O'Brien, has been investigated for "over a century with early studies being limited to simple ocular observations and introspection" (2006: 185). One of the areas in which eye tracking has been most extensively applied is reading, where some "basic facts" have been well documented regarding "the typical duration and length of saccades and the typical duration of fixations" (Jakobsen and Jensen 2008: 103). The duration of eye fixations is known to be affected by factors such as word familiarity, predictability, length, and complexity, as well as lexical and syntactic ambiguity (ibid; cf. Göpferich 2008: 56–57).

More recently, eye tracking has been successfully used to examine subjects' cognitive processing and cognitive load in other domains, such as comprehension, writing, language acquisition, bilingualism, psycholinguistics, psychology, neuroscience, and computer science (Duchowski 2003; O'Brien 2006; Doherty, O'Brien, and Carl 2010). Topics that have been investigated with the aid of eye tracking include "mental activity during problem solving . . ., cognitive workload during strategy shifts . . ., emotional stimulation through audio stimuli . . ., and strategies for reading news on the Web . . ., to name but a few" (O'Brien 2006: 185–186). Nowadays, eye tracking is commonly used in the field of human-computer interaction (HCI), as well as in usability studies (ibid.: 186). As shown in 3.2.2., it is also used in the field of information behavior in areas such as menu searching (Aaltonen, Hyrskykari, and Räihä 1998; Byrne et al. 1999) and web-based information searching (Goldberg et al. 2002) and has proved particularly useful for research into web search result evaluation (Salojärvi et al. 2003; Granka et al. 2004; Aula, Majaranta, and Räihä 2005; Rodden et al. 2008).

In translation studies, eye tracking offers an alternative, additional method to investigate translation cognitive processing. O'Brien, for example, one of the first researchers to apply eye tracking to translation process research, argues that "[o]ne of the most interesting aspects of eye-tracking for translation studies is the link that has been firmly drawn between cognitive effort and eye movement," especially pupil dilation (2006: 186). For Jakobsen and others, the possibility of using eye tracking to study translators' visual attention "across the source and target text has opened up an exciting new research field" in translation (2008: 123). The authors nevertheless point out that while the study of eye movements in translation can "draw

on existing reading research up to a point, [it] needs to develop its own body of knowledge" based on translation-specific features (ibid.).

As Jensen explains, the majority of eye-tracking studies in reading have focused on single words or short strings of words, while relatively few studies have used "larger text units for investigating cognitive processing of reading" (2008: 158). In contrast, the Eye-to-IT project involves a number of experiments on reading and translating not only single words or individual sentences "but also longer texts, simulating the normal process of translating (or interpreting) whole texts" (ibid.). In particular, the *Eye-to-IT* project explores the combination of "eye-tracking and key-logging in order to create new research opportunities for studying translation processing, particularly with respect to how source text comprehension and target-text production are coordinated" (Göpferich, Jakobsen, and Mees 2008b: 2).

One of the main achievements of the Eye-to-IT project has been the development of the "Gaze-to-Word Mapping (GMW) tool," which allows for the automatic—as opposed to the manual—identification of words based on gaze fixations (ibid.). Jensen nevertheless warns us that the GWM tool "assumes a linear style of reading where one line of text is read before proceeding to the next line (down)" (2008: 159). This naturally poses the question of how the tool "will cope with non-linear reading, for example when translators shift their attention between the source text and the target text . . . , or when they scan a sentence or paragraph repeatedly" to find appropriate renderings (ibid.). Contrary to Jensen's expectations and in spite of problems linked to the research method, the results of his eye-tracking study "tentatively suggest that the same degree of accuracy can be achieved in non-linear reading tasks as in linear reading tasks" (ibid.: 173). The overall degree of accuracy and validity of eye-tracking data, however, continues to be a major concern for some translation researchers.

Another achievement related to the Eye-to-IT project has been the publication of a dedicated volume on the use of eye tracking (often used in combination with other methods) for research into translation cognitive processing. The volume, edited by Göpferich, Jakobsen, and Mees, focuses on "the way translators read, and especially . . . [on] how the human brain is capable of controlling and coordinating such a complex interlingual process as translation" (2008b: 3). It includes studies that investigate translation and reading processes in general and, more specifically, cognitive effort when using translation memories, viewing subtitled media, as well as reading and understanding food labels.

Other eye-tracking studies in translation have focused on the application of the method for evaluating machine translation output (Doherty, O'Brien, and Carl 2010) and studying the effects of time pressure and text complexity on translators' gaze fixations (Jakobsen et al. 2008); the production of online help texts (Heine 2008); the mental simulation of speed in text processing (Rydning and Janyan 2008); various aspects of translation directionality (Jensen and Pavlović 2009; Alves, Pagano, and da Silva

2009); time and behavioral differences between different modes of transla-
tion (Dragsted, G. Hansen, and Sørensen 2009); and, only very recently, the
information behaviors of student and professional translators (Massey and
Ehrensberger-Dow 2011a).[2] Regarding the latter, Massey and Ehrensberger-
Dow found that eye tracking had helped them identify the reasons why
a particular source text segment was problematic for one of their gradu-
ate students (ibid.: 206). They found that "while the screenshot recordings
and verbal protocol" suggested the student's insecurity and confusion in
researching that particular item, the eye-tracking data revealed "systematic
research procedures" being adopted by the student (ibid.). Like in studies of
search result evaluation within the field of information behavior, eye track-
ing in Massey and Ehrensberger-Dow's also proved particularly useful for
tracking eye movements on web search results pages (2011b: 6–9).

In addition to the research topics mentioned previously, methodologi-
cal and technical aspects of eye tracking have been the object of discussion
among numerous researchers (e.g., Jensen 2008; Carl 2008; O'Brien 2006,
2009; Alves, Pagano, and da Silva 2009). O'Brien (2006), for instance,
while acknowledging that eye tracking offers a new supplementary and ex-
citing method for research into translation, calls for a cautious application
of this new methodology. In O'Brien (2009), she discusses the methodologi-
cal challenges of eye tracking in greater detail, establishing five categories:
research environment (invasiveness of the equipment, costs associated with
it, and accommodation to control for pupil dilation, as well as the famil-
iarity of the subjects with the working and research conditions), research
participants (finding an appropriate number of participants who have trans-
lation competence and are generally suitable for eye-tracking research), eth-
ics (obtaining approval from the ethics committee of a given organization),
data explosion (especially if triangulated with keyboard logging and other
research methods), and validity of research design (analytical capacity of
sole researchers, experimental conditions, data-elicitation tools, etc.) (ibid.:
251–262).

In addition to the challenges outlined by O'Brien—for which she offers a
number of practical solutions—the accuracy and reliability of eye-tracking
data have also been questioned. Jensen, for example, in his study of the
overall accuracy that can be expected from an eye tracker and its ability
to correctly identify subjects' word fixations, found that even "the best
measures obtained in his experiment show that about 20% of all known
fixations . . . go undetected, which means that an error rate of 20% or
more (sometimes much more) can be expected" (2008: 173). He therefore
suggests improving detection accuracy—that is, "the association of fixa-
tions with text units"—by manually examining "gaze points and fixations"
(ibid.). Alves, Pagano, and da Silva call for the "standardization of proce-
dures in the treatment and analysis of eye-tracking data as the choice of
filter and the type of data used can yield different results" (2009: 288–289).
This, in turn, may influence the reliability of eye tracking for establishing

the minimum average fixation length in translation (ibid.: 289). For Heine (2008: 145) and Göpferich (2008: 59), eye tracking is yet to be fully developed as a research method in translation. O'Brien (2009) nevertheless reminds us that the possibilities offered by eye tracking as a supplementary method for research into translation should not be neglected. Eye tracking for her "certainly adds a very rich dimension to the tools and methods we have for investigating [translation], and the challenges involved in implementing it, while not insignificant, can be overcome" (ibid.: 266).

Other methods from which translation researchers could potentially benefit are those from the neurosciences, in particular electroencephalography (EEG) and imaging techniques such as functional magnetic resonance imaging (fMRI) and positron emission tomography (PET) (cf. Göpferich 2008: 63–65; O'Brien 2010: 5–6). As Göpferich and Jääskeläinen state, however, these methods "require extremely artificial experimental situations in which the subjects must not move, not even their eyes and mouths, because such body movements cause artefacts which distort the recordings reflecting the cerebral activities caused by the cognitive translation processes proper" (2009: 171). In translation, as shown previously, more modest methods borrowed from psycholinguistics and cognitive science (seem to) lend themselves more to the study of cognitive processes. Brain research, in contrast, appears to be more suitable for investigating interpreting processes, which, unlike translation processes, "do not involve eye movements because an auditory input can be provided" (Göpferich and Jääskeläinen 2009: 171).

Clearly, all the methods described previously have their own strengths and weaknesses, thus "provid[ing] access to specific aspects of the translation process while leaving other aspects in the dark" (ibid.: 173). Methodological triangulation is therefore necessary to gain a more comprehensive, yet indirect, picture of cognitive processing in translation. The choice of methods for translation process research will be naturally constrained by a number of factors, including the very nature of the research project; the type of research questions asked; the availability of both research participants and equipment; approval from relevant ethics committees; funding opportunities; the capacity of the researcher or research team to handle the amount of data generated during the study; and last, but not least, the ontological and epistemological positioning of the researcher(s) involved in the project. In the following chapter, I will describe the research methodology and design of my translation-oriented web-searching study, taking into consideration the previously mentioned factors.

5 Exploring Translation-Oriented Web Search Behaviors

This chapter includes a detailed presentation of the research questions and aims of the study that I carried out to explore translation-oriented web search behaviors, refining and integrating the main objectives with the theoretical perspectives reviewed in previous chapters, especially in Chapter 3. The methodology and research design are then described, followed by a full description of the participants' backgrounds and the main research stages involved in the study (i.e., data collection, data processing, and data analysis).

5.1 QUESTIONS AND METHODOLOGY

As indicated previously, the main goal of my study was to explore certain cognitive and affective dimensions of web searching for translation problem solving. I therefore monitored the web search behaviors of the research participants through my notion of web search task. I specifically aimed at answering the following questions:

- What type of self-generated web search tasks did the participants of the study carry out to eventually solve the problems they encountered in their translations of two popular-science texts? Web search tasks are, as shown in 3.1.3, characterized by the participants' search needs, search goals, search processes, and search outcomes.
- Regarding the affective dimension of web searching for translation problem solving, how did the participants of the study perceive their search tasks in terms of search goal success, search outcome satisfaction, and search task difficulty?
- How do the participants' perceptions of translation-oriented web search success compare to their search performance for translation problem solving?

To answer these questions, I adopted grounded theory as originally developed by sociologists Glaser and Strauss in the 1960s, an approach commonly

used in qualitative web-searching studies that strongly consider the context in which searchers seek and retrieve web-based information, with a view to identifying relevant search factors, practices, styles, and so forth. As Mansourian points out, "considering the context of search is a pivotal factor in understanding users' behaviours, feelings, and thoughts during the period of information seeking in an online environment" (2008: 202).

I combined this exploratory research approach with case study research, a method used extensively in the social sciences for the in-depth investigation of one or more individual cases (e.g., single individuals, groups, institutions, and communities) embedded in a real-life context. From this perspective, and within the context of translation studies, Susam-Sarajeva defines a "case" as "a unit of translation or interpreting-related activity, product, person, etc. in real life, which can only be studied or understood in the context in which it is embedded. A case can be anything from a translated text or author, translator/interpreter, etc. to a whole translation situation or source/receiving system" (2009: 40).

Depending on the design adopted, there can be single-case studies or multiple-case studies, both of which can be further divided into holistic or embedded ones (ibid.: 41, drawing on Yin 1994: 41–42). Single-case studies that focus on one unit of analysis and examine only its "global aspects" make use of a "holistic design," whereas multiple-case studies that focus on more than one case can be either holistic or embedded (ibid.). My websearching study, for instance, fits the characteristics of a multiple case with embedded single cases, in which I compared the participants' web search tasks embedded in their English translations of two popular science texts in Spanish. The ability to conduct comparative analyses is perhaps one of the main advantages of carrying out a multiple-case study with embedded single cases. Comparisons may, in turn, lead to the drawing of more solid conclusions and provide a richer basis for replication. Another way of strengthening scientific rigor in case study research (or, for that matter, any other type of research) is to use multiple research methods and sources of data. Trochim, for example, argues that "a combination of methods" can be used "to conduct a case study" (2001: 162). Similarly, Susam-Sarajeva views case study research as "an overarching research method which can include different sub-methods . . ., such as surveys, interviews, observations, research in archives, etc." (2009: 40).

For the purpose of my study, I aimed at methodological triangulation by combining direct observation with survey research. In particular, I used the screen recorder known as BB FlashBack and two types of online questionnaires—a background questionnaire and an online search report (OSR)—that I designed in and administered via SurveyMonkey (an application specifically developed to create online surveys). In addition, I conducted one-to-one, semistructured interviews with the participants of the main study (i.e., four translation students in their first year of studies; see 5.3).

5.2 DESIGN

To answer the research questions formulated previously and explore translation-oriented web search behaviors with a pedagogical aim in mind, I designed a specific syllabus for an introductory course on scientific and technical translation with English and Spanish. The course, which took place in an English-speaking environment, lasted for a twelve-week period during one semester and had four participants and provided the setting to collect the study's research data using a variety of sources, methods, and tools. Figure 5.1, adapted from Pavlovic´'s (2007: 66) research design for the study of directionality features in collaborative translation processes, gives an overview of the design for this study.

Except for semistructured interviewing, I tested all the data-collection tools included in Figure 5.1 in a pilot study that preceded the main study. A total of four participants were recruited for the pilot study, which took place in February 2009. Two criteria were considered for recruiting these participants. First, their working languages had to include English and Spanish, regardless of their translation directionality. Second, they needed to have some experience in translation. These criteria were determined on the basis of the criteria used for course admission in the translation practice courses offered at the tertiary institution where the main study took place.[1] As further explained 5.3, students wanting to take a translation practice course in their respective language combination, which must necessarily include English, have to declare what their first language is and what their second language is for translation purposes. The reason for this is that most translation practice courses offer translation from one's second language into the first (i.e., L1 translation) and translation from one's first language into the second (i.e., L2 translation) in an 80:20 proportion.

During the pilot study, which lasted for almost two hours, the participants were first asked to fill in a background questionnaire for information on their declarative knowledge of (i.e., knowing what) and past experiences with translation and web searching. They were subsequently asked to translate a popular-science text from Spanish into English and use the web as an external resource of consultation when needed. In addition, they were instructed to complete, at any chosen point in time (i.e., before, during, or after translation), an OSR to provide information on their source-text (ST) domain knowledge and web search tasks carried out for translation problem solving. All processes of translating, researching, and problem-solving reporting were screen recorded in BB FlashBack.

Of the four participants in the pilot study, only two—a PhD student of translation with three years of casual professional translation experience and a translation teacher with over fifteen years of experience—completed all the tasks entirely. They were therefore included in the data analysis of
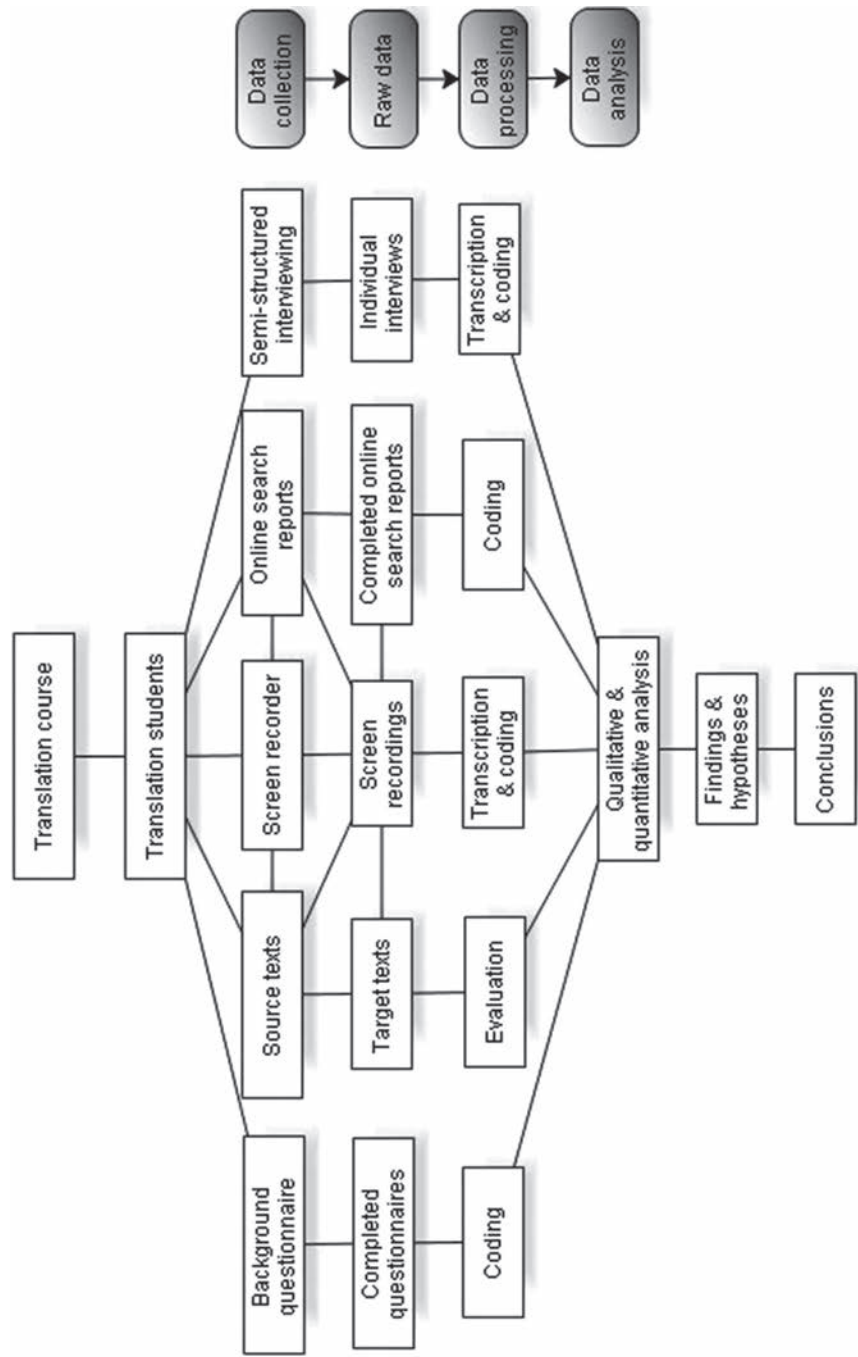
Figure 5.1 Research Design

the main study. Although this was done for reasons of data comparability (as further explained in 5.4 the participants of the main study translated the same ST as the participants of the pilot study), one should not ignore the fact that the data collected in both research settings are not directly comparable. First, the pilot study took place in a computer lab resembling an experimental situation, while the main study was conducted in a pedagogical setting. Second, both the background questionnaire and the OSR were slightly modified after having been tested in the pilot study. As a result, these tools collected slightly different data from both groups of participants.

This does not mean, however, that the performance of the two participants who entirely finished their translations and completed the respective OSRs during the pilot study should be neglected for research purposes. Quite on the contrary, their web-searching performance for translation problem solving is of particular interest here given that their backgrounds are very different from those of the participants in the main study. These were four translation students who spontaneously enrolled in the introductory course on scientific and technical translation and who participated in a total of four screen-recording sessions that took place in class as part of their coursework.

Like the participants of the pilot study, the translation students were first asked to fill in the online background questionnaire for a diagnostic view of their knowledge of and experience with both translation and web searching. The questionnaire also served as a consent form for research purposes. Then, in each of the four sessions, the students translated a different domain-specific ST from Spanish into English, the first of which was the same popular-science text that was translated by the participants of the pilot study. The translation students also completed an OSR in each session to (a) specify their level of ST domain knowledge and (b) describe the web search tasks performed for translation problem solving. They had access to personal computers (PCs), as well as the Internet, and were instructed to use the web as needed to conduct their documentary research[2] and report on their search tasks by completing an OSR at any point in time—that is, they could follow whichever order of completion they felt most comfortable with. As a result, the progression of task completion also became part of the data analysis (see 5.5.2).

All four sessions produced a total of sixteen screen recordings. However, one of the screen recordings obtained in the second session was corrupted and therefore none of the video files resulting from this session were used for data analysis. Furthermore, due to the wealth of information produced by the remaining twelve screen recordings, as well as to time and space restrictions, only eight of these recordings are analyzed here. These correspond to sessions one and three of the main study, for which I selected two popular-science texts. I refer to these texts as "first embedding task" (or Task 1) and

"second embedding task" (or Task 2), respectively. Finally, I conducted one-to-one interviews with the students during the last weeks of the semester.

5.3　PARTICIPANTS

As indicated previously, the research participants of the main study were not randomly sampled, nor were they selected for research purposes. Rather, all four participants enrolled in the introductory course on scientific and technical translation as part of the degrees they were completing in an English-speaking environment at the time of the study. The main study's population is therefore one naturally occurring within a real teaching and learning context; hence, I conducted naturalistic research to explore the participants' web search behaviors in a natural setting with no attempt to influence said behaviors.

The course participants were all females in their early to midtwenties, except for Martha (all names are fictitious),[3] who was in her midthirties at the time of the study. She and Laura are native speakers of English, while Maria, the youngest of all four participants, is a native speaker of Russian.

Anna, who grew up in a Mandarin-speaking environment for the first eleven years of her life and then in an English-speaking environment for the subsequent eleven years, considered English her L1 and Mandarin her L2. Nevertheless, all four students declared English their L1 and Spanish their L2 for the purpose of the translation practice course. As Table 5.1 shows, this meant that L1 translation was the working directionality for Martha and Laura, and L3 translation (i.e., from the third language into the first) for Anna. Translation for Maria, however, involved working from her L3 into her L2.

As far as their qualifications are concerned, the four translation students had completed a three-year BA in Spanish (major). Maria, Laura, and Anna minored in French, while Martha minored in Latin American Studies. Furthermore, Laura and Martha (i.e., the two English native speakers of the main study) obtained the DELE (Diploma of Spanish as a Foreign Language) at different levels of proficiency (intermediate and advanced, respectively),

Table 5.1　Languages Spoken by the Student Participants

Participant	L1	L2	L3
Martha	English	Spanish	Portuguese
Anna	English	Mandarin	Spanish
Maria	Russian	English	Spanish
Laura	English	Spanish	French

while Anna completed a fourth year of study, namely, a BA Honors in Spanish. Maria was completing this very same degree at the time of the study and took the introductory course on scientific and technical translation as an elective paper within said degree. For Laura and Martha, however, the translation practice course was a core paper within the one-year Postgraduate Diploma in Translation Studies they were completing at the time of the study. Similarly, Anna enrolled in the translation practice course as part of the one-year Master of Professional Studies in Translation she was also completing at the time of the study.

In contrast to the participants of the main study, the two participants of the pilot study considered in my data analysis were a translation teacher (Bob) and a PhD student of translation (Daniel) in their early forties and thirties, respectively. Bob, who had obtained a four-year BA and a PhD in Translation, considered German his L1, English his L2 (he nevertheless had near-native, if not native, skills in said language), and Spanish his L3. Daniel considered English his L1 and Spanish his L2 (unlike all the other participants, he did not specify a L3 in the background questionnaire). He was completing a PhD in Translation at the time of the study and had obtained a one-year Master of Professional Studies in Translation and a one-year Postgraduate Diploma in Translation, as well as a three-year BA in Spanish and Psychology.

The analysis of the participants' user attributes show that the translation students had fairly low levels of expertise in both translation and web searching. They were first-semester students in translation, except for Anna, who was a second-semester student in her translator training program. They had little or no experience in translation (neither didactic nor professional), and the quality of the translations they produced was relatively low. The study's research data also show that the students' web search expertise was rather low.

Overall, major findings regarding the user attributes of all six participants suggest that their translation experience correlated with their knowledge about and notions of translation, with Bob being the most experienced and knowledgeable participant of all, followed by Daniel and the four translation students. This and other findings regarding the user attributes selected for this study are extensively reported in Enríquez Raído (2011: 236–305). Suffice it to say here that the quality of the translations produced supports such a correlation, showing significant differences not only between Bob and Daniel but also among the translation students themselves. With regard to web searching, the findings of the study suggest that only Bob's and Daniel's web search experience (an average of 17.5 years) correlated with their web search knowledge (the highest of all participants, especially that of Bob). In contrast, the web search experience of the translation students (an average of 11.25 years) did not seem to correlate with their knowledge about web searching, which was significantly lower than that of Bob and Daniel.

In addition to the participants' user attributes, I analyzed in detail their working styles—which I conceptualized in terms of time usage and task progression—to explore the potential impact that the completion of the OSR (i.e., before, during, or after translation) may have had on the participants' translation and research processes. First, their use-of-time profiles indicate that the ST chosen for the second embedding task was more challenging than the one selected for the first embedding task, despite the fact that the second text was shorter than the first one (177 and 232 words long, respectively). Second, the participants' task progression profiles show that in most cases translation quality correlated with the number of changes among the four online tasks of the study (i.e., translating, researching, reporting, and switching between windows): The higher the number of online task changes, the lower the degree of translation quality. The number of online task changes, in turn, seemed to be influenced by the participants' number of information needs (cf. Enríquez Raído 2011: 312–337 for more details).

The participants' task progression profiles, finally, suggest that the OSR interfered with the translation processes of some of the participants, which seemed to have an impact on their translation performance—understood here both from a process and product point of view. In general, those who produced high-quality translations (Bob and Daniel, i.e., the two translators of the pilot study) seemed to progress through the various online tasks in a more controlled and focused manner, thus spending more prolonged and stable periods of time in each online task than those who produced medium-quality translations (Laura and Martha, i.e., the two English native speakers of the main study) and low-quality translations (Anna and Maria, the two nonnative speakers of the study). Longer periods of uninterrupted translation, in turn, seemed to correlate with the processing of larger units of information—that is, at the sentence and paragraph level—at a time. These also seemed to reflect a lower cognitive load than in cases with frequent interruptions and changes among all four online tasks and where no progression phases could be clearly identified. Here, an increase in cognitive load would appear to be related not only to the number of information needs but also to the interference that the OSR may have caused on some of the participants' translation or research processes.

5.4   DATA COLLECTION

5.4.1   Source Texts for the Embedding Tasks

The choice of the STs for teaching and research purposes was based on a number of explicit criteria, namely, their authenticity (the original texts were not manipulated in any way), various intralinguistic factors (domain, text type, and text function), and their degree of text specialization (given the fairly introductory nature of the course, from nonspecialist to nonspecialist

and from specialist to nonspecialist or specialist). The original texts were accompanied by a task description (i.e., a translation brief) that provided information on the commissioner and purpose of the translation, the place of publication, and the addressee. Each task description, in turn, included a link to access the OSR that the research participants had to complete with information on their translation-related web-searching activities.

The ST used for the first embedding task, which was carried out by all six participants (i.e., the four translation students and the two participants of the pilot study), is an excerpt from a Greenpeace guide to genetically modified food. It is a popular-science text dealing with agriculture and biology, which covers a broad topic and has an informative, as well as an appellative, function. The translation brief for this task asked the participants to translate the excerpt for the immediate publication of an information package on genetically engineered food for a New Zealand audience.

The ST used for the second embedding task, which was only carried out by the translation students, is an excerpt from a press release from the Spanish National Research Council (CSIC) on the discovery of two new enzymes that could possibly be used in the treatment of AIDS. It is a popular-science text dealing with a specialized topic that belongs to the subject areas of chemistry and biology and has an informative function. The translation brief for this task asked the students to translate the excerpt for publication in the science and health news section of Reuters.com.

5.4.2   Background Questionnaire

The background questionnaire aimed to obtain information on the participants' knowledge of and experience with (i.e., two of the four qualities that make up the notion of expertise in this study) translation and web searching. It was designed using SurveyMonkey and consisted of thirty-one questions, for which I considered a number of parameters regarding the (a) relevancy of the content, (b) its accuracy, (c) the structure of the survey, and (d) the type of questions asked.

As for content relevancy, I formulated questions based on my research objectives and the kind of information I wished to collect (cf. Trochim 2001; Brace 2004). Regarding content accuracy, I evaluated a number of aspects to try to collect data in a reliable and valid way, in particular the wording of questions (brief, objective, simple, and concise), their sequence, and the length of the survey. Concerning the structure of the survey, this begins with opening questions aimed at establishing rapport with the respondents and continues with questions that follow a specific order of ideas or topics clustered around three different sections (cf. Enríquez Raído 2011: 202–207 for an overview of the types of questions asked).

The first section gathered information on the participants' demographic data (age, gender, country of origin, spoken languages, and academic qualifications). The second section explored qualities of translation knowledge,

for which I used Orozco Jutorán and Hurtado Albir's 2002 "Translation Notions Instrument" (which covers notions such as the unit of translation, equivalence, function, problem-solving strategies, competences, etc.), and experience (previous translation training and translation jobs, average hours worked per month, and use of translation resources). The third and final section looked at qualities of web search knowledge (search operators, search engines, online databases, query formulation, search results evaluation and information reaccessibility) and experience (frequency of Internet usage, Internet accessibility, types of online activities, and previous web-related training).

Finally, an introductory page that informed the participants about the survey's purpose and the estimated duration of completion preceded the three sections described previously. Confidentiality of information was discussed verbally with a view to easing any potential concerns among the participants of the study. In addition, the survey ended with a dichotomous question that sought the participants' consent to use their answers for teaching and research purposes, a single textbox for additional explanations and comments, and a descriptive text thanking the participants for their time.

5.4.3   Online Search Report

The OSR presented the participants with a systematic retrospective method for reporting on their level of ST domain knowledge and web search tasks performed for translation problem solving. This tool adopted a form similar to that of existing written reports (cf. 4.1.2) used to elicit introspective data on students' translation problems, translation strategies, sources and aids consulted, solutions adopted, and rationale for adopting said solutions.

To design the OSR, I drew on Gile's (2004) integrated problem and decision reporting (IDPR) method, as well as González Davies and Scott-Tennent's (2005) written protocol. The main reason for so doing is that, as these authors point out, problem-solving reporting is a useful method to collect readily available information on students' translation problem-solving activities. In addition, this method is "significantly useful in indicating problems with source consultation methodology" (Gile 2004: 3). In fact, "one aspect of the translation process which is particularly well covered by IDPR is ad hoc information acquisition (the information specifically sought to translate a given source text)" (ibid.: 10). Furthermore, and of particular importance for this study, Gile specifically refers to the Internet as a source of information because "[e]vidence shows not only that . . . the Internet has virtually replaced hard-copy texts as a resource for student translators . . ., but also that reliance on Web sites is often too excessive, in particular with the search for specific collocations" (ibid.).

Nevertheless, as Gile admits, one of the drawbacks of IDPR is that students generally need some time "before compliance [with the method] is achieved" and "some ignore the reporting requirement" despite the

instructions received (ibid.: 7). This might have to do with the fact that IDPR requires no particular reporting format. The OSR designed for this study has a specific set of questions that guide the reporting process. My research data suggest that having a specific reporting format along with initial instructions and on-site guidance seems to help counterbalance students' initial reactions "as to what exactly they should write" in the reports (ibid.: 3).[4]

The reporting format of the OSR consists of two parts. The first comprises five questions aimed at gathering information on the participants' knowledge of ST domain (gained, e.g., through previous training), terminology, expressions and ideas they were familiar with before translating the ST, as well as their *perceived* level of domain knowledge. The second part required the participants to report on their web search tasks carried out for translation problem solving. For each web search task performed, respondents had to answer a total of five questions. Question 1 addresses cognitive aspects of translation-oriented web searching. More specifically, it includes six multiple open-ended textboxes that ask respondents to specify the ST item or element that is perceived as a translation problem and that prompts a specific search need, the rationale for the search need, the type of information required to tentatively satisfy the search need (i.e., the search goal or goals), the selected search result, the rationale for said result, and the source and context in which the final solution was found. Questions 2, 3, and 4 address affective aspects of web searching. In particular, Question 2 required the participants to assess their overall level of search success (successful, partially successful, or unsuccessful) and elaborate on the rationale for said perception. Questions 3 and 4 asked the respondents to rate their perceived levels of search satisfaction and search difficulty. Finally, Question 5 sought additional comments that the participants of the study may have had on the specific search task at hand.

5.4.4   Screen Recorder

As indicated earlier, Blueberry's BB FlashBack screen recorder was used to capture the participants' processes of translation, web searching, and problem reporting with OSR. Screen recording was also used to explore the two remaining qualities that make up the notion of expertise in this study: *awareness* and *skills*. Given that these two cognitive qualities are highly interdependent, any attempt at a neat separation for theoretical purposes may be futile. I nevertheless took *awareness* to refer to the participants' self-monitoring abilities to detect a given problem and *skills* to refer to their abilities to solve said problem, be it a translation one or an information-seeking one.

Like the key logger Translog, BB FlashBack records all the keystrokes, including the changes, deletions, additions, keyboard shortcuts (e.g., cut and paste), cursor movements, and mouse clicks made by a person during the process of typing text. Unlike Translog, however, which only records

writing operations carried out in its own text editor, BB FlashBack captures any PC screen activity, including searches performed on the web. I should nevertheless point out that "[f]or research where it is important, e.g. to track information retrieval procedures from the Internet or from other electronic resources, Translog can be combined with screen capture programs such as ScreenCam and Camtasia" (Jakobsen 2006: 103). However, for reasons of ecological validity and technical simplicity, I recorded the participants' translation-oriented web searches in individual movies using one single program. Translog would have been extremely useful (if not absolutely required) if this study were to investigate in detail temporal aspects of text production (e.g., time delays that allow for the study of distributional patterns of pauses) using keystroke-logging research.

Movies recorded in BB FlashBack have a FlashBack Recording (FBR) file extension and can be either displayed in its proprietary player or published in popular formats by exporting them to Flash, QuickTime, Windows Media Video (WMV), Audio Video Interleave (AVI), PowerPoint, and executable (EXE) files. I exported the original movies—which last for an average of 50 min. 16 sec. in Task 1 and 73 min. 32 sec. in Task 2—to WMV files, which, like any of the previous formats, facilitates their viewing on virtually any PC. Before exporting the movies to WMV, however, I edited the original FBR video files to remove the participants' first and last names typed in the OSRs, thus preserving their anonymity.

5.4.5   Audio Digital Equipment

I used audio digital equipment to record the four individual interviews that I conducted with the translation students. The interviews, which lasted for an average of 47 min. 34 sec., took place in my office during the last three weeks of the semester. All four interviews were transcribed and, like the original movie files, edited to remove the participants' personal details, as well as other sensitive data that may have involved their private lives, feedback on their performance in the course, or advice on their future studies.

The purpose of the interviews was to gain knowledge about (a) any potential influence that the screen recorder and the OSR may have had on translation and web-searching processes; (b) the (dis)advantages of using such tools for teaching and learning about translation; (c) the type of web search and navigation actions carried out by the participants, as well as the translation resources they consulted; and (d) their strategies for evaluating information and resources on the web. I therefore prepared a set of questions based on the preliminary data analyses that I had conducted in previous research stages. Following the principles and techniques of semistructured interviewing, I used a similar set of questions for each interview, albeit tailored to the needs of each interviewee.

5.5   DATA PROCESSING

5.5.1   Evaluation of Translations for Research Purposes

Research into translation processes shows that a myriad of criteria has been used to assess "translations produced in the course of experimental studies" for the purpose of correlating translation quality products and "the strategies that led to their production" (Pavlović 2007: 60). Indeed, "if we are to take translation quality into consideration as one of the variables, some system of evaluation, however imperfect and liable to criticism, has to be applied" (ibid.: 70).

In the study presented here, the translations produced by the students in the translation practice course were coevaluated by a fellow translation teacher and me to aim for a less biased perspective. For teaching purposes, and from a product-oriented view, we evaluated said translations by combining a numerical marking system (based on Hurtado Albir 1995 and the quality metric BlackJack developed by ITR International Translation Resources Ltd) with Waddington's (2001) holistic method. However, for the purpose of conducting research into web searching for translation problem solving, the study's coevaluator and I used a slightly different system to assess, from a process-oriented perspective, the problem-solving performance of all six participants. We developed, like other process researchers (Gerloff 1988; Kiraly 1995; Jääskeläinen 1989, 1990; Scott-Tennent, González Davies, and Rodríguez Torras 2000, 2001; G. Hansen 2006; Pavlović 2007), a fixed number of categories to assess the participants' translation solutions according to their degree of successfulness. Translation solutions were thus classified as unsuccessful, partially successful, successful, or highly successful. Similar to Pavlović's (2007: 78) proposed system of "revisability scores," we considered unsuccessful solutions parts of the target text [TT] that contained clear misinterpretations of the ST, content inaccuracies, terminological mistakes or inconsistencies, and major grammatical or other linguistic errors. We considered partially successful solutions parts of the TTs that were rendered in a more or less satisfactory manner but that nevertheless required improvement of some kind, in particular concerning aspects of style, punctuation, language variety, and formatting. Unlike Pavlović's system, however, but similar to the evaluation methods adopted by the researchers mentioned previously, we considered all other target-text elements as either successful or highly successful solutions.

Successful solutions were correct solutions in the sense that they neither represented any of the problems that characterize solutions as unsuccessful nor required any improvements, although we could still think of *better* solutions. Highly successful solutions involved those parts of the TT that did not qualify for any of the previous categories and thus completely fulfilled the requirements set by the translation brief in terms of addressee, text function,

style, register, and linguistic variety. We also considered highly successful solutions parts of the TT that read very fluently—mainly as a result of the detachment from the source language syntax (i.e., Spanish) and the adherence to the syntactic norms of the target language (i.e., English)—as well as those TT elements that were creative or sounded highly idiomatic. For this type of solution, we could not necessarily think of other highly successful solutions.

This evaluation system was used to assess the translation solutions that the participants explicitly identified in the OSRs. It was also used, albeit to a lesser extent, to review solutions adopted to translate parts of the text that were not identified as problematic in said reports but that nevertheless seemed to be the result of unresolved problems. While the former type of solutions requires the ability to spot translation problems, the latter may not necessarily involve said ability. The system also allowed for the comparison of the participants' perceived levels of success regarding their web search performance for translation problem solving with the perceptions of the evaluators.

5.5.2   Coding of Questionnaire and Online Search Report Data

The completed background questionnaires and OSRs were downloaded from SurveyMonkey.com, processed in Word, and coded in nVivo. This qualitative data-analysis software allows for the exploration of qualitative data sources—such as field notes, video and audio recordings, and video and audio transcripts—using a variety of functions that aid the researcher in coding and analyzing data. Coding, in particular, allows researchers to gather all the material related to a topic, concept, or theme in so-called nodes. These are points of information that can be arranged in "free nodes" (stand-alone nodes with no clear connection with other nodes), "tree nodes" (classified in a hierarchical structure), "cases" (nodes used to collect data about sites or people that have attributes, e.g., gender or age), and "matrices" (a collection of nodes that results from a matrix coding query run to ask a wide range of questions about patterns in the data). It is possible to code data at new nodes, at existing ones, or code "in vivo"—that is, create a new free node based on selected content where the selected text becomes the node name.

In addition to coding, nVivo provides linking, classifying, and visualizing aids to analyze unstructured, semistructured, and structured qualitative data. For unstructured data, nodes have to be created manually. For structured data, nodes can be created automatically using the "autocoding" function. For semistructured data, such as semistructured interviews, only questions that are asked across all respondents can be coded automatically. Autocoding is a fast way to create nodes for each question in an interview or questionnaire, or for each participant in a focus group, and then code the answers.

To use the autocode function, paragraph styles have to be applied consistently in the documents that are to be coded and analyzed. This can be

done in a word processor or in nVivo directly. Here, the background questionnaires (structured data), the OSRs (structured data), and the interviews (semistructured data) were first processed in Word by applying paragraph styles to main questions and related subquestions. These were then coded in nVivo at nodes that represent the topics explored in each type of survey.

5.5.3   Transcription and Coding of Screen-Recorded Data

The most arduous and labor-intensive phase in my research was transcribing the ten screen recordings of the study. Nevertheless, once I developed a coherent method for this transcription process, it became apparent that using this (or a similar) method could be highly advantageous to pool and exchange the same type of data among various research projects. This transcription method involved creating a script "resembling 'stage directions'" (Pavlović 2007: 76) of every online task and related actions carried out by the participants on the computers they worked with. I distinguish among three main types of online tasks in this study: translating, web searching, and problem-solving reporting with OSR.

Online actions represent different events within each type of online task. For example, translation task-related actions may involve typing, adding, deleting, or modifying text rendered in the target language. Web searching–related actions may include typing a search query, modifying a query, clicking a link or a button, typing an URL, and so forth. Reporting on web searches for translation problem solving include specifying or justifying search needs, search goals, search results, and sources of consultation, as well as clicking buttons for selecting rating options in the OSRs.

I recorded the participants' online actions on individual spreadsheets (one per participant and embedding task) in which each online action was designated by a separate line of code (cf. Table 5.2). This transcription process is based on Hargittai's "method for coding and classifying users' online information-seeking behavior," a method that "makes it possible to understand many details about users' sequence of actions simply by looking at the spreadsheet that contains the information" (2004: 210).

While an online action for Hargittai is "the mode of moving from one Web page to the next" (ibid.: 211), here online actions refer not only to such information-seeking movements but also to any other information seeking–related events, as well as translating and problem solving–reporting ones. This extended concept of online action allowed for a contextualized analysis of web-searching behaviors from a multitasking perspective. As Spink, Park, and others explain, multitasking refers to "the ability of humans to simultaneously handle the demands of multiple tasks through task switching" (2006: 264–265). Hence, "Web search can also include information multitasking behaviors that occur when users juggle the challenge of searching on multiple topics" (ibid.). More specifically, "Web search engine users may information multitask in two ways. First, a user may begin their Web search

Table 5.2 Example of Coded Data on a Participant's Online Actions

Time	Window/Tab	Actions	URL	Query	Link/Tab Text	Button Text	Select/Highlight	OSR	Translation	Error	Auto.
0:07:26		Translate							Long-term health risks that the GMOs present in our food or in the animals whose products we consume are not being correctly evaluated and their		
0:08:55							L				
0:08:56		Retranslate							The l		
0:09:03		Add punctuation							,		
0:09:46		BkSp							[present]		
0:09:52		Retranslate							present to us		
0:10:02	Switch to OSR window										
0:10:11	Switch to Firefox window	Reaccess site results page	http://www.wordreference.com/es/translation.asp?spen=suponer	suponer							

Time	Action	Detail		
0:10:12	Type site query			
0:10:14	Ret			
0:10:15	Access site results page	http://www.wordreference.com/es/en/translation.asp?spen=alcance	alcance	
0:11:04	Switch to Translation window			
0:11:13	Highlight			
0:11:14	Retranslate			means
0:11:25	Switch to Firefox window			equates to
0:11:26	Switch to OSR window			
0:11:29	Modify result			equates to

with multiple topics, or second begin with a single topic and then develop additional topics during the search process. Both processes include information task switching, or switching back and forth between different topics during a search session. For example, a user may switch between seeking health information and new car information as they think and work on multiple information problems concurrently" (ibid.: 265). The research participants of my study switched back and forth not only between different web search tasks but also among these and the remaining online tasks (i.e., translating and problem-solving reporting). Switches among web searching, translating, and problem reporting were recorded under a category I named "Window/Tab" in the spreadsheets. This category refers to the different working environments or windows in which said online tasks were performed.

Task environments include the "Translation" window (where translation-related actions were carried out); the "OSR" window (where reporting on web searches for translation problem solving took place); and the browser window, or tab, in which web searches were performed. The browser window and tab adopted the name of the web browser that was used by each participant (either Internet Explorer, which is referred to as "IE" in the spreadsheets, or Firefox, named as such in said spreadsheets). The distinction between web browsing windows and tabs was made to accommodate the participants' different navigation styles, as some preferred to work with windows only, others used tabs within windows, and yet others used a combination of both methods.

Online actions occurring in each of the windows described previously were coded in the spreadsheets under a dedicated category named "Actions." Contextual information relating to these actions (e.g., access, reaccess, click, open, close, type, copy, paste, delete, add, specify, select, highlight) was classified and coded under other dedicated data categories (time, URL, query, link/tab text, button text, select/highlight, OSR, translation, error, autocomplete, and comments) (cf. Enríquez Raído 2011: 222–223 for a detailed description of these categories and related actions).

The coding of online actions was done by viewing each movie in the BB FlashBack Player window and using the Playback controls, as well as by navigating through different movie frames using the Timeline and Frame bar. Some online actions were coded using a second scheme, one that accounts for the use of virtual keys, such as arrow keys, modifier keys (e.g., Ctrl and Alt), and function keys. Virtual keys were captured along with other key presses by BB FlashBack's keystroke logging function, which registers keystrokes at record time and saves them in a key log. The key logs were then exported in sentence format to individual Rich Text Format (RTF) files, which were later used as a basis for creating the scripts in the spreadsheets that would be complemented in detail with other online actions, such as mouse clicks, access to web pages, switches, and so forth.

Another important aspect of the transcription process relates to spelling mistakes, which I recorded in the spreadsheets using "[sic]." However, I did
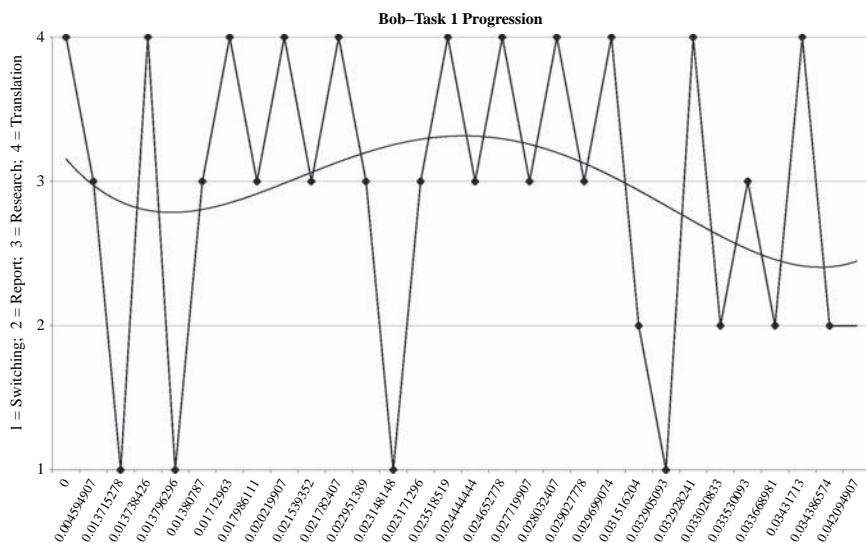
Figure 5.2   Bob's Progression Chart (Task 1)

not indicate missing accents in Spanish words that were entered as part of a search query with "[sic]," as it was impossible to know for sure whether the accents had been omitted unintentionally or not (most search engines are accent-insensitive anyway).

Once I transcribed and coded all the screen recordings, I proceeded to analyze the individual Excel spreadsheets in various ways. For example, to examine the participants' multitasking abilities, I created a timeline to record the exact points in time at which changes from and to the various online tasks were performed. A suitable term to refer to these changes—that is, to changes from one online task to the other—would have been "switching." However, I decided to use this term to refer to the participants' continuous clicks on windows to locate a particular online task, thus creating a fourth category of analysis called "switching."

I assigned the individual categories of analysis a number from one to four, which allowed me to generate charts representing users' task progression profiles (cf. Enríquez Raído, 2013). These charts, in turn, facilitated the analysis of how the research participants switched back and forth between different tasks and how the OSR may have interfered with their translation or research processes. For instance, the two charts (these are not to scale) shown in this section represent two very different task progression profiles.

These progression profiles correspond to the translator with the highest level of expertise (Bob) and the student with the lowest level of translation expertise (Maria), respectively. The first profile generally shows periods of uninterrupted translation that are considerably longer than those of the
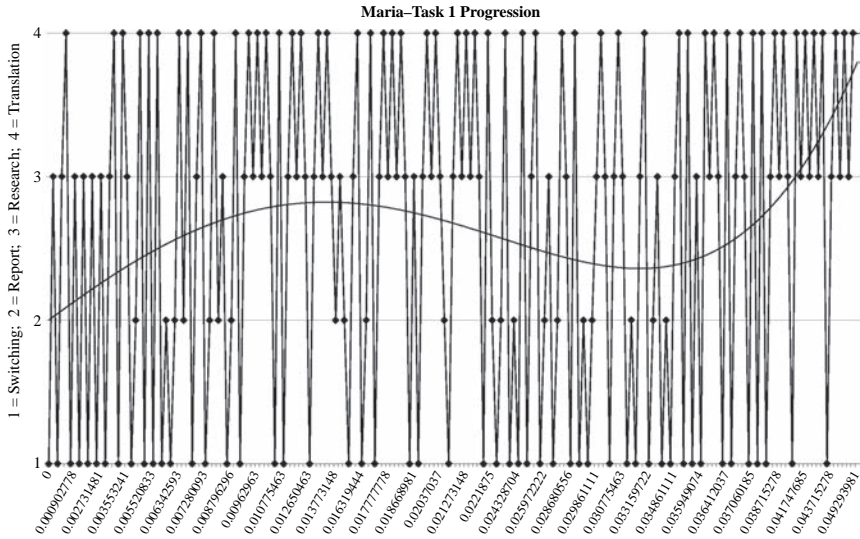
Maria–Task 1 Progression

1 = Switching; 2 = Report; 3 = Research; 4 = Translation

Figure 5.3   Maria's Progression Chart (Task 1)

translation student, indicating, in turn, that the translator processed larger units of information—typically, at the sentence or paragraph level—at a time. Although some features point to some commonalities between the working styles of these two participants, their task progression profiles vary significantly.

Figure 5.2 corresponds to Bob, who produced the translation of the highest quality and performed the least amount of online task changes of all participants, with a total of twenty-nine changes. As indicated previously, Bob is a near-native speaker of English and the most expert translator and web searcher among the participants. His task progression chart shows a rather controlled manner of progressing through the various online tasks: switching (represented by number 1 in the charts), reporting about problem solving (represented by number 2), researching (number 3), and translating (number 4).

He spent the first six and a half minutes reading the translation brief and the ST for Task 1, and then proceeded directly to carrying out his background research before starting to translate. He continuously researched a number of items until the twenty-five-minute mark, when he begun translating, a process supported by his resorting to the web to find translation variants or confirm his own solutions. That is, for Bob, translation progressed until a problem was encountered, at which point research was undertaken, and then translation was resumed. This process lasted until the forty-five-minute mark, when the first change to the report task occurred. In fact, the last fifteen minutes focus solely on completing the OSR with only three

switches to previous web pages and the translation window to gain contextual information to complete said report.

To sum up, Bob's chart shows four highly distinctive phases: ST reading, background research, translation interspersed with selected research, and problem-solving reporting. The fact that this translator completed the OSR at the end of the whole exercise suggests that this tool did not interfere directly with his translation or research processes.

Figure 5.3, corresponding to Maria—that is, the nonnative speaker of English among the students, who produced the translation of the lowest quality—shows a very different task progression profile that resembles a highly ricocheting behavior by frequently switching between online tasks. Although her task progression profile is less distinctive than those of the other participants, her chart still shows several progression phases.

The initial phase, which lasts for five minutes, focuses exclusively on research. It is followed by an eight-minute period of changes between translation, the OSR, and some minor research. From the thirteen- to the fifty-minute marks, a sequential pattern of changes between translation and research emerges, interspersed with reporting, for which Maria sometimes conducted repeat searches. The last phase starts at the fifty-minute mark after the OSR reporting was finished and includes the remaining twenty minutes, which are dedicated to translation combined with research for checking purposes. Maria's task progression profile shows the highest level of interference between the OSR and the translation process.

Overall, the methods presented here for coding and analyzing users' online actions made it possible to identify a few behavioral patterns concerning the participants' task progression profiles, as well as web-searching behaviors. While behavioral patterns regarding task progression profiles are presented in detail in Enríquez Raído (2011: 332–336), the participants' web search behaviors are discussed in Chapters 6 and 7 of the present volume.

5.5.4   Transcription and Coding of Interview Data

I outsourced the transcription of the one-to-one interviews with the translation students of the study to a company specializing in professional transcription services. A full and accurate transcript of each interview was created without repeated or unnecessary words, commonly referred to as "fillers" (e.g., "ums," "ahs," and "ers"), unless said words were located at the beginning of a sentence followed by a long pause.

Upon receiving the interview transcripts, I compared these with their respective original audio recordings to ensure maximum accuracy and quality. This was particularly useful and necessary given the use of some Spanish terms, the occurrence of overlapping speech, and the presence of foreign accents, my own in particular. This process of quality assurance also allowed me to solve problems of "unknown terminology," "non-English terms,"

and "unsure words" (e.g., misspellings) found in the interview transcripts. However, I left passages that I could not hear or understand as "unintelligible," as per the original interview transcripts. Additional conventions were used to signal long pauses (indicated as "pause"), short pauses (indicated with a comma), and laughter, indicated as such in the interview transcripts.

Like with the background questionnaires of the study, I formatted the postedited transcripts by applying paragraph styles to each interview question so that I could automatically code questions common to all four interviews in nVivo. I manually coded questions specifically tailored to the needs or situation of each participant at either existing or new nodes in my nVivo research project. The results of this coding process are used to support the data analyses provided in Chapters 6 and 7.

5.6   DATA ANALYSIS

5.6.1   Qualitative Methods

As indicated earlier, grounded theory is the qualitative research approach that I adopted in my study. There are three main analytic strategies for analyzing qualitative data in grounded theory: coding, memoing, and concept mapping. I used these strategies in nVivo with the help of the program's data-coding, linking, classifying, and visualizing aids described previously. Chapter 6 presents the categories and concepts generated for describing the participants' search needs (individual vs. common needs, reported vs. unreported needs, etc.), search goals (comprehension, production, or both), initial search actions (direct address searches, navigational searches, search engine queries, etc.), and information sources (dictionaries, databases, newspapers, journal articles, etc.), to name but a few.

5.6.2   Quantitative Methods

Qualitative analyses are supported by descriptive statistics (counts, percentages, and mean values) to process part of the data and provide a multifaceted overview of the participants' web search behaviors. In particular, I counted the participants' screen-recorded searches according to the number of reported versus unreported information needs, as well as the number of individual versus common needs, and determined the frequency and distribution of common needs per participant.

I also counted the participants' search goals based on the number of ST comprehension goals, TT production goals, and goals of a dual nature, and determined their distribution per participant and common information need. Furthermore, I determined the distribution of initial search actions per common information need, participant, and information goal.

To account for the participants' search processes, I adopted, from the web-searching literature, a number of evaluation metrics that I later adapted to suit the needs of my own study. These metrics apply to two main levels of data analysis: the search session and the search query. The analysis of the search sessions includes their length, which I measured in minutes and seconds, and which I complemented by the number of online actions taken by the participants to potentially satisfy their information needs. I determined the distribution of search sessions, online actions, and search session lengths per common information need and participant. At the level of the search query, I adopted three different metrics. These include query complexity (determined by the number of simple vs. advanced queries), query length (measured by the number of terms in a query, excluding articles, prepositions, and punctuation), and query types (classified into initial queries and subsequent queries, with the latter being further classified into modified queries, repeat queries, and unique queries). Data on query complexity, length, and type are provided per common information need and participant.

Also in relation to the participants' search processes, I counted the number of direct address searches and browse searches per common information need and participant. The same applies to the total number of pages accessed and their distribution per participant and common information need.

Finally, quantitative analyses of the search outcomes include the distribution of adopted sources of information and degree of perceived search success, search satisfaction, and search difficulty per participant and reported information need.

6 Modeling Web Search Behaviors
First Embedding Task

This chapter reports the findings obtained from the screen recordings and the online search reports (OSRs) on the participants' web search behaviors embedded in Task 1. As mentioned in 5.4.1, the source text (ST) used for this task, which was carried out by the four translation students of the main study and the two translators of the pilot study, is an excerpt (232 words long) from a Greenpeace guide to genetically modified food that covers a broad topic and has an informative, as well as an appellative, function. All six participants had to translate the excerpt from Spanish into English for the immediate publication of an information package on genetically engineered (GE) food for a New Zealand audience. Predictably, Bob and Daniel (i.e., the two translators of the pilot study) produced the highest-quality translations of all. They were followed by the two students who are English native speakers (i.e., Laura and Martha) and who produced medium-quality translations, and by Anna and Maria, the two nonnative speakers of the main study, who produced low-quality translations.

The translation problem-solving performance of these participants nevertheless varied significantly from one another. In the following, I will discuss said performance in relation to the participants' web search tasks, which, as discussed earlier, involve four main information-seeking (IS) stages within the context of translation problem solving: (a) the formulation of a search need, (b) the specification of one or more search goals, (c) the implementation of a search process, and (d) the selection of a search outcome. Discussions revolving around these units of analysis will primarily focus on web search tasks that involve information needs common to at least two participants.

6.1 SEARCH NEEDS

The six participants who completed the first embedding task had a total of thirty-eight types of information needs that occurred in eighty-one instances (tokens). This means that on average, 2.1 participants shared one information need. However, of these eighty-one instances, a total of forty-eight (i.e.,

more than half) were generated by Maria (twenty-nine) and Anna (nineteen) alone. This phenomenon could be explained by these participants' lack of confidence in their skills to translate from their L3 into their L2 (Maria) or L1 (Anna). The remaining thirty-three instances of information needs were generated by Laura (eleven), Bob (ten), Martha (seven), and Daniel (five).

A noteworthy characteristic of the participants' web search behaviors for translation relates to the number of information needs that some of the participants researched but did not report in the OSRs (i.e., the number of unreported information needs). With the exception of Martha and Daniel, who reported all their information needs, the rest of the participants omitted to report a large number of needs (see Table 6.1). This is particularly prominent in the case of Maria and Anna, with Maria not reporting twenty-four (i.e., almost 83%) of her twenty-nine information needs and Anna not reporting fifteen (i.e., almost 79%) of her nineteen information needs. They are followed by Laura and Bob, who only reported seven (i.e., slightly above 63%) and six (i.e., 60%) of their total number of information needs, respectively.

The fact that more than half of the participants' information needs (forty-seven out of eighty-one) and related searches for translation problem solving were unreported is significant in two ways. First, it seems to support previous claims (e.g., Gile 2004; G. Hansen 2006) about the noncomprehensive nature of the data collected by means of written reports. As some participants in this study pointed out, reporting in writing takes time and effort, and this could partly explain—along with problems of information recall—the lack of thoroughness with which subjects tend to complete reports on problem solving. Combining the OSRs with the screen recordings compensated for this methodological drawback. Nevertheless, the lack of introspective (written) data on the unreported information needs and related searches meant that the degree of inference for these searches had to

Table 6.1   Reported versus Unreported Information Needs per Participant (Task 1)

	Reported Information Needs	Unreported Information Needs	Total
Martha	7	0	7
Anna	4	15	19
Maria	5	24	29
Laura	7	4	11
Daniel	5	0	5
Bob	6	4	10
TOTAL	34	47	81

be higher than that of the reported searches. In most cases, this did not pose a major problem, as the unreported searches were frequently conducted to confirm various translation hypotheses (e.g., word meanings or equivalents) and word spellings, as shown later in the chapter.

This leads to the second significant implication—that is, the perception of problems and their degree of difficulty. In this regard, the interview data of the study challenge previous claims about the notion of a problem as involving something serious or difficult. Quite to the contrary, the answers that Laura, Anna, and Maria provided as to why they had not reported certain information needs and their respective searches suggest that not all problems necessarily refer to difficult processing, and that, as discussed in 2.1, deliberative behavior also takes place when translators make unproblematic decisions (cf. Jääskeläinen 1993; Séguinot 2000a; Sirén and Hakkarainen 2002). This is most evident in Laura's account of her rationale for not reporting all her information needs and related searches. She admitted, for example, that she had skipped the information needs "that weren't really that problematic" and that she did not have "much to say" about information needs that were "really simple."

For Anna and Maria, the two nonnative speakers of English, not reporting some of their information needs and searches could be explained by the fact that they perceived certain needs not so much as problematic but rather as a matter of reaffirmation or, in Maria's own words, "reassurance." Anna, for example, stated that certain information needs were not a problem "as such" and that she had conducted a number of searches "for confirmation purposes" only. Similarly, when I asked Maria if she could think of a reason why she had not reported all her information needs and related searches, she replied, "Because probably for some of the searches I knew the answer and I was just making sure that was the correct one. So it wasn't actually a search as such. It was just reassurance of my hypotheses."

This seems to support previous statements about these participants' lack of confidence in their L2 (or, in Maria's case, L3) translation skills. This, in turn, appears to be in line with previous suggestions that translators generally feel less confident in L2 translation than in other directions (e.g., Kiraly 2000b). However, this lack of confidence does not necessarily have to be a bad thing. As Massey and Ehrensberger-Dow remark, "there is a risk of overconfidence and complacency when people translate into their L1" (2010a: 137). When people translate into their L2, however, they may feel encouraged "to be more cautious and check resources for unfamiliar terms" (ibid.).

If we take this information into account—that is, the fact that these participants' unreported searches were conducted for confirmation purposes only and that the nature of their information needs was unproblematic—we can then observe that all six participants had a similar number of more or less problematic information needs, ranging from four to seven in total (see the next section).

6.1.1   Individual versus Common Information Needs

As stated previously, the participants faced a total of thirty-eight types of information needs that occurred in eighty-one instances. Of the thirty-eight different types of information needs, twenty-two (i.e., 57.9%) are individual (i.e., subjective needs), while sixteen (i.e., 42.1%) are information needs that were common to at least two participants. Of the twenty-two individual types of (reported and unreported) information needs—which generate 27.2% of the total instances (eighty-one)—only two were reported (by Maria and Laura) in the OSRs. Based on the results discussed in the previous section, this would seem to indicate that the remaining twenty information needs were researched either to confirm translation hypotheses, which are perhaps best illustrated by searches conducted in the source language, or translation solutions, best represented by searches conducted in the target language. In this regard, it is interesting to note that of the total instances of individual information needs, 69.6% were *initially* searched in Spanish, while 30.4% were initially searched in English. Of the fifty-nine instances of common information needs, 91.5% were initially searched in Spanish, while initial searches in English accounted for only 8.5% of all the instances.

Furthermore, in accordance to what appears to illustrate differences in linguistic ability among the participants, out of the twenty-two individual information needs, fifteen correspond to Maria alone, four to Anna, two to Bob, and one to Laura. With the exception of Laura, the other native speakers of the study (i.e., Martha and Daniel) did not have any individual information needs. I should also note that while the searches of the three translation students were conducted to seek and retrieve lexical information on individual words—except for one collocation in the case of Maria—Bob's searches were conducted for phraseological information only, more specifically, to confirm two collocations.

6.1.2   Types of Common Information Needs

Although the number of individual needs types (twenty-two) is greater than that of the common needs (sixteen), the latter generate a far greater number of instances than the former. In particular, and as Table 6.2 shows, the sixteen different types of common needs occurred a total of fifty-nine times in Task 1, which represents 72.8% of the total number of instances.

Table 6.2 also shows that certain information needs occurred more frequently than others. For the purpose of the following discussion, I categorized the participants' common information needs into three main groups according to their frequency of occurrence, from the highest level to the lowest level of frequency. The group with the common information needs that occurred most frequently includes the collocation "armas predilectas" (weapons of choice), which represented a more or less problematic item for

Table 6.2 Frequency and Distribution of Common Information Needs per Participant (Task 1)

Common Needs	Martha	Anna	Maria	Laura	Daniel	Bob	Number of Occurrences	% of Common Needs	% of Total Needs
Armas predilectas	1	1	1	1	1	1	6	10.2	7.4
Transgénicos	1	1	1	1	0	1	5	8.5	6.2
Guía roja y verde	1	1	1	1	0	1	5	8.5	6.2
OMG	1	1	1	1	0	1	5	8.5	6.2
Cultivo	0	1	1	1	0	1	4	6.8	4.9
Conjunto	1	1	1	1	0	0	4	6.8	4.9
Alcance	0	1	1	1	1	0	4	6.8	4.9
Ganadería	0	1	1	1	1	0	4	6.8	4.9
Malas hierbas	0	1	1	1	0	1	4	6.8	4.9
Supone incremento	1	1	1	0	1	0	4	6.8	4.9
Imprevisible	1	1	1	0	0	0	3	5.1	3.7
Agentes tóxicos	0	1	1	0	0	1	3	5.1	3.7
Pasar por	0	1	1	1	0	0	2	3.4	2.5
Reforzar	0	1	1	0	1	0	2	3.4	2.5
Resistencia	0	0	1	0	0	1	2	3.4	2.5
Constituir	0	1	1	0	0	0	2	3.4	2.5
TOTAL	7	15	14	10	5	8	59	100.0	72.8

all six participants. This first group further includes the term "transgénicos" (transgenic organisms), the acronym "OMG" (GMO or genetically modified organism), and the name of the GE free food guide "guía roja y verde," which prompted information needs that were common to all the participants, except for Daniel. This is most likely due to Daniel's level of ST domain knowledge, which he rated as high in the OSR, thus stating that he was "a member of Greenpeace for a little while, and made a submission to the Royal Commission of Enquiry on GMOs in New Zealand, back in 2003 or so."

The significance of this first group of common information needs is two-fold. First, except for the collocation "armas predilectas," the remaining three information needs are directly related to the topic dealt with in the ST. Hence, these information needs would have to ideally involve thematic searches. Second, in contrast to the participants' individual needs, which were predominantly unreported and seemed to be prompted by unproblematic items, the common needs mentioned previously seemed to be prompted by what Christiane Nord refers to as "translation problems," or objective problems "which every translator has to solve during a particular translation task" (1991: 151).

The rationale for the most frequent types of common needs vary across the participants. For example, regarding the collocation "weapons of choice," all four translation students seemed to find the term "predilecto" (preferred, favorite) more or less problematic, with Martha not remembering its meaning and Laura suspecting it being a false friend. The student participants who elaborated on their rationale for the remaining information needs expressed gaps in their terminological knowledge, which led to problems of ST comprehension or target-text (TT) production. Furthermore, the allosemic words (i.e., words that are used in an unusual sense) in the Spanish name of the GE free food guide (i.e., the colors red and green used to refer to food brands that contain or do not contain GMOs) were also problematic for all the participants, except for Daniel.

Laura did not report any of the thematic information needs, which could perhaps be explained by what Anna described as a difficulty in reporting background searches that require the use of parallel texts: "For me searching for a parallel text is probably not a problem as in such, like 'cause I think to search for parallel text just means that I have no background information on this so I need to read up on it. And so I didn't consider it as a problem and I wasn't sure if I should report it and how I'm going to report it." Anna nevertheless reported all her thematic information needs, which, like most participants, she presented as terminological problems (said needs in fact required terminological information that was sometimes retrieved via reference works, parallel texts, or a combination of both).

The second group of information needs, which occurred less frequently than the needs discussed previously, includes a total of six common information needs that are of a lexical nature, except for one lexico-syntactic

information need encountered by Anna ("malas hierbas," or weeds). Three of the six information needs were caused by polysemous words, in particular the nouns "alcance" (scope, in the context of the ST) and "conjunto" (all, as in all living organisms), as well as the verb "suponer" in the expression "supone incremento" (to lead to an increase in). It is interesting to note that the first five information needs in this group were common to Anna, Maria, and Laura. Of these information needs, Bob found the terms "cultivo" (to grow crops) and "malas hierbas" somehow problematic, Martha the term "conjunto," and Daniel the terms "alcance" and "ganadería" (cattle farming). In contrast to the other four participants, Bob and Laura did not find the expression "supone incremento" problematic.

Finally, the third group of common needs that occurred with the lower frequency among the participants of the study includes information needs that are of a lexical nature only. Anna and Maria, for example, shared three of the six information needs in this group. These were prompted by the adjectives "imprevisible" (unforeseeable) and "tóxico" (in the expression "toxic agents"), as well as the verb "constituir" (to be, in the context of the ST). Bob also found the expression "toxic agents" problematic. However, unlike the translation students, who only researched the adjective "tóxico," Bob researched the entire expression in English. Like Maria, he found the term "resistencia" (resistance) somewhat problematic. Unlike Maria, however, he only researched this term to check its English spelling. Daniel and Anna researched the term "reforzar" (to strengthen, reinforce). Like Laura, Anna also researched the polysemous verb "pasar por" (in this case, to be or to involve). In contrast to all the participants, Martha did not face any of the information needs in this group, except for the adjective "imprevisible."

As it can be seen, with the exception of Anna's lexico-syntactic problem, the majority of the participants' information needs were primarily lexical (i.e., prompted by terminological problems). The language learners in Lörscher's (1991: 207) study, for example, also problematized primarily at the lexical level. The analysis of the participants' rationale for their search needs thus shows that the main causes for their knowledge gaps are rooted in unknown words, allosemic words, polysemous words, and false friends—results that are somewhat akin to those obtained by Bogaards (1998) in his study of the types of words underlined and looked up for translation by a group of language learners.

6.2   SEARCH GOALS

6.2.1   Nature and Types of Information Goals

As Table 6.3 shows, 27.1% of all instances of common information needs led to information goals related to target-text production. This is followed by information goals of a ST comprehension nature (18.6%) and information goals of a combined comprehension-production nature (11.9%). Of

Table 6.3   Distribution of Information Goals per Common Information Need (Task 1)

Common Needs	Comprehension	Production	Both	Unreported	TOTAL
Armas predilectas	2		0	2	6
Transgénicos	0	1	3	1	5
Guía roja y verde	1	2	0	2	5
OMG	1	0	3	1	5
Cultivo	0	2	0	2	4
Conjunto	2	0	0	2	4
Alcance	1	2	0	1	4
Ganadería	0	1	0	3	4
Malas hierbas	1	2	1	0	4
Supone incremento	1	1	0	2	4
Imprevisible	1	0	0	2	3
Agentes tóxicos	0	1	0	2	3
Pasar por	1	0	0	1	2
Reforzar	0	1	0	1	2
Resistencia	0	1	0	1	2
Constituir	0	0	0	2	2
TOTAL	**11**	**16**	**7**	**25**	**59**
%	**18.6**	**27.1**	**11.9**	**42.4**	**100.0**

all the instances, 42.4% correspond to the common information needs and goals that were unreported (by Maria, Anna, and, to a lesser extent, Laura) and were thus not classified under any of the three categories mentioned previously. These instances involve unreported searches that were either exclusively or initially conducted in WordReference (WR), which suggests that these participants might have searched for information of a comprehension or production nature either to confirm their own translation hypotheses, as noted previously, or to find translation variants.

This is also the case with the twenty-two types of individual information needs, which, like the unreported common needs, were either initially or exclusively researched in WR. Of the twenty-two individual needs, one was reported by Maria (a production goal) and one by Laura (a comprehension goal).

In addition to the twenty-five unreported (and unclassified) instances of common information needs and related goals, there are two further instances that Bob omitted to report. However, as these instances concern

Table 6.4   Distribution of Information Goals per Participant (Task 1)

	Comprehension	Production	Both	Unreported	TOTAL
Martha	5	1	1	0	7
Anna	0	3	1	11	15
Maria	0	2	2	10	14
Laura	5	1	0	4	10
Daniel	0	5	0	0	5
Bob	0	5	3	0	8
TOTAL	10	17	7	25	59
%	16.9	28.8	11.9	42.4	100.0

usage information regarding the expression "toxic agents" and the English spelling of the word "resistance" (both items researched in English), the search goals for these items were classified in Tables 6.3 and 6.4 as requiring information of a target-text production nature.

If we examine the nature of the reported search goals per participant (cf. Table 6.4), a number of patterns can be identified. It is possible to observe, for example, that the student participants who are native speakers of English (i.e., Martha and Laura) primarily reported search needs requiring information of a ST comprehension nature. In contrast, Daniel, the other native speaker of the study whose translation expertise is higher than that of Martha and Laura, only required information for target-text production purposes. This is also true for Bob, who placed more emphasis on production goals than on comprehension goals. This seems to be more or less consistent with the results of some of the studies discussed in 2.2.

Gerloff, in particular, found that the foreign language learners of her study "almost exclusively" worked with "comprehension goals in mind," while "competent translators" focused much more on "production goals" (1986: 252). Similarly, Jääskeläinen states that the two advanced translation students of her study faced primarily production problems (in the form of monitoring), while the two novice students mostly faced comprehension problems (1987: 47–50). She obtained similar results in her 1990 study, in which she found that in the successful translation processes, "a larger share of attention units" involved the production of an improved translation product, and that "the more successful translators worked with higher level production goals than the less successful translators" (ibid.: 217). In Lörscher's study, the nontranslators tended to face lexical problems "arising from lack of competence in SL [source language] or TL [target language]" (1996: 30–31). The competent translators, however, primarily faced formulation problems, "with the optimal expression of sense according to the TL norms of text production" (ibid.: 31).

The findings of these researchers also seem to apply, at least to some extent, to the novice students of my study who are not native speakers of English. Anna and Maria faced goals of a combined comprehension-production nature (part of their unreported searches most likely falls in this category as well). Their search goals are mainly linked to lexical problems that in fact seemed to arise from their lack of confidence in their SL or TL skills. As indicated previously, however, Anna's and Maria's lack of confidence in their TL skills may explain the fact that, as a result of tighter TL monitoring processes, these participants faced more production goals than the other novice students who are English native speakers (i.e., Martha and Laura).

With regard to the participants' types of information goals, most of them involved searches for SL definitions or TL equivalents, some of which were conducted (primarily by Anna, Maria, and Laura) for "checking" purposes in WR. Other information goals were coded as acronym resolution (in the SL, the TL, or both), contextual meaning (or use of certain SL terms or expressions in context), usage (use of certain TL terms or expressions in context), lexico-syntactic, and spelling.

Finally, I should note that for information goals of a comprehension nature, the distinction between definition and contextual meaning is an important one in this study, as each type of information seemed to be associated with different comprehension needs. While searches for contextual meaning appeared to indicate that a given participant already had an idea about the meaning(s) of a certain ST item, the search for definitions generally indicated that they did not. Furthermore, searches for contextual meaning were mainly reported in connection with polysemous words (e.g., "alcance," "suponer," and "pasar por"), while searches for definitions were primarily reported in relation to more or less specialized terms or expressions (e.g., "transgénicos" and "armas predilectas").

6.2.2 Information Goals and Initial Search Actions

One could argue that different types of information predetermine to some extent the types of information sources to be consulted. For instance, the search for contextual meaning would ideally involve the use of parallel texts, while the search for definitions could be conducted in reference works and, of course, in parallel texts if required. In other words, the types of information sources used to satisfy different information needs depend on the questions that users ask regarding the information they need—that is, their search goals. White and Iivonen, for instance, view search questions as "expressions of the information needs raised by information problems" (2001: 723). The way in which questions "are formulated and phrased has implications for information retrieval (IR) and provides insights into the individual's understanding of the problem and of information necessary to address it" (ibid.). These authors thus distinguish between "two question characteristics: the open/closed nature of the questions and the predictability of

the source of the answer" (ibid.). Closed questions elicit factual and unambiguous information and are typically asked when searchers want brief and exact answers. Searchers "have little discretion in judging correct answers or choosing alternatives. Instead, they may face many options about where to find correct answers" (ibid.). Generally speaking, definitions and translation equivalents, for example, would seem to yield questions of a closed nature for which various options for suitable answers are available. In contrast, when questions are of an open-ended nature, "there is no one exact answer and searchers must develop acceptable responses. There are many relevant sources, and searchers may have to study them and perhaps combine information available from several sites. For some questions, searchers know or can guess with high probability of success where relevant information can be found; for other questions they cannot do this. Instead they have to find appropriate sources to be able to develop responses by using various search services or by linking from related sites" (ibid.). The need for contextual meaning, phraseological information (e.g., collocations), or thematic information could lead to more or less open questions for which multiple sources of information may need to be combined in order to find satisfactory answers. Moreover, these (or, for that matter, any other) information needs could lead to questions that combine White and Iivonen's two characteristics, thus forming the following four categories: closed, predictable source; closed, unpredictable source; open, predictable source; and open, unpredictable source (ibid.: 721).

Question characteristics, in turn, may have an impact on users' choices about their initial "Web search strategy" (ibid.: 723). This initial search strategy or, in my terminology, initial search action, refers to the first step in a search process, which may involve subsequent steps. This particular decision point in a user's search behavior is of key relevance because, as White and Iivonen point out, "it has implications for the continuation of the search" (ibid.: 722).

Users may start their searches by choosing one of the three approaches to IS distinguished, for example, by Austermühl (2001: 52). These are, as indicated previously, institutional searches (via URLs), thematic searches (via subject trees), and keyword searches (via search engines), which correspond to White and Iivonen's "direct address," "subject directory," and "search engine" types of "search strategies" (2001: 722). Direct address searches generally take "only one step to reach a specific site," as searchers typically know the URL of the site or are able to infer the specific address "based on their knowledge of a company or organization's name, the address structure, categories and abbreviations" (ibid.). Subject directory searches allow users to browse data through subject trees or thematic categories of information. These searches involve multiple steps and are based on "recognition" rather than "recall, which is important in the other [search] options" (ibid.). Here, users "need to be able to recognize topical or other categories that are likely matches for specific questions" (ibid.). Searches carried out in

search engines, finally, yield all kinds of information and, like subject directory searches, also involve a multiple-step process. Furthermore, searching via search engines "is a more analytical and demanding method for locating information than browsing, as it involves several phases, such as planning and executing queries, evaluating the results, and refining the queries, whereas browsing only requires the user to recognize promising-looking links" (Aula 2005: 14). Users therefore depend on their understanding of search engine features, as well as on their knowledge on a given domain in order to transform questions into appropriate search queries.

Two of the three approaches to information searching mentioned previously were identified in connection with the participants' initial stage of their search processes. These approaches are direct address searches and search engine queries. None of the participants conducted subject directory searches at the initial stage of (or at any point in) their search processes. Some of the participants, however, initiated their search processes by conducting one of the two further types of searches indentified in my study. These are "navigational queries" and "browse searches" (as further discussed later in this section however, a browse search does not represent an initial search step in the strict sense).

Navigational queries involve typing in a search engine box a word (or words) that a user knows will yield the site they wish to visit (Battelle 2006: 31). These queries generally take two steps only (i.e., typing the word and clicking the known site link) and hence provide one of the shortest routes (in addition to direct address searches) to a site known to exist. Browse searches involve navigating the web, which itself is "supported by a structure that allows and encourages users to follow links" (White and Iivonen 2001: 724). Searchers typically "navigate in a small area with frequent use of backtracking . . . and conduct swift, flexible searches, making quick decisions about where to click next" (ibid.).

Although browse searches cannot be chosen as an initial search action, they have been included in the data analysis as they provided (on occasion) some of the participants with a starting point to search new items on the basis of previously researched items. Browsing thus emphasizes the changing nature of information needs, as searches evolve during the search process, providing users with starting points to conduct new searches.

The findings of the study show that direct address was the preferred initial search action among the participants (74.6%), followed by search engine queries (18.6%), browse searches (5.1%) that led to new searches in a couple of instances, and one navigational query (1.7%). The frequent use of direct address searches reveals that known sites are important for all the student participants, as well as Daniel. This is consistent with the search behavior of regular users, who tend to "start their searches from known sites and visit known sites many times during their searches . . . or over time" (White and Iivonen 2001: 723). In contrast, Bob, the most expert web searcher of all, preferred search engine queries as his initial search action. That is,

while the participants with the least search expertise (Martha, Laura, Anna, Maria, and, eventually, Daniel) started their searches from the known, Bob preferred to initiate his searches with the unknown.

The results obtained also show that there is little or no variation of initial search action across the participants of the study. Bob systematically used search engine queries to initiate all his searches, except for two browse searches. Maria used direct addresses to initiate all of her searches, while Daniel and Laura also did so, except for one occasion in which they conducted a navigational query and a search engine query, respectively. Similarly, Martha and Anna chose to initiate all their searches using direct addresses, except for two initial search engine queries in both cases and one additional browse search in the case of Anna. It is also interesting to note that while Martha, Anna, and Laura conducted their initial search engine queries in Google.co.nz, Bob did not always restrict his searches to New Zealand pages alone.

Furthermore, not only did most of the participants use one and the same initial search action in all situations, they also chose the same source of information regardless of the type of question asked (or search goal pursued). In other words, question characteristics seemed to have no impact on either the participants' initial choice of search actions or their selection of information sources—the latter phenomenon, however, does not apply to Bob. This is particularly true for Maria, Anna, Laura, and Daniel, who used WR as the only resource for searching linguistic information, extralinguistic information, or both. Similarly, Martha used Real Academia Española (RAE, a Spanish monolingual dictionary) as the only initial resource for searching linguistic, as well as extralinguistic, information. As Martha herself stated in my interview with her, and as suggested previously, this could be explained by the fact that "you tend to stick with the things that you know." Bob, in contrast, used Google as a platform for finding and selecting different sources of information based on the type of search needs and goals, which mostly concerned extralinguistic information.

These findings are somewhat similar to those obtained by Massey and Ehrensberger-Dow in their pilot survey of resource use that was "completed by 14 instructors and 96 students of translation" (2011a: 196). According to the authors, "the greatest differences in research behavior between the students and instructors emerged for extra-linguistic problems requiring expert or specialized knowledge. Online dictionaries (both monolingual and multilingual) featured high on the students' list of resources, as did multilingual print/CD/DVD dictionaries. . . . By contrast, the top choices for the instructors were model or parallel texts and various uses of search engines. . . . As in the case of linguistic research, instructors again showed a greater preference for monolingual print and CD/DVD dictionaries than the students did" (ibid.: 198). The fact that the student participants (along with Daniel) did not differentiate their initial search actions and sources of information based on question type highlights the need for formal training in

question analysis. All the students relied heavily on dictionaries as their initial source of information, independent of the type of information needed, and thus frequently misused said dictionaries. The misuse of dictionaries is perhaps best illustrated by the fact that all four students (as well as Daniel) searched the collocation "armas predilectas" in a regular monolingual (Martha) or bilingual dictionary (Anna, Maria, Laura, and Daniel). This was also the case regarding the acronym OMG—with the exception of Anna, who searched this acronym in Google.co.nz.

In addition, Laura and Maria used WR to search the colors "red" and "green" included in the Spanish name of the Greenpeace GE free food guide, possibly to find out about additional meanings of these colors. Breaking multiword expressions into smaller constituents is also a strategy that both Maria and Anna used to look up the word combination "supone incremento" in WR. Maria, finally, also used WR to search the term "malas hierbas." This behavior seems to correlate with novice students' translation performance regarding their units of translation. As previous translation process studies, as well as this study, show, novice trainees tend to break sentences down into smaller units that vary in size and grammatical level (cf. 2.1).

6.3   SEARCH PROCESSES

In this section I will first discuss the participants' search sessions, or temporal series of interactions with the web, to address their information needs. These sessions were measured using a time unit (minutes and seconds) that was complemented with information on the number of online actions carried out per participant and common information need.

Second, I will examine the participants' adopted approaches to web searching—that is, their direct address searches, search engine queries, and browse searches (navigational queries are excluded from the data analysis, as there were only two such queries in the first embedding task). In particular, I will analyze direct address searches in relation to the use of reference works, given that these searches systematically involved resorting to known dictionaries and encyclopedias for information acquisition. I will describe the participants' query behaviors using primarily two of the three measures discussed in 5.6, namely, query complexity and query length. The third measure (i.e., query effectiveness) will also be taken into account to provide an overview of the participants' abilities to transform questions into appropriate query statements and hence will be examined in relation to their query construction and query modification behaviors.

Before discussing the participants' overall query effectiveness, however, I will briefly elaborate on the types of queries (classified here as initial queries, subsequent queries, and repeat queries) used to address some of the common information needs that emerged from the first embedding task. In

addition, I will provide an overview of the total number of pages accessed to research said information needs. As for browse searches, I will examine these for the two participants (Bob and Anna) who conducted this type of search.

This multifaceted analysis of the participants' search behaviors allowed me to discern several qualitative information seeking and information retrieval patterns concerning their range and depth of search behaviors, as well as their degree of repetitive behavior. While the number of websites visited is taken here to provide an indication of the participants' range of search behavior, their interactions and level of engagement with website content—as manifested, for example, by the number and type of internal site queries conducted, internal and external pages accessed, and overall time spent consuming website content—provide an indication of their depth of search behavior. The number and type of search engine–query modifications also adds to this dimension (i.e., to the depth of search behavior).

Repetitive behavior, finally, refers both to the number of repeat visits to the same website and the number of repeat searches addressing the same information need. Whereas the number of repeat visits to the same website "tells us something about Website loyalty and satisfaction" (Nicholas et al. 2006: 215), the number of repeat searches "may indicate the fact that a user has not found all that they wanted the first time around" (ibid.: 225).

6.3.1   Search Sessions

One of the main difficulties associated with the comparison of web-searching studies (or any studies in other disciplines) concerns the definition of adequate evaluation metrics and the lack of consistent terminology to refer to the same metric. To compensate for this and facilitate both the presentation and comparison of results obtained in different web-searching studies, Jansen and Pooch (2001: 243) recommend three levels of data analysis along with their respective terms and definitions. These levels are the *session,* the *query,* and the *term* (ibid.: 243–244). I will discuss these concepts in the following sections, starting with the session level of analysis.

A search session is typically understood as the sequence of interactions between a searcher and a web search engine aimed at locating relevant information that addresses a single information need. Hence, the session level has always been "a key paradigm for measuring the performance of Web search engines" (Jansen et al. 2007: 862). However, one of the difficulties in analyzing users' web search sessions involves "determining 'exactly what is the session' in practical terms" (ibid.: 863). While in traditional IR systems (e.g., online library catalogues), users can be identified based on their logon details, identifying single-user sessions on the web becomes a difficult task due to the "stateless nature of client-server relationship" (ibid.).

For the purpose of this study, like in many other studies that take a holistic rather than a technical approach to web searching, I defined the notion of

search session from a contextual point of view as a temporal series of online actions aimed at satisfying a specific information need. This notion is based on other contextual definitions like that of Jansen and others, who view a search session as "a series of interactions by the user toward addressing a single information need" (ibid.). However, unlike most contextual definitions of search session (including Jansen et al.'s), which are restricted to online actions performed *only* in web search engines, I expanded my notion of search session to include all other actions that can be performed to seek and retrieve information on the web (e.g., typing a URL, clicking a browser's Back and Forward buttons to navigate the web, typing a site query in a website's internal search engine). I also expanded my notion of search session to include online search actions aimed at addressing more than one information need at a time whenever said actions could not be clearly attributed to a single information need. This, in turn, allowed me to consider the dynamic, interactive, and evolving nature of some of the searches performed by some of the research participants.

According to Jansen and Pooch (2001: 243), the analysis of the session first involves its length, which is often measured by the number of queries per searcher. Alternatively, sessions can be measured in a time unit (usually minutes) that accounts for the search actions taken by a user (Kaske 1993: 80). Here, session length was measured in minutes and seconds and was complemented by the number of online actions taken by the participants to (potentially) satisfy an information need. Search sessions were thus delimited by changes in online tasks. To be more precise, a single search session addressing a specific information need was delimited by a change of web search task (i.e., one that addresses a new information need), which may have been preceded by a change to the translating or reporting tasks (these changes do not involve switching back and forth between tasks but rather performing task-specific actions). Multiple search sessions addressing the same information need were also delimited by a change of online task—that is, from web searching to translating, reporting with OSR, or initiating a different web search task. Finally, searches addressing more than one information need at a time were considered part of the same search session whenever a clear distinction between needs and related search actions could not be established.

Table 6.5 ranks the participants' common information needs according to the average session length (i.e., from the longest to the shortest duration, the average number of online actions, and the total number of occurrences). Naturally, the data provided in this table are not directly comparable, as not all information needs are common to all participants. Nevertheless, several observations can be made. It is possible to see, for example, that the average time length does not always correlate with the total number of occurrences and the average number of online actions taken to address an information need. While, in some cases, the higher the number of occurrences is, the higher the average time length and the average number of online actions are, in other cases such a correlation cannot be established. This is particularly true with regard to two information needs that stand out as clear exceptions to the former trend.

Table 6.5   Ranking of Common Information Needs per Session Length, with Online Actions and Occurrences (Task 1)

Rank	Common Needs	Average Time (hh:mm:ss)	Average Number of Actions	Number of Occurrences
1	guía roja y verde	0:04:24	29.4	5
2	OMG	0:02:55	19.8	5
3	pasa por	0:01:29	4.5	2
4	malas hierbas	0:01:21	8.8	4
5	transgénicos	0:01:18	8.0	5
6	supone incremento	0:01:16	8.8	4
7	cultivo	0:00:48	5.3	4
8	imprevisible	0:00:41	4.7	3
9	resistencia	0:00:37	3.0	2
10	conjunto	0:00:28	4.0	4
11	alcance	0:00:27	4.3	4
12	ganadería	0:00:26	4.8	4
13	agentes tóxicos	0:00:22	4.7	3
14	armas predilectas	0:00:22	4.2	6
15	reforzar	0:00:16	4.0	2
16	constituir	0:00:12	3.0	2
AVERAGE		**0:01:05**	**7.6**	**3.69**

These are the collocation "armas predilectas," which, despite being common to all six participants, took an average time of only 22 sec. to research, and the verb "pasar por," which, despite being common to only two participants, took an average time of 1 min. 22 sec. to research.

A closer look at the data of the study reveals that for "armas predilectas," all the participants, except for Bob, conducted one-stop searches (i.e., visits to one website only) to address their information needs and goals. This is evident not only in the small amount of time spent but also in the few actions taken to research this collocation. Only Maria spent more time on this need and performed twice as many actions as the other student participants and Daniel, which can be explained by the fact that she searched for the collocation components individually, whereas the other participants only searched for the adjective "predilecto." This, in turn, resulted in Maria carrying out two search sessions. Furthermore, with the exception of Bob, all the other

participants initially searched for this collocation in WR or, in the case of Martha, in RAE. The short length of the search sessions and the low number of actions taken show that there were no further searches conducted to address this common information need—a phenomenon supported by the video recordings. Bob, in contrast, spent almost a minute searching for said collocation in Google until he found a satisfactory answer.

Regarding the second exception mentioned previously, "pasar por," we find that while there are only two occurrences, the average session time is considerable higher than that of other information needs that occurred more frequently. This results from the fact that Anna alone spent 2 min. 13 sec. on this search (Laura, the second participant with this search need, only spent 45 sec.). In particular, Anna carried out a two-session search in WR for what appeared to be confirmation or reassurance purposes (see the parallels to Maria's search for "imprevisible" later in this section).

Other information needs involving one-stop searches concern various lexical items. The session lengths for these averaged between 12 sec. (for "constituir") and 48 sec. (for "cultivo"). The individual session lengths, i.e., the time spent by the individual participants, were mostly under one minute. Only three individual searches exceed the one-minute mark. These are Bob's search for "cultivo" (2 min. 19 sec.), Maria's search for "imprevisible" (1 min. 30 sec.), and Laura's search for "ganadería" (1 min. 11 sec.).

For Bob and Laura, the above-average session length can be explained by the fact that their searches included the consultation of more than one source of information. Maria's search, in contrast, did not involve multiple sources of information. Rather, it showed iteration—that is, repeat visits to the same source of information (i.e., WR).

The information presented in this and the following sections suggests that the student participants' range of search behavior for the lexical items listed in Table 6.5 was very limited, as well as loyal and sticky. It was limited because the students (as well as Daniel) only visited one website (as opposed to multiple websites) per search need, and loyal because they always resorted to the same website (i.e., WR, except for Martha, who used RAE instead). For Nicholas and others, the number of repeat visits or the "number of times someone returns to a Website is . . . a key metric, and tells us something about Website loyalty and satisfaction. Coming back to a Website constitutes a conscious and directed use. The industry calls it 'Website stickiness,' and everyone wants their Website to be 'sticky'" (2006: 215). At first site, a repeat and limited range of search behavior may seem somewhat unsuccessful. As Nicholas and others remark, "[t]he greater the number of Websites visited the greater the likelihood of a positive . . . outcome" (ibid.: 219). This is mainly due to websites not presenting information in the same way and with the same level of detail; hence, the value of visiting multiple sites for triangulation purposes. However, "the frequency at which people return to a Website is related to the nature and purpose of the Website" (ibid.). In my view, it is also related to the nature and purpose

of the information sought. Although, in some cases, resorting to WR led to unsuccessful or partially successful outcomes (most notably regarding the identification of the correct meaning for certain polysemous words), it also led to successful outcomes in other cases (mainly concerning definitions and selected equivalents). Furthermore, most of the searches concerning the previously mentioned lexical items were unreported, which, as indicated earlier, suggests that said items involved somewhat unproblematic processing, as well as searches conducted for checking or reassurance purposes.

In contrast to the lexical items and the collocation mentioned previously, the search sessions for the remaining common information needs averaged between 1 min. 16 sec. (for "supone incremento") and 4 min. 24 sec. (for "guía roja y verde"). As for individual search session lengths, the participants generally spent at least one minute researching the Spanish title of the GE free food guide (i.e., "guía roja y verde"), the acronym "OMG," and the multiword expression "malas hierbas." This is particularly true in the case of "guía roja y verde," for which Anna spent the longest time (8 min. 15 sec.), carrying out two search sessions. She is followed by Bob, who also conducted two search sessions but spent slightly above six minutes, and Martha (3 min. 34 sec.), Maria (2 min. 54 sec.), and Laura (1 min. 10 sec.), who conducted single search sessions. Whereas the multiple sessions conducted by Anna and Maria to research selected lexical items seem to be associated with issues of reassurance, multiple sessions conducted by Anna and Bob in relation to items involving thematic searches seem to be connected with their degree of search success for finding satisfactory answers.

Regarding the acronym "OMG," only Anna did not exceed the one-minute mark (she nevertheless spent 58 sec. researching this item). This could be explained by the fact that she had spent almost five minutes researching the term "transgénico," which may have provided her with sufficient information regarding the topic dealt with in the ST. The reversed trend may apply to the other participants, who spent more time researching the acronym "OMG" than the term "transgénico." Bob, in contrast to the students, researched both terms together, thus spending a total of 8 min. 30 sec. searching for background information on the web. Although he reported both search needs in separate web search tasks with different information goals, Bob constructed search engine queries that combined both terms in the same query. Hence, in his case it was impossible to distinguish which searches specifically belonged to which information need or goal. Both search needs were therefore considered part of the same search session, which was counted only once under "OMG."

Finally, concerning the expression "malas hierbas," the four participants who researched this search need spent more than one minute, except for Laura, who spent approximately half a minute. This can be explained, once again, by the fact that Laura only visited one website, while the other participants visited multiple websites. I should also point out that for the expression "supone incremento," the reverse trend can be observed—that is,

the participants who researched this need spent less than a minute, except for Martha, who spent over three minutes searching for relevant information in Google. In contrast, Anna and Maria searched this expression in WR by looking at its individual components separately (which resulted in these participants carrying out two sessions, respectively), while Daniel "wordreferenced" the polysemous verb "suponer" only.

As I will show in the following sections, most of the individual search sessions that exceed one minute (e.g., the ones mentioned previously) correlate with a wider range of search behavior—that is, with visits to multiple websites as opposed to visits to one website only (i.e., what I referred to previously as one-stop searches).

6.3.2   Direct Address Searches

The analysis of the participants' direct address searches throughout their entire search processes (as opposed to only their initial search actions) shows that this type of search continues to be associated with the use of reference works only. In particular, WR accounts for 91% of the all searches conducted in reference works for Task 1, followed by RAE (9%). The only exceptions to these sources of information are Dictionary.com and Wikipedia.org, which, as indicated previously, were consulted by Laura to look up the term "ganadería" and Bob to check the English spelling of "resistance," respectively. These consultations, however, were not performed via direct address searching.

The analysis of all direct address searches also shows that the translation students, as well as Daniel, used the two types of dictionaries mentioned previously (i.e., WR and RAE) only in the initial stages of their search processes. The only exceptions to this pattern concern the repeat searches (carried out in separate search sessions) that Anna and Maria conducted for some of their search needs.

Furthermore, the screen recordings for Task 1 show that the use of WR (or RAE in Martha's case) was not only Daniel's and the students' first port of call in 74.6% of all their instances of common information needs, but also the last one regarding all the lexical items mentioned in previous sections, for which these participants conducted one-stop searches only. The remaining types of common information needs were further researched via search engine queries by at least one participant.

6.3.3   Search Engine Queries

Having discussed patterns of direct address searches, in the following sections, I will examine the participants' search engine queries entered in Google (i.e., the only search engine used). To do so, I will look at aspects of query length (number of terms in a query, excluding articles, prepositions, and punctuation), query complexity (simple vs. advanced queries), and query types (i.e., initial queries vs. subsequent queries). The latter are further

classified into modified queries, repeat queries, and unique queries. The first query in a session is known as the *initial query,* subsequent queries that are identical to other queries in the session are referred to as *repeat queries,* subsequent queries that are different from previous queries in the session are called *modified queries,* and queries that differ from any other queries in the session are known as *unique queries* (Jansen and Pooch 2001: 244).

I will also examine the total number of pages accessed by the participants, as well as their query (re)formulation patterns, which, in turn, will allow for an overview of their query construction and query modification behaviors from the perspective of query effectiveness.

6.3.3.1 Query Complexity. A total of forty-one searches were generated for the seven common information needs for which at least one search engine query was performed. The majority of the forty-one searches were advanced queries (78.05%). At first glance, this comes as a surprise considering that, as shown previously, the participants' first port of call are dictionaries accessed via direct address—that is, a rather simple yet oftentimes effective way of looking for information. One would therefore expect to find more simple searches than advanced searches. What we see here, though, is that simple queries only make up 21.95% of the total number of queries and, of those, two-thirds are searches that aim at resolving the acronym OMG. Only Martha and Bob constructed advanced queries (one and four queries, respectively), to search this need.

Having said that, a closer look at the advanced queries shows that more than half of them (59.38%) were carried out by Bob alone. This means that when looking only at the queries carried out by the four translation students, we see that they conducted nine simple queries and thirteen advanced queries. Of Bob's nineteen advanced queries (he did not perform any simple queries), seven alone concerned the title of the GE free food guide. This common information need also generated a relatively high number of advanced queries among the translation students. In particular, there were seven advanced queries for this need, which represent more than half of the students' total number of thirteen advanced queries. In contrast to Bob and the students, Daniel did not carry out any search engine queries at all, except for one navigational query aimed at yielding the WR site. He is consequently excluded from the analysis of the participants' query behaviors.

With regard to the word combinations "armas predilectas" and "supone incremento," for which one would expect to see queries aimed at retrieving contextual information or checking tentative translation solutions, only Bob and Martha performed search engine queries. More precisely, Bob carried out three advanced queries to research "armas predilectas" (the other word combination did not pose a problem for him), while Martha conducted one advanced query to research "supone incremento." She did not perform any queries for "armas predilectas," presumably for the same reason as that of the other student participants and Daniel, who seemed to find satisfactory answers in the dictionaries they used (i.e., WR and RAE).

Concerning the word combination "agentes tóxicos," only Bob queried this need with two advanced searches aimed at checking the frequency of usage of his own tentative solutions (i.e., "toxic agents" and "toxic elements"). (Bob also conducted frequency checks regarding his two individual information needs, i.e., the word combinations "to free/liberate gases" and "genetic contamination/pollution").

Information on transgenic organisms (i.e., "transgénicos") was only queried by Martha (Anna also researched this need but did so via browse searching). She conducted a simple query to verify the meaning of the term in English and to check whether said term is a synonym of genetically modified food. Martha's lack of additional research led her to believe that both terms had the same meaning and could thus be used interchangeably, a result that also applies to the rest of the students and Daniel. Bob's combined search for "OMG [and] transgenic organisms," on the contrary, allowed him to find out that these terms indeed do not have the same meaning and that the latter is a variety of the former—a distinction that is not clearly made in the original ST.

Finally, with regard to "malas hierbas," all the participants who shared this need performed at least one advanced query, except for Anna, who used browse searching to research this item. Some of the participants also conducted a number of queries using the internal search engines of specialized websites. These queries, here referred to as "site queries," are treated separately from the search engine queries performed in Google due to the different nature of the sites, as well as their less frequent occurrence. Anna and Bob are the only two participants who conducted site queries, which concern the acronym OMG and the title of the GE free food guide. While Anna carried out a simple site query for the English acronym in Wikipedia, Bob queried (also via a simple search) the English acronym on Greenpeace.org. Regarding the title of the GE free food guide, both participants researched this need on Greenpeace-sponsored sites, with Anna conducting a simple query for "guía roja y verde" on Greenpeace Spain and Bob performing one simple and two advanced queries for several of his own translation variants on Greenpeace.org.

6.3.3.2 Query Length. This section provides an overview of the total number of terms per query, the total number of queries and query terms, and the average number of terms per query with regard to both simple and advanced queries. Concerning simple queries—and taking into account that only three information needs were queried using simple searches—there were a total of nine searches, all carried out by the translation students. Of these nine, five alone were Maria's. Six of the nine searches relate to the information need OMG. The number of query terms used per search varies from one (Anna's search for "OMG") to four (as in the case of Maria's searches for OMG and the title of the GE free food guide). Overall, the searches averaged 2.44 query terms per search. Of course, the previously mentioned long searches carried out by Maria had an impact on this average. Nevertheless, the average length of the simple queries in this study is

in line with findings obtained in other studies (e.g., Batelle 2006; Carpineto and Romano 2012) focusing on regular search engine users' queries, which tend to include just one, two, or three words per query.

Like with the simple queries, the length of the advanced queries was measured by the number of individual terms in a query, also excluding articles, prepositions, and punctuation. Furthermore, search operators and modifiers were not counted towards the length of advanced queries. Instead, search operators and modifiers are examined in relation to the participants' query modification behaviors in 6.3.3.5. Furthermore, phrase searches were counted as one term only, independently of any multiword expressions they may have contained. The reason for this is to account for the matching criteria used by web search engines, according to which only documents matching a specific query are retrieved.

Taking the previous information into account, the high number of advanced queries with only one search term (nineteen) is not surprising. Of the total thirty-two advanced queries (which cover six information needs), none exceeds three terms in length. In addition to the nineteen single-term queries, there are ten searches with two query terms and three searches with three query terms. The latter were all carried out by Bob. In fact, Bob's combination of phrase searches and additional single terms generally resulted in a longer length. This is also reflected in the fact that two-thirds of all query terms (i.e., thirty-two out of forty-eight) used in advanced queries were employed in searches carried out by Bob alone. Taking a closer look at the overall number of searches, we see that Bob carried out nineteen of the total thirty-two advanced queries. The remaining thirteen are distributed rather evenly among the four student participants, with Laura carrying out four searches, and Anna, Martha, and Maria each carrying out three searches.

As with the simple queries, the thematic search needs "OMG" and "guía roja y verde" led to the highest number of advanced queries (seven and fourteen, respectively). The average number of search terms per query is 1.5—that is, half the average of the simple query length. Again, this length is influenced by the decision to count phrase searches as one-term queries.

6.3.3.3 Query Types. The six common information needs, which led to a total of forty-one search engine queries, were initially queried seventeen times. Of these seventeen initial queries, seven were one-time searches that did not involve any subsequent queries. Of these seven one-time queries, four belong to Martha alone. She only carried out one query each for the thematic items "transgénicos," "OMG," and "guía roja y verde," as well as for the word combination "supone incremento." Similarly, Anna only conducted one query for "OMG" (yet, as indicated previously, she further researched this item via browse searching), while Maria and Laura carried out one single query each for "malas hierbas."

Interestingly, with the exception of Martha, who conducted the one-time searches mentioned previously, the other translation students did not query four of the six common information needs, in particular "armas predilectas,"

"transgénicos," "supone incremento," and "agentes tóxicos." This suggests that the students' range of search behaviors for these and the previously mentioned common information needs is, like with the lexical items discussed earlier, very limited. In other words, their search behavior involved little or no research conducted via search engine queries. Instead, it involved mostly fast and easy access to WR only. This, in turn, suggests that the student participants', as well as Daniel's, depth of search behavior for Task 1 was generally shallow, as no significant content was consumed. This is line with Nicholas and others' claim that "[d]igital information consumers are generally characterized by their shallow searching. . . . Website penetration is the metric we use to determine this and it represents the number of items viewed during a search session. It provides an indication of how involved or engaged people get with Websites or digital services. The metric typically shows that visits are characteristically brief, to-the-point, and possibly cursory" (2006: 210). The remaining ten initial queries led to a total of twenty-four subsequent queries, of which twenty-three are modified, unique queries, and only one is a repeat query (conducted by Anna regarding the GE free food guide). Of these twenty-three modified queries, Bob alone performed fourteen, with the remaining nine queries distributed among Maria (five), Laura (three), and Anna (one). That is, from a query modification point of view, Bob's depth of search behavior was deeper than that of the students and Daniel. The only exception is Anna, who, as further shown in the following section, favored browse searches as opposed to search engine queries as her preferred approach to IS, thus resulting in a deeper search behavior than that of her classmates.

Of Bob's fourteen subsequent queries, almost half of them (i.e., six) were carried out to seek information on the GE free food guide alone, three to conduct background research on GMOs and transgenic organisms, and five to obtain language usage information or confirm his tentative translation solutions regarding the expressions "armas predilectas" (two), "malas hierbas" (two), and "agentes tóxicos" (one). The fact that Bob conducted nine out of his fourteen subsequent queries to research the aforementioned thematic needs shows that, unlike most of the students, who primarily sought linguistic information (except for Anna, who also conducted some background research), Bob concentrated mainly on searches aimed at acquiring knowledge on the topic dealt with in the ST. That is, Bob's high number of subsequent queries points to a deep and wide range of search behavior that mainly revolved around the search for background information.

6.3.3.4 Total Number of Pages Accessed. The continuum of depth and range of search behavior may be determined not only by the number of initial versus subsequent queries (or the number of "no queries") but also by the number of web pages viewed during a search session. Table 6.6 provides an overview of the total number of queries performed and pages accessed by the participants to address their search needs via search engine queries (i.e., it excludes web pages accessed via direct address searching, as well as pages reaccessed for browse searching).

Table 6.6   Distribution of Pages Accessed per Participant (Task 1)

	Bob	Laura	Maria	Anna	Martha	TOTAL
Total number of queries	19	6	8	4	4	41
Total number of SERPs	14	4	3	1	1	23
Total number of result links	5	2	6	4	4	21
Total number of internal links	0	0	1	12	2	15
Total number of site queries	0	0	0	1	0	1
Total number of external links	0	0	0	0	0	0
Total number of pages accessed	**19**	**6**	**10**	**18**	**7**	**60**

Table 6.6 thus illustrates a general information-search model, according to which a user carries out an initial query, examines the search engine results pages (SERPs), and decides whether to click on one or more result links or modify the initial query to obtain a different set of results. I expanded this general information-search model to accommodate the participants' range of search actions by taking into account (a) the site queries they conducted in the internal site engines of various websites, (b) the internal links they clicked on to access within-site pages, and (c) the external links they clicked on to access pages in other related websites.

Overall, Table 6.6 includes:

- the participants' total number of queries (initial and subsequent)
- the total number of SERPs that were viewed but where no result links were clicked on (which in turn led to query reformulation, the end of the search, or a new search)
- the total number of result links, or websites, that the participants decided to visit
- the total number of site queries and internal links that the participants decided to perform and click on, respectively, to access pages within websites
- the total number of external links that the participants decided to follow in order to access or view pages in other related websites.

As Table 6.6 shows, Bob conducted almost five times as many search engine queries as Anna and Martha, approximately three times as many queries as Laura, and over twice as many queries as Maria. More specifically, Bob's nineteen search engine queries, which covered five of the seven common information needs that were queried by at least one participant, led him to visit five different websites and view a total of nineteen pages (i.e., on average, he conducted 3.8 queries, visited one website, and viewed 3.8 pages per search need). Anna conducted four queries, visited four websites, and accessed a total of eighteen pages to research two common information

needs only. On average, she performed two queries, visited two websites, and accessed nine pages per search need. Like Anna, Martha carried out a total of four search engine queries and visited four different websites. Unlike Anna, however, she did so to research four common information needs (as opposed to two) for which she viewed a total of seven pages (compared to eighteen) (i.e., on average she carried out one query, visited one website, and accessed 1.7 pages per search need). Maria carried out double the amount of Anna's and Martha's search engine queries (i.e., eight queries to research three common information needs for which she visited six different websites and accessed a total of ten pages). This represents an average of 2.6 queries, 1.3 websites, and 3.3 pages per search need. Finally, Laura had a total of six search engine queries, visited two different websites, and accessed six pages to research three common information needs (i.e., an average of two queries, 0.6 websites, and one page per search need).

These results show that, from the point of view of the average number of websites visited per common information need queried, the range of search behavior in the case of Laura and Martha (i.e., the two native speakers of English who conducted at least one search engine query) is the most limited one of all participants (including Daniel, i.e., the third native speaker of English, who did not conduct any queries at all and viewed no websites other than WordRefrence.com, most likely as a result of his self-declared high level of domain knowledge). They are followed by Maria, Bob, and Anna.

The fact that from the perspective of visited websites Anna's range of search behavior is wider than that of Bob comes as a surprise considering that Bob conducted far more queries than Anna. A closer look at their searching styles, however, suggests that Bob's range of search behavior could be taken to be wider than that of Anna. As Table 6.6 shows, Bob examined a high number of SERPs (a total of fourteen) and, although he did not click on any result links, he prescanned a significant number of websites. Not clicking on any result links thus means that Bob was highly engaged in query reformulation (including the construction of new queries), which, in turn, contributes to characterizing Bob by his deep searching style.

The same can be said for Anna, who favored browse searching as opposed to search engine queries. As mentioned earlier, the number of site queries performed along with the number of internal and external links accessed is taken here to provide an indication of a user's amount of browse searching, which, in turn (along with the overall time spent interacting with content), shows his or her depth of research. Anna, for example, performed one site query and followed a relatively high number (twelve) of internal links. However, the number of queries, visited websites, and browse searches (i.e., via site queries or internal links) were mostly associated with one search need only—that is, "guía roja y verde"—and, to a much lesser extent, with the acronym OMG (i.e., the second search need that she decided to query).

Bob, in contrast, shows a more balanced depth of search behavior concerning all five common search needs that he queried in Google. While he

accessed a total of seven pages for "guía roja y verde," he viewed four pages for his combined search on GMOs and transgenic organisms; three for "armas predilectas" and "malas hierbas," respectively; and two for "agentes tóxicos." Similarly, Maria accessed the same number of pages (four) to research "guía roja y verde" and "OMG" (and two pages for "malas hierbas"), while Laura also viewed four pages for the latter but only one for the former (and one for "malas hierbas"). Martha, finally, viewed more pages for "guía roja y verde" (three) than for "supone incremento" (two), "transgénicos" (one), and "OMG" (one).

6.3.3.5 Query Construction, Query Modification, and Overall Query Effectiveness. As indicated earlier, the seven common information needs that were researched via Google were initially queried a total of seventeen times. In addition, on seven occasions, the translation students decided to perform site queries in dictionaries before carrying out queries in Google. Leaving these initial site queries aside and focusing on the initial search engine queries only, it is possible to observe that of the seventeen initial queries, six are simple queries and eleven are advanced queries. Of the eleven initial advanced queries, Bob (who did not have any simple queries at all) carried out five, with the remaining six initial advanced queries distributed among Martha (two), Laura (two), Anna (one), and Maria (one).

Interestingly, the students did not modify any of their initial advanced queries at all. Except for one query that Maria formulated, for which she combined a phrase search with a single term, these initial advanced queries consisted exclusively of phrase searches only. They did not include any query modifiers (e.g., "define:" or "site:") or combine more than one phrase search in the same query. Bob, in contrast, frequently combined phrase searches with single terms, additional phrase searches, or the "site:" query modifier to further constrain his searches to specific sites.

The translation students did, however, modify the initial *simple* queries on three occasions. These refer to Laura's and Maria's search for "OMG," as well as Maria's search for "guía roja y verde." More precisely, Maria only constructed simple queries for OMG by formulating natural-language questions (e.g., "what is OMG" or "que significa OMG en ingles"), switching between or combining both English and Spanish in the same query, and using the language identifier "es" (yet, without the "site:" modifier) in an attempt to constrain her searches to Spanish sites only. Laura switched back and forth between simple queries and single-phrase searches that combined the singular form of the acronym OMG with either the indefinite article (singular) or the definite article (plural) in Spanish. Finally, concerning the GE free food guide, Maria transformed her initial simple query "guía roja y verde" into another simple query by adding a single term ("translate") but without specifying any particular language. Later, she nevertheless deleted the term ("translate") and transformed her initial simple query into a single-phrase search, which she then modified by adding a different query term ("English").

Based on the these results, one may conclude that in most cases the students carried out search engine queries only when their dictionary searches failed to provide them with satisfactory answers—a type of behavior also found in White, Matteson, and Abels's (2008: 591) study of the information behaviors of nineteen professional translators. Overall, the students constructed simple and broad queries. The lack of specification in constructing and modifying their queries suggests that their general query-formulation abilities were not very effective for obtaining background information concerning the thematic search needs. However, their query statements were oftentimes successful in retrieving equivalents. In fact, the students' simple-query construction patterns and, in Maria's case, modification patterns show that these participants were mainly interested in retrieving equivalents in a quick and easy fashion. Their generally short session lengths for the common information needs that they queried at least once—as well as the lexical items that they simply searched in either WR or RAE—support the claim that their search behaviors are characterized by shallow searching (Anna, at least in some cases, represents an exception to this). Although, as Nicholas and others point out, this type of searching "might suggest an unsuccessful, uninformed, or lazy form of behavior . . ., shallow search behavior probably suggests a horizontal, checking, comparing sort of behavior that is a result of fast and easy access to information, as well as a shortage of time and a huge digital choice" (2006: 210).

In contrast, Bob almost never resorted to dictionaries (except for one search on Merriam-Webster online, i.e., an English dictionary), mainly because he was not in much need of linguistic information, favoring search engine queries instead, which led him to browse search some of the websites retrieved by Google. He systematically initiated all his searches by typing advanced queries directly in Google's search box, and then followed result links or came back to the main SERPs to modify his advanced search queries until he found the desired information. His query construction and modification patterns suggest that he was mostly interested in acquiring background information on the topic dealt with in the ST. To do so, he combined two specific thematic keywords ("OMG" and "transgénicos") in the same query, resulting in two search sessions of a combined length of 8 min. 30 sec. The second search session on transgenic organisms evolved into a new browse search session for information on "cultivo" (i.e., the growing of crops) that lasted for an additional 2 min. 19 sec. This sort of searching style is reminiscent of an "interactionistic" approach to information searching, which supposes that IS "is inherently an interactive process between humans and texts" and emphasizes "the changing nature of information needs during the search process" (Vakkari 1999: 823).

Engagement with the texts, or website content, being explored is also visible in Anna's case (i.e., the student who had the most translation training experience of all). She spent almost five minutes searching for information on transgenic organisms and slightly over eight minutes researching the title

of the GE free food guide. In both cases, browse searching was involved, a type of search that, as further discussed in the following section, Bob also conducted in relation to the same thematic needs.

6.3.4   Browse Searches

In addition to the total pages accessed via search engine queries, Bob and Anna reaccessed some of the websites they had already visited (as a result of the queries they had previously conducted) to browse for information concerning some of the thematic information needs. They both reaccessed pages within Greenpeace.org to conduct further research on the GE free food guide. Anna, for instance, reaccessed a total of three Greenpeace pages, followed eleven internal links, and conducted one site query to further research this need. Bob reaccessed one Greenpeace page, within which he conducted three site queries and followed four internal links. He did the same during the first search session for his combined search on OMG and transgenic organisms (i.e., he reaccessed a Greenpeace page, followed seven internal links, and performed one site query). During the second session, he reaccessed the Wikipedia entry on transgenic organisms, a search that resulted into a new browse search for "cultivo." This time, he followed two external links. Anna also conducted research on transgenic organisms by reaccessing another Greenpeace.org page and following three internal links. She did the same for "malas hierbas" (i.e., she reaccessed another Greenpeace.org page, where she followed three internal links).

Overall, Bob's and Anna's browse searches resulted in successful or highly successful search outcomes that they used for translation problem solving. As further shown in the following section Anna's interactionistic browse searching style allowed her to find a highly suitable title for the guide on genetically modified organisms, as well as to creatively resolve her syntactic problem regarding the development of resistance in weeds and insects, among others. Although Bob did not manage to find a suitable translation for the title of the guide (and, hence, left it untranslated), his searching style, also characterized by an interactionistic approach to information searching, led him to acquire the necessary background information. This, in turn, allowed him to identify text type conventions, as well as phraseological, terminological, and collocation-related information, thus resulting in a highly idiomatic translation.

To sum up, the previously mentioned browse searches also contribute to characterizing Bob's and Anna's search behaviors as both deeper and wider than that of the remaining participants. A deep and wide range of search behavior, in turn, seems to be facilitated by an interactionistic approach to information searching. In contrast, a shallow and limited type of search behavior is mostly characterized by a checking, comparing type of search behavior that primarily involves easy, fast, and more or less cursory visits to a few selected websites. This type of search behavior, although perhaps

unsuccessful for addressing certain types of search needs (in particular, of a thematic nature), nevertheless allowed the students to successfully retrieve equivalents on several occasions.

6.4   SEARCH OUTCOMES

In this section, I will look at the solutions that the individual participants adopted for their identified search needs, the rationale for adopting said solutions, and the web pages that the adopted solutions correspond to. I will also discuss the participants' perceptions of search success (or lack thereof) and will contrast their self-assessments with the assessments of the evaluators. Finally, I will analyze the participants' perceptions of solution satisfaction, comparing this with their perceived degrees of search need difficulty.

6.4.1   Adopted Solutions, Rationales, and Web Pages

The web resources providing the solutions adopted by the research participants shows (again) the strong reliance on classical reference works (i.e., dictionaries and encyclopedias). Out of a total of thirty-six adopted pages, almost half (seventeen) correspond to online dictionaries, namely, WR and RAE. The encyclopedic pages (seven) all refer to Wikipedia. The remaining twelve adopted pages correspond to two SERPs, two pages from Greenpeace.org, two additional organizational websites, one academic site, two commercial sites, one journal, and one discussion forum.

The two adopted SERPs relate to Bob's searches for "malas hierbas" and "armas predilectas" and seem to indicate that he used the SERPs to confirm his preexisting, tentative translation solutions. His solution rationale supports this assumption, as he cites "frequency" as the reason for his adopted solutions from SERPs.

The quantitative overview of the adopted pages also shows that dictionary sites were the preferred choice of all participants, except for Bob, when it came to solving problems of a generally lexical nature (e.g., "alcance," "conjunto," "imprevisible"). For lexical problems of a more specialized (i.e., terminological) nature (e.g., "OMG" or "transgénico"), encyclopedic resources were more prominent. A closer look at the adopted pages from a qualitative perspective supports these trends, showing that WR was indeed the default online dictionary for both the students and David (Martha, however, favored the use of RAE).

A look at websites other than WR, RAE, and Wikipedia shows that web resources containing actual parallel texts (in either English or Spanish) were only used on seven occasions (in connection with "malas hierbas," "supone incremento," "guía roja y verde," and "transgénicos"). Among the parallel texts that Anna accessed was a web page authored by Greenpeace New Zealand that contained a reference to the English title of the "guía roja y

verde" (the GE free food guide). Interestingly, only Anna was able to find this particular website, despite the fact that Martha and Bob both accessed Greenpeace websites. However, these were the website of Greenpeace Mexico (Martha) and the global website Greenpeace.org (Bob).

6.4.2   Search Success

The participants were asked to specify in the OSRs whether they considered their searches and the adopted solutions for their search needs successful. To do so, they had to chose from one of the three following options: "Yes," "Not quite," and "No." These three answer options correspond to the categories used for assessing translations from a problem-solving perspective— that is, "successful," "partially successful," and "unsuccessful." Note that there also was a fourth assessment category called "highly successful."

The self-assessment was generally very positive. In twenty-five out of thirty-four instances (73.5%), participants considered their solutions successful. In seven cases (20.6%), they considered them not quite successful, and in only two cases (5.9%) did the participants consider their search outcomes unsuccessful. As I will show later, these two cases (Bob's unsuccessful search for translating the guide's title, and Maria's adopted solution for "alcance") were indeed considered unsuccessful by the assessors.

The common problems leading the participants to doubt the success of their solutions are "guía roja y verde" (Anna), "malas hierbas" (Anna and Maria), "supone incremento" (Martha and Daniel), "ganadería" (Daniel), and "pasa por" (Laura). Bob refers to his lack of sociocultural knowledge with regard to finding a solution for "guía roja y verde." Here, he is possibly referring to the metaphoric use of the colors and their cultural function. Maria cites her lack of competence in English (as a nonnative speaker) as a reason for what she perceived as an unsuccessful solution for "alcance," making it impossible for her to identify the correct usage of said term. In this regard, White, Matteson, and Abels's research on dictionary consultation "shows that non-native speaking adults . . . make semantic errors such as selecting the incorrect sense of a word or latching on to only one word from the definition that does not completely express the definition of the word being looked up" (2008: 589).

Anna's doubts for "guía roja y verde" and "malas hierbas" (which she found both on Greenpeace-sponsored sites) related on the one hand to the fact that the color metaphor of the Spanish text would be lost and on the other hand to the acceptability of her adaption of the term "super weed" to "super bug." Interestingly, the assessors considered both of these solutions as highly successful and thought that Anna's doubts were unfounded.

Martha's and Daniel's doubts regarding their solutions for the expression "supone incremento" ("indicates an increase" and "equates to," respectively) seem to have resulted from the polysemy of the Spanish expression and their insecurity as to the usage of an English equivalent adequate for

the TT context. The same seems to apply to Laura's solutions for "pasa por" and "supone incremento." Daniel's doubts about his solution for "ganadería," finally, seem to be related to his decision to discard the search result "cattle farming" for the solution "cattle raising."

A look at the unreported problems, which, with the exception of Bob, were all solved by referring to WR, shows the limits of this particular resource. While most of the unreported problems were solved successfully, an analysis of the unsuccessful solutions shows that uncritical reliance on solutions offered in bilingual dictionaries often leads to poor translation solutions. This fact—most likely due to an oversupply of (perhaps poorly contextualized) possible translation solutions—emphasizes the importance of training (novice) translation students in the use of dictionaries in print, electronic, and online forms.

When comparing the participants' assessment of their own search success with the evaluation of the adopted solutions, we find that Martha's, Bob's, and (with one exception) Daniel's self-assessment exactly matches that of the assessors. The discrepancy in Daniel's case results from the fact that the assessors considered his solution for "ganadería" successful as opposed to Daniel's own assessment of it being "not quite successful."

In the cases of Laura and, even more so, Anna and Maria, the discrepancies between self-and external assessment are more numerous and more pronounced. Laura's assessment of the success of her searches matches that of the assessors in three out of seven cases. In one case (her solution for "pasa por"), the external assessment was more positive than her own. In two cases ("cultivo" and "malas hierbas"), the assessors found her solutions not quite successful (as opposed to her assessment of them being successful). In one case, finally, Laura's translation of "conjunto" as referencing "to the environment," the self-assessment (successful) and the external assessment (not successful) are clearly at odds. Interestingly, in this last case, Laura's actual translation ("to the environment") and the reported adopted solution ("to all") do not match.

Laura also changed her initial solution for "cultivo" from "farming" (a solution that she reported as her adopted outcome in the OSR and that would have been a well-suited translation indeed) to "cultivation," an option that Laura, in her OSR entry, had initially discarded as being "less appropriate" than "farming." A third case of major discrepancies between the reported adopted solutions and the solutions found in the TT relates to Martha's translation of "supone incremento." Here, she changed her initial solution "indicates an increase," which she considered not quite successful, to "results in," which, for the assessors, constituted a successful solution. In addition to these major differences between the reported adopted solutions and the final translation solutions, there were a number of terminological inconsistencies and spelling variations between the OSRs and the TTs.

Finally, Maria and Anna (i.e., the two nonnative speakers) show two very different assessment profiles. In Maria's case, all of her five self-assessments

do not match that of the assessors. In four of these cases, the assessors considered her solutions less successful than Maria herself did. In the case of "alcance," which Maria considered unsuccessful, the assessors had a slightly better opinion, considering it "not quite" successful. While Maria's self-assessment seemed to have been overly optimistic, Anna's assessment of her own search success is overly pessimistic. In two out of four cases ("guía roja y verde" and "desarrollo de resistencias en insectos y 'malas hierbas' "), the assessors considered solutions that Anna herself found "not quite" successful to be "highly successful." These were indeed the two solutions found in the previously cited Greenpeace-related sites. In the two additional cases ("OMG" and "transgénicos"), the assessors agreed with Anna's self-assessment (successful).

As shown previously, a number of unsuccessful solutions resulted from the consultation of online dictionaries. This seems to be particularly the case with regard to polysemous words (e.g., "suponer," "alcance," and "pasar por") and also for unreported regular words (e.g., "constituir" and "sanitario"). As mentioned before, it is often the abundance of choice in dictionary entries that causes users to select inappropriate solutions. Here, translator training would benefit from emphasizing more strongly the need for cross-checking dictionary search results, both within the dictionary accessed itself and within selected parallel texts.

While dictionary access among the students was mainly motivated by the need for linguistic information, thematic searches—primarily conducted by Bob and Anna—led mostly to interactions with the texts being found via browse searching. Here, searches for the information needs "OMG" and "transgénicos" were conducted jointly or led to the same resources. Furthermore, access to appropriate parallel texts and the information provided within these texts seemed to have contributed to the quality of translation solutions (e.g., expressions such as "transgenic organisms," "genetic pollution," or "soil contamination"). Successful solutions also seem to be linked to search engine queries, as in Bob's case, and the use of predictable sources, such as Greenpeace sites and encyclopedias. The positive effects of a deep and wide type of searching style are particularly visible in the case of Anna.

Unlike Bob and Anna, however, the other four participants conducted no or little background research. Martha did some background research with regard to the title of the text, but only in Spanish. Maria did no background research, instead relying almost exclusively on dictionary resources. Laura, as well as Daniel, did not carry out thematic searches either. A look at some of their translation solutions indicated that a more thorough browsing of English parallel texts would have contributed to a higher amount of successful or highly successful solutions for these participants. Nevertheless, their generally shallow and checking type of searching style enabled them to successfully retrieve some equivalents in a quick and easy manner (i.e., through short, to-the-point, and oftentimes cursory visits to selected web pages).

6.4.3 Search Satisfaction and Difficulty

To identify the participants' degree of satisfaction with their adopted solutions on the one hand and the perceived degree of difficulty of their searches on the other hand, they were asked to rank both aspects on a scale from 1 to 5 (with 5 indicating the highest level of both categories, i.e., "very satisfied" and "very difficult"). Among the information needs encountered by more than one participant, the expression "guía roja y verde" was considered to represent, on average, the highest degree of difficulty (3.67). Corresponding to the high degree of search difficulty associated with this information need, the average degree of satisfaction was the lowest for all search needs reported by more than one participant. A similar correlation between the degree of satisfaction and degree of difficulty can be found with regard to the information need "alcance," which showed the second-lowest average satisfaction degree of 3.33 and the second-highest average difficulty score of 3.

Regarding the other common needs, it is possible to observe a pattern in which the lower the difficulty score is, the higher the degree of satisfaction is. Thus, regarding the "least difficult" information need, "armas predilectas" (average score of 1.25), the four participants who shared this need (Martha, Laura, Daniel, and Bob) reported a satisfaction level of 5 for their adopted solutions. Similar results can be found concerning the information needs "OMG" (average difficulty score of 5; average satisfaction score of 2), "conjunto" (4.5 and 1.5), "transgénicos" (4 and 2), and "supone incremento" (4 and 2). The two remaining problems that were reported by at least two participants, "malas hierbas" (3.75 and 2.25) and "cultivo" (3.5 and 2.5), resemble the values of the two needs—"guía roja y verde" and "alcance"—mentioned at the beginning of this discussion. The average degree of satisfaction for all information needs is 4.03, and the average degree of difficulty is 2.21.

Seen from the point of view of the individual participants, Martha shows the highest average degree of satisfaction with her adopted solutions (4.86). She also shows the lowest average score for the perceived level of difficulty of her problems or search needs (1.43), which again supports the correlation between perceived ease of problem and search satisfaction. Daniel, Laura, and Bob all show an average degree-of-difficulty score of 2, yet their levels of satisfaction range from 4.2 (Daniel) to 4 (Laura) to 3.83 (Bob). Anna's level of satisfaction with her solutions (3.5) is closer to the perceived level of difficulty of her problems (2.75). Maria is the only participant for whom the level of satisfaction (3.4) is lower than the perceived level of difficulty (3.6).

The interview transcripts further show that the translation students, except for Maria, mostly associated their overall perceptions of search success and satisfaction with the finding of the correct equivalent. In Martha's case, however, search success and satisfaction were more linked to the confirmation of her own tentative solutions than finding the correct equivalents. Unlike Martha but similar to Maria, Anna related search success and

satisfaction not so much to the confirmation of her own tentative transla-
tion solutions but to the finding of exact matches. Similarly, Laura asso-
ciated search success with the finding of equivalents, and highlighted the
importance of these fitting the textual context. She also associated search
success with the degree of search difficulty. For Maria, however, time was
the only criterion upon which she based her perception of search success.
Maria's perception of both search success and search difficulty was thus
primarily linked to fast and easy access to information.

Time was also a factor that affected the easy–difficult rating of the re-
maining translation students. Martha, for example, stated that time affects
said rating and that she usually checks one or two sites only before trying
a different search route. Nevertheless, search success for her ultimately in-
volved finding the information she was looking for. For Anna, fast and easy
access to information had a stronger impact on her perception of search
success than that of Martha (and Laura). Laura, finally, also considered that
fast access to information affected her perceptions of search success and
difficulty. In addition, she associated the latter with the type of information
she needed to search for (i.e., for her, the less complicated words were, the
easier searches became).

Overall, the findings of the study suggest that the students' perceptions of
search success, satisfaction, and difficulty match their web-searching styles,
described previously as a checking, comparing type of search behavior
aimed primarily at retrieving equivalents in a fast and easy fashion.

7 Modeling Web Search Behaviors
Second Embedding Task

In this second data-analysis chapter, only the web search behaviors of the translation students for Task 2 are examined and compared to their behaviors for Task 1. That is, the two participants of the pilot study (Bob and Daniel), who did not carry out the second task, are excluded from the data analysis presented in this chapter. As with Task 1, however, the data analysis for Task 2 will also follow a four-step path of looking at (a) the participants' search needs, (b) search processes, (c) search goals, and (d) search outcomes for translation problem solving.

As shown in 5.4.1, the source text (ST) used for Task 2 is an excerpt (177 words long) from a Spanish National Research Council's (CSIC) press release on the discovery of two new enzymes that could be possibly used in the treatment of AIDS. It is a popular-science text dealing with a specialized topic that belongs to the subject areas of chemistry and biology and has an informative function. The translation brief for this task asked the students to translate the excerpt for publication in the science and health news section of Reuters.com. The translations obtained for this task reveal the steep learning curve of Laura (who produced the highest-quality translation of all), followed by Anna. The translations produced by Martha and, in particular, Maria (i.e., the nonnative speaker with the least translation experience) indicate that their translation learning curves were considerably less steep than those of Laura and Anna.

7.1 SEARCH NEEDS

Task 2 produced a total of seventy individual instances of information needs (tokens) among the four translation students. As Table 7.1 shows, thirty-one of these needs were reported, while thirty-nine were unreported. The longer text of the first embedding task produced a total of sixty-six search need instances for the four students, indicating a higher degree of difficulty for the second text.

Comparing the number of information needs of Tasks 1 and 2, a couple of differences become visible.[1] First, we notice that Maria's information

Table 7.1   **R**eported versus Unreported Information Needs per Participant (Task 2)

	Reported Information Needs	Unreported Information Needs	Total
Martha	7	0	7
Anna	8	13	21
Maria	8	15	23
Laura	8	11	19
TOTAL	**31**	**39**	**70**

needs decrease in Task 2 by six needs, while Laura's needs increase by a total of eight. The number of needs for Martha and Anna remain the same (in Martha's case) or almost the same (for Anna) as in Task 1. Correspondingly, Maria's share of the total needs decreases from 43.9% to 32.9%, while Laura's share increases from 16.7% to 27.1%. The percentages for Martha (10% in Task 2, 10.6% in Task 1) and Anna (30% in Task 1, 28.8% in Task 2) are very similar.

A second observation concerns the number of reported versus unreported needs. As Table 7.2 shows, for Task 2, the number of reported needs (thirty-one out of seventy, or 44.3%) was higher than for Task 1, where 34.8% (twenty-three out of sixty-six) of the information needs were reported. As discussed in the previous section, the lack of reporting seems to be related to the concept of unproblematic processing. In Task 2, we see similar numbers of reported needs as in Task 1, which, along with the fact that five of the reported needs were common to all four participants, seems to indicate that primarily, only very problematic items in the traditional sense were reported. Nevertheless, for Task 2, more than half of the information needs remained unreported. Here, it is also noteworthy that Laura, who in Task 1 had four unreported needs out of a total of eleven information needs, had a total of eleven unreported needs (and eight reported ones) for Task 2.

Furthermore, taking into account the number of information needs shared by the participants (see Table 7.3), the total number of discrete types of information needs is thirty-five, and the average number of need instances per need type is two.

In comparison, in Task 1 there were thirty-four information need types among the four students, which generated sixty-six instances, for an average number of need instances per need type of 1.94. The slightly higher numbers for Task 2 becomes prominent when considering the fact that the ST of Task 2 has about 24% fewer words than that of Task 1. A similar interpretation applies to the average number of needs per participant, which was 17.5 for Task 2, and 16.5 for Task 2.

Table 7.2 **Reported versus Unreported Information Needs per Participant (Task Comparison)**

	Task 1				Task 2			
	Reported Needs	Unreported Needs	TOTAL	%	Reported Needs	Unreported Needs	TOTAL	%
Martha	7	0	7	10.6	7	0	7	10
Anna	4	15	19	28.8	8	13	21	30
Maria	5	24	29	43.9	8	15	23	32.9
Laura	7	4	11	16.7	8	11	19	27.1
TOTAL	23	43	66		31	39	70	
%	34.8	65.2		100	44.3	55.7		100

7.1.1   Individual versus Common Information Needs

Comparing the needs common to at least two of the four students with the needs unique to individual participants, we see that more than half the needs of Task 2 were common needs. More precisely, nineteen out of the thirty-five information types (54.3%) were needs shared by two or more participants, while sixteen needs were of an individual nature (45.7%).

In Task 1, the majority of the needs had been individual ones (58.8% vs. 41.2%). This could be explained by the fact that the second task was more challenging (i.e., had a more specialized topic) than the first task.

The individual needs are mostly those of the two nonnative English speakers among the students, Maria and Anna, with eight and seven needs, respectively. Laura had only one individual need, and Martha had none. While Maria's share of the individual needs in Task 2 is still 50%, her share in Task 1 is 75% (fifteen out of twenty individual needs).

Similar to Task 1, the vast majority of the individual information needs concerns general lexical items such as "así como" (as well as), "por ello" (therefore, consequently), or "costoso" (costly, expensive). The fact that Maria's individual needs also contain English search terms ("at a fewer cost" and "scientist") indicates that, like in Task 1, individual searches also seem to serve the purpose of confirming the participants' tentative solutions (including matters of spelling and usage). The only exceptions to this are Anna's searches for the (official) English translation of Consejo Superior de Investigaciones Científicas (CSIC, i.e., the Spanish Research Council) and her rather expansive search need for translating the press release title. While in the former case, Anna was interested in finding a suitable equivalent, in the latter (as stated in her interview) she aimed at obtaining background information on the text topic.

Table 7.3   Individual versus Common Information Needs (Task Comparison)

	Task 1		Task 2	
	Number	**%**	**Number**	**%**
Individual	20	58.8	16	45.7
Common	14	41.2	19	54.3
TOTAL	34	100	35	100
Instances	66		70	
Needs per participant	1.94		2.0	

7.1.2   Types of Common Information Needs

Whereas the (mostly unreported) individual needs concern ST elements of a mostly general lexical nature, the list of the common needs in Table 7.4 paints a different picture. Of the nineteen common needs, only three— "posee eficacia" (to be effective), "aplicable a" (applicable to, can be used for, can be used to), and "llevar a cabo" (to carry out)—can be considered as belonging to a more general vocabulary. The other sixteen items represent terminological or thematic needs, which confirms that the degree of specialization of Task 2 is higher than that of Task 1.

The total number of instances generated by the nineteen types of common information needs is fifty-four. The average number of instances per common need type is 2.84, and thus higher than the average for Task 1 (1.78). When looking at the total number of common information needs per participant, we can see that Laura shared all but one ("to carry out") of the nineteen common information needs. Maria shared fifteen information needs, and Anna fourteen. Martha had by far the lowest number of common information needs (seven). A comparison with the common needs per participant in Task l—ten for Laura, fourteen for Maria, fifteen for Anna, and seven for Martha—shows that the increase in need instances results from Laura's higher numbers.

As briefly mentioned previously, all four students shared five of the nineteen common information needs. That is, these five common information needs generated twenty need instances, of which only two (Anna's and Laura's need "Catálisis y Petroleoquímica," which refers to the Catalysis and Petrochemistry Institute of CSIC) were unreported.

As Table 7.4 shows, the three specialized terms in this first group of common needs—"[antibióticos] beta-lactámicos" (beta-lactam antibiotics, e.g., penicillin), "enantiómeros" (enantiomers, i.e., a specific type of isomeric molecule) and "solketal" (a form of glycerol)—reflect the thematic core of the text to be translated. The other two most frequent information needs

Table 7.4 Frequency and Distribution of Common Information Needs per Participant (Task 2)

Common Needs	Martha	Anna	Maria	Laura	Number of Occurrences	% of Common Needs	% of Total Needs
Beta-lactámicos	1	1	1	1	4	7.4	5.7
Catálisis y petroleoquímica	1	1	1	1	4	7.4	5.7
CSIC	1	1	1	1	4	7.4	5.7
Enantiómeros	1	1	1	1	4	7.4	5.7
Solketal	1	1	1	1	4	7.4	5.7
Alcoholes primarios	0	1	1	1	3	5.6	4.3
Enzima	0	1	1	1	3	5.6	4.3
Posee eficacia	0	1	1	1	3	5.6	4.3
Mezclas racémicas	1	1	0	1	3	5.6	4.3
Enantioméricamente puros	0	1	1	1	3	5.6	4.3
Tratamientos anti-sida	1	1	0	1	3	5.6	4.3
Aplicable a	0	1	0	1	2	3.7	2.9
Enantiómero "R"	0	0	1	1	2	3.7	2.9
Fármaco	0	0	1	1	2	3.7	2.9
Investigador	0	0	1	1	2	3.7	2.9
Llevar a cabo	0	1	1	0	2	3.7	2.9
Separación de los enantiómeros	0	0	1	1	2	3.7	2.9
Síntesis	0	0	1	1	2	3.7	2.9
De interés farmacéutico	0	1	0	1	2	3.7	2.9
TOTAL	7	14	15	18	54	100.0	77.1

in this group—"[Instituto de] Catálisis y Petroleoquímica" and "CSIC"—reflect both the technical nature and the cultural context of the ST. This prompted the students to search not only for equivalent specialized terms for "catálisis" and "petroleoquímica" but also for background information on the research institute mentioned, as well as the Spanish Research Council, and the (official) translation of the names of both institutions into English.

The search rationales given by the participants in their online search reports (OSRs) support these assumptions.

The second group of common information needs with the highest level of frequency includes six search needs that were shared by three of the four translation students. Laura was involved in all six information needs, sharing four of them with Anna and Maria and two with Martha and Anna. Furthermore, these six information needs generated a total of eighteen need instances, of which eleven were unreported. The more general nature of the unreported needs—"alcoholes primarios" (primary alcohols), "enzima" (enzyme), "posee eficacia" (to be effective), and "tratamientos anti-sida" (anti-AIDS treatment)—again seems to support the assumption that the participants tend not to report on searches that involve unproblematic processing and primarily aim at confirming preexisting solutions.

The only exceptions here (i.e., technical terms that were not reported) seem to be Maria's search for the adverb "enantioméricamente [puro]" (enantiomerically pure drugs) and the search need "enzima". The latter appears to have triggered more thematically oriented searches, as both Laura's and Maria's search needs show. Laura was interested in "aids enzymes," thus searching for English texts dealing with this topic. Maria's search need was also of a thematic nature; however, as her screen recording shows, she was interested in information about enzymes for cancer treatment (and not in the treatment of AIDS) and spent about five minutes researching the wrong topic.

The third group of common information needs, finally, includes eight needs that generated a total of sixteen instances, of which ten were unreported. Again, the unreported problems—mostly attributed to Laura (seven) and Maria (six), with Anna sharing three of the problems—are more general and more lexical in nature. In addition, as mentioned previously, Maria and Laura had the highest number of common information needs. However, the nature of their needs was rather different and seemed to indicate two very different styles and levels of need analysis. A closer look at the information needs "síntesis" (synthesis) and "separación de los enantiómeros" (separation of enantiomers), which were shared only by Maria and Laura, illustrates this. While Maria's focus was at a microlexical level, Laura's focus was at a macrothematic one. As I will show in the section on search outcomes, Laura thus clearly produced the best translation of all four students, a result to which her more in-depth style of (thematic) searching likely contributed.

7.2   SEARCH GOALS

7.2.1   Nature and Types of Information Goals

Looking at the nature of the information goals identified by the participants of Task 2, some significant differences to Task 1 become apparent. Table 7.5

Table 7.5 Distribution of Information Goals per Common Information Need (Task 2)

Common Needs	Comprehension	Production	Both	Unreported	TOTAL
Beta-lactámicos	0	3	1	0	4
Catálisis y petroleoquímica	0	0	2	2	4
CSIC	0	0	4	0	4
Enantiómeros	0	3	1	0	4
Solketal	0	4	0	0	4
Alcoholes primarios	0	0	1	2	3
Enzima	0	0	0	3	3
Posee eficacia	0	0	0	3	3
Mezclas racémicas	0	3	0	0	3
Tratamientos anti-sida	0	1	0	2	3
Enantioméricamente puros	0	2	0	1	3
Aplicable a	0	0	0	2	2
Enantiómero "R"	0	2	0	0	2
Fármaco	0	0	0	2	2
Investigador	0	0	0	2	2
Llevar a cabo	0	2	0	0	2
Separación de los enantiómeros	0	0	0	2	2
Síntesis	0	0	0	2	2
De interés farmacéutico	0	1	0	1	2
TOTAL	**0**	**21**	**9**	**24**	**54**
%	**0.0**	**38.9**	**16.7**	**44.4**	**100.0**

shows, for example, that none of the reported search goals for Task 2 was for comprehension purposes only. Twenty-one goals were related to target text (TT) production, and nine goals had dual (i.e., comprehension and production) purposes. Out of the fifty-four common search goals, twenty-four were unreported. Excluding the latter, 70% of the reported search goals concerned text-production purposes. In comparison, the production-oriented search goals for Task 1 only amounted to 32% of the commonly reported search goals. For Task 2, the remaining 30% of the commonly

reported search goals concerned both questions of ST comprehension and TT production, while, as previously mentioned, there were no comprehension-only search goals reported. For Task 1, comprehension problems had made up half of all reported search goals (50%), and combined comprehension-production search goals made up only slightly more than 18% of the reported search goals.

Table 7.5 also shows that the five information needs shared by all four students generated two-thirds (sixteen out of twenty-four) of the reported search goals. The high number of solely production-related search goals for the technical terms "beta-lactámicos" (three), "enantiómeros" (three), and "solketal" (four) indicates the challenges that specialized text production poses not only for nonnative speakers but also for native speakers, as demonstrated by the fact that Martha and Laura shared these search goals as well.

The proper names "[Instituto de] Catálisis y Petroleoquímica" and "CSIC" generated two-thirds (six out of nine) of the combined comprehension-production search goals, a fact that is also reflected in the previously mentioned search needs, which included both thematic and linguistic elements.

The high number of TT–oriented search goals can be explained as representing a necessary shift (when compared to Task 1) to problems resulting from the production of specialized texts. Nevertheless, the fact that a rather specialized ST like the one for Task 2 does not seem to have generated comprehension-only (reported) search goals is surprising.

It is quite possible—and in line with the participants' tendency not to report many of these problems mentioned previously—that many of the twenty-four unreported problems focused on matters of ST comprehension. Furthermore, the nine search goals in the "Both" category do comprise comprehension problems as well. However, the fact that they always appear in combination with matters of TT production seems to indicate a more holistic approach of the students to their information need analyses, which, in turn, might indicate an evolution of their translation skills.

Examining the different information goals from the point of view of the individual participants (see Table 7.6), we can see that the thirty reported goals are fairly evenly distributed among the students. The production goals range from four (Maria) to six (Anna and Laura), and the category "Both" shows values of one (Anna), two (Martha and Laura), and four (for Maria). The similarity in the participants' goals categories is only disrupted by the "Unreported" column. Here, Laura shows the highest number (ten) of unreported goals, while Anna and Maria each had seven unreported goals. Martha, as mentioned earlier, has no unreported problems at all.

Finally, a more detailed look at the descriptions of the individual search goals in the OSRs supports the previous analysis of the five needs shared by all four participants. The technical terms "beta-lactámicos," "enantiómeros," and "solketal" generated ten production-related searches and two searches aimed at satisfying both comprehension and production needs,

Table 7.6   Distribution of Information Goals per Participant (Task 2)

	Comprehension	Production	Both	Unreported	Total
Martha	0	5	2	0	7
Anna	0	6	1	7	14
Maria	0	4	4	7	15
Laura	0	6	2	10	18
TOTAL	**0**	**21**	**9**	**24**	**54**
%	**0.0**	**38.9**	**16.7**	**44.4**	**100**

highlighting the increased difficulty of producing specialized TTs. This production-oriented focus is also reflected in the search goals for other technical terms such as "mezclas racémicas" (racemic mixtures,) "fármacos enantioméricamente puros," or "enantiómero 'R'" (R-enantiomer). The search needs for the two proper names (i.e., the institute and the national research council) are related to broader search goals, including both ST comprehension and TT production goals, which highlights the intercultural nature of these two search needs.

7.2.2   Information Goals and Initial Search Actions

Table 7.7 shows that direct address searches account for exactly half of the initial actions (twenty-seven out of the fifty-four). A total of twenty-three of these initial direct address searches were carried out in WordReference (WR), while Wikipedia (WK) accounted for three initial searches and the online dictionary TheFreeDictionary.com (FD) for one. Comparing the initial search actions of Task 2 with those of Task 1, a major shift away from direct address searches becomes apparent.

While in Task 1, almost three-quarters (74.6%) of all initial search actions were direct address searches, this number fell to 50% for Task 2.

Table 7.7   Distribution of Initial Search Actions per Task

		Search Needs	Search Goals	Direct Address Searches	Navigational Queries	Search Engine Queries	Browse Searches
Task 1	TOTAL	59	44	1	11	3
	%	100.0	74.6	1.7	18.6	5.1
Task 2	TOTAL	54	27	0	26	1
	%	100.0	50	0.0	48.15	1.85

Instead, for Task 2, the four students carried out a total of twenty-six out of fifty-four initial search actions (or 48.15%) in the form of search engine queries (exclusively using Google's New Zealand site). The remaining one initial search action was a browse search, carried out by Anna on the BBC News website (compared to three browse searches in Task 1).

The increased importance of search engine searches—a fact also confirmed by the distribution of the sites adopted for the participants' search outcomes—correlates with the larger number of text production–oriented search goals described previously, which is supported by the participants' search goal explanations. Out of the twenty initial search actions for the five most frequent common needs, thirteen led to initial searches in Google, while seven initial searches were direct address searches. As in Task 1, the preferred site for direct address searches was WR, which saw twenty-three of the twenty-seven initial direct search actions (three more were carried out in WK, one in FD).

Furthermore, a look at the students' individual search actions for Task 2 paints a different picture to that of Task 1. Whereas the results for Task 1 show that there was little or no variation of initial search actions across the participants of the study, the results for Task 2 show increased variation for almost all the students (possibly as a result of their translation learning experience). In particular, for Task 2 there is increased variation across the participants' initial search actions, except for Martha, and increased variation of sources of information, except for Maria. The increased variation of sources is particularly visible in Anna's case. These findings, in turn, suggest that question characteristics had a bigger impact on the participants' initial choice of search actions (except for Martha), as well as their selection of information sources (except for Maria) for Task 2 than for Task 1.

7.3   SEARCH PROCESSES

7.3.1   Search Sessions

The average time spent by the participants of Task 2 to search their common information needs and the average number of actions taken during said searches reflects, again, the more challenging nature of Task 2. On average, participants spent 1 min. 51 sec. on each information need, carrying out 15.6 actions during that time (i.e., each action lasted for an average of 7.1 sec.; see Table 7.8). For Task 1, the average session lengths for the four participants of Task 2 were 59 sec., and the average number of actions carried out during that time was 7.1 (i.e., each action lasted for an average of 8.3 sec.).

For Task 2, two information needs—the word combinations "fármacos enantioméricamente puros" and "separación de los enantiómeros"—generated searches with average lengths of over three minutes. This compares to

Table 7.8 Ranking of Common Information Needs per Session Length, with Online Actions and Occurrences (Task 2)

Rank	Common Needs	Average Time (hh:mm:ss)	Average Number of Actions	Number of Occurrences
1	enantioméricamente puros	0:03:31	27.7	3
2	separación de los enantiómeros	0:03:08	16.0	2
3	CSIC	0:02:53	38.3	4
4	enantiómeros	0:02:37	15.5	4
5	fármaco	0:02:23	18.5	2
6	enzima	0:02:22	18.0	3
7	enantiómero "R"	0:02:01	18.0	2
8	síntesis	0:01:59	18.5	2
9	de interés farmacéutico	0:01:51	15.0	2
10	Catálisis y Petroleoquímica	0:01:47	13.0	4
11	beta-lactámicos	0:01:38	12.3	4
12	tratamientos anti-sida	0:01:37	12.3	3
13	mezclas racémicas	0:01:30	14.3	3
14	alcoholes primarios	0:01:29	14.0	3
15	solketal	0:01:13	13.3	4
16	llevar a cabo	0:01:11	9.0	2
17	aplicable a	0:00:51	10.0	2
18	posee eficacia	0:00:38	6.3	3
19	investigador	0:00:29	6.0	2
AVERAGE		**0:01:51**	**15.6**	**54**

one search need ("guía roja y verde") in Task 1. Seven sessions in Task 2 lasted for between 2 and 3 min. (none for Task 1), and nine between 1 and 2 min. (five for Task 1). The main differences in the session lengths are with regard to short sessions (i.e., those lasting less than one minute). In Task 2, there were only four out of nineteen average session lengths under one minute, while for Task 1 the majority of sessions (ten out of sixteen) lasted less

than one minute. As I will show later in the section, the overall increase in session lengths for Task 2 can be explained by the more specialized nature of this task.

As mentioned previously, the information need with the highest average session length is "fármacos enantioméricamente puros" (3 min. 31 sec.). Nevertheless, a closer look at the individual scores for this search need shows that Anna alone spent a total of more than eight minutes searching for this need, thus carrying out fifty-seven search actions. The information need that generated the highest average number of search actions (38.3) is the acronym CSIC. Here, again, it is Anna, whose total of seventy actions—distributed over five different search sessions—skew the results.

The total times spent by the individual participants on each information need and the number of actions carried out during that time highlight the individual "problem zones"—that is, the information needs that prompted the longest searches for each individual participant.

As previously mentioned, Anna, who spent the most time of all participants on her searches (39 min. 8 sec.), spent a significant amount of time on the information need "fármacos enantioméricamente puros" (8 min. 2 sec.; fifty-seven actions) and "CSIC" (4 min. 13 sec.; seventy actions). Maria, whose overall session time of 33 min. 32 sec. was the second longest, spent most of her time on searching the information needs "CSIC" (6 min. 44 sec.; thirty-nine actions) and "enzima" (6 min. 21 sec.; forty actions). By comparison, the other two students who researched "enzima" (Laura and Anna) only spent 20 sec. and 16 sec., respectively, on said information need.

Laura, who spent a total of 25 min. 39 sec. carrying out online search actions, did not show any of the long searches seen with the other three students. Only two of her information needs exceed the three-minute mark. These are "separación de los enantiómeros" (4 min. 40 sec.; twenty-three actions) and "síntesis" (3 min. 1 sec.; twenty-six actions). Martha, finally, who spent the least amount of time on her search sessions (17 min. 50 sec.), spent almost eight (uninterrupted) minutes researching the information need "enantiómeros" (7 min. 57 sec.; thirty actions). Martha's second-longest search session was for the information need "Catálisis y Petroleoquímica" (2 min. 40 sec.; ten actions).

Among the eight time-intensive information needs mentioned previously, only one (CSIC) appeared twice, a fact that shows the wide range of needs associated with Task 2 and the different text sections providing "difficulties" for the individual participants. However, despite these individual differences, we can also see that the thematic and terminological needs were at the center of the participants' research. The four information needs identified earlier as being of a more general lexical nature—that is, "llevar a cabo," "aplicable a," "posee eficacia," and "investigador" (researcher)—represent the four least time-consuming information needs—averaging only between 29 sec. and 1 min. 11 sec.

7.3.2 Direct Address Searches

A comparison of the participants' direct address searches throughout their entire search processes between Tasks 1 and 2 shows that while the number of direct address searches is lower for Task 2 (forty-four as compared to fifty-four in Task 1, the reason being the higher number of search engine searches in Task 2), participants accessed a wider range of reference works in Task 2. Here, participants used the online dictionaries WR, Merriam-Webster (M-W), and FD, as well as WK. The online dictionary of the Real Academia Española (RAE), which was the only reference work next to WR in Task 1, was not used at all for direct address searches in Task 2.

The vast majority of direct address searches were still carried out in WR; in addition, its total percentage of 77.5% is below that for Task 1 (91%). WK, which was not accessed via direct address searches in Task 1, had the second-highest number of direct address searches (seven, or 15.9%), which indicates a greater need for thematic knowledge for Task 2. M-W's online dictionary and FD, which were not used by the students in Task 1, both had three direct address searches (6.8% each). It is thus interesting to note that the students' individual needs for Task 2 were all researched in WR only, a fact that again indicates the more general, lexical nature of these needs.

Table 7.9 shows the distribution of reference materials accessed via direct address searches per participant. Martha (one search only) and Maria (a total of nineteen searches) form the two ends of the direct search spectrum, with Anna and Laura both having carried out twelve direct address searches. Here, the preference of the participants for WR is still very visible, with Maria accessing the site fifteen times and Anna and Laura accessing it eight times each. Maria also accessed WK most often (four times), while Laura is the only one using M-W's online dictionary (three times).

Table 7.9   Distribution of Reference Works per Participant (Task 2)

Common Needs	Dictionaries			Encyclopedias	Total
	WR	FD	M-W	Wikipedia	
Martha	0	1	0	0	1
Anna	8	2	0	2	12
Maria	15	0	0	4	19
Laura	8	0	3	1	12
Total	**31**	**3**	**3**	**7**	**44**

7.3.3   Search Engine Queries

7.3.3.1 Query Complexity. The analysis of the complexity of the search engine queries carried out in Task 2 shows that 80.2% (seventy-three out of ninety-one) of all Google searches were implemented as simple queries (see Table 7.10). Advanced queries only account for eighteen of the total search engine searches. In Task 1, the number of advanced queries had been higher (thirteen) than that of the simple queries (nine). The overall number of search engine queries in Task 1 was, however, rather small (twenty-two).

A look at the query behavior of the individual students shows that Anna carried out fourteen of the eighteen advanced searches in Task 2 alone, with Martha and Laura conducting two advanced searches each. Maria, who had the highest number of direct access searches, did not carry out any advanced search engine queries at all.

A look at the total number of queries carried out per common information need shows that six of the total of nineteen common needs generated the highest number of search engine queries, ranging from seven to twelve queries. These six needs include, with the exception of "Catálisis y Petroleoquímica," the needs shared by all participants—that is, the needs that occurred with the highest level of frequency (i.e., "beta-lactámicos," "CSIC," "enantiómeros," and "solketal"). For the remaining common information needs, the same correlation can be identified—that is, the less specialized the nature of the needs and the lower their frequency of occurrence, the lower the total number of search engine queries.

I should also note that, unlike in Task 1, for which Bob and Anna conducted a number of site queries using the internal search engines of specialized websites, the participants of Task 2 did not conduct any such queries on websites that were immediately accessed via Google. Nevertheless, Anna and Maria conducted a number of site queries on websites that were later reaccessed for additional or new research in the form of browse searching (see 7.3.4).

Table 7.10   Query Complexity per Participant (Task Comparison)

	Task 1			Task 2		
	Simple	Advanced	Total	Simple	Advanced	Total
Martha	1	3	4	14	2	16
Anna	1	3	4	7	14	21
Maria	5	3	8	23	0	23
Laura	2	4	6	29	2	31
Total	**9**	**13**	**22**	**73**	**18**	**91**

7.3.3.2 Query Length. The analysis of the simple query lengths shows that queries with three search terms have the highest frequency (twenty-two). This is followed by queries containing one (twenty-one), two (nineteen), and four (thirteen) words. Only three queries are longer than four words (one has five words, and two have six words). These correspond to Maria and concerned the Spanish names of the research institute and the Spanish Research Council mentioned in the text. The average number of words per query for Task 2 is 2.38, which is lower than the 2.44 word average for Task 1. Task 1 had, however, only a small number of basic searches (nine). The on-average shortest query carried out by at least two participants was the one for "enantiómeros" (1.67 words), while the longest ones were the ones for "separación de los enantiómeros," "applicable a," "enzima," and "alcoholes primarios" (with three words each).

The three information needs that generated the highest number of simple queries are "beta-lactámicos" (ten), "solketal" (seven), and "síntesis" (seven). The first, which was researched by all four participants, was also the information need that generated the overall highest number of search terms (twenty).

With regard to the lengths of the eighteen advanced queries, we find that, like in Task 1, queries with one term (or phrase) are still the most frequent ones (fourteen out of eighteen, compared to ten out of twelve in Task 1). Advanced queries with more than one search term were also rare in Task 2, with only two search queries containing two terms, one query containing four terms, and one query containing six terms. In Task 1, there were only two queries containing two terms, and no queries longer than that, which is the reason why the average length of the advanced queries is longer in Task 2 (1.56) than in Task 1 (1.23). As previously explained, the lower averages (compared to the average of the simple searches) result from treating phrase search as constituting one search term.

7.3.3.3 Query Types. As Table 7.11 shows, the query modification behavior of the four participants in Task 2 is more active than it was in Task 1. There are a total of ninety-one queries, out of which forty-four were initial searches only (i.e., they did not lead to any query modification or repetition). In forty-six cases, initial queries were further modified, and in one case, an initial query was repeated.

When comparing the types of queries across the two tasks, it is important to note again that the number of search engine queries was much higher in Task 2 (ninety-one) than in Task 1 (twenty-two). Nevertheless, while in Task 1 the majority of the queries were initial queries only (twelve out of twenty-two, or 54.55%), in Task 2 the majority of search engine queries were modified queries (forty-six out of ninety-one, or 50.55%). This compares to forty-four initial queries in Task 2 (48.35%). In addition, in both tasks, there was one repeat query each. I should also note that the information needs "CSIC," "solketal," and "enantiómero 'R'" produced identical

Table 7.11   Query Type per Participant (Task 2)

Common Needs	Initial Queries	Modified Queries	Repeat Queries	TOTAL
Martha	6	10	0	16
Anna	12	9	0	21
Maria	11	12	0	23
Laura	15	15	1	31
Total	**44**	**46**	**1**	**91**
Average	**11**	**11.5**	**0.25**	**22.75**

queries by the participants researching this term, most likely due to their name-like character.

The analysis of the query types per participant reveals that on average participants carried out 11 initial queries and 11.25 modified queries. Anna and Maria are very close to these averages, while Martha only had six initial queries and Laura fifteen initial and fifteen modified queries.

The total number of queries also shows the significant difference between the two native English speakers in the group. While Laura had a total of thirty-one queries, Martha only had sixteen. Both numbers are, however, a direct consequence of the number of common needs. While Laura shared eighteen of the nineteen common needs (including linguistic and extralinguistic needs), Martha only shared seven common needs (almost entirely of a linguistic nature).

Finally, a look at the number of modified queries indentifies information needs for which the participants seem to have struggled to construct a satisfying query. Here, the information needs vary according to participant. Martha, for example, carried out five modified queries in relation to her search need "enantiómeros." Similarly, Anna created six modified queries in her attempt to research the information need "[fármacos] enantioméricamente puros." For Maria, the information need "[antibióticos] beta-lactámicos" was the one requiring the highest number of query modifications (six). In Laura's case, finally, the information need "[etapas de] síntesis" proved most demanding, prompting her to conduct a total of four modified queries. All these needs reflect, to a lesser or greater extent, the thematic core of the text.

7.3.3.4 Pages Accessed. The types of queries and their distribution discussed previously show that the range of searching of all four students was considerable and far broader than in Task 1. To see whether the same can be said about the depth of research (i.e., the level of engagement with the websites accessed), I will, in the following, analyze the number of pages accessed and the types of actions carried out with regard to said pages.

Table 7.12   Distribution of Pages Accessed per Participant (Task 2)

	Martha	Anna	Maria	Laura	TOTAL
Total number of queries	16	21	23	31	91
Total number of SERPs	4	7	9	19	39
Total number of result links	15	15	21	13	64
Total number of internal links	5	16	8	2	31
Total number of site queries	0	0	0	0	0
Total number of external links	0	0	0	0	0
Total number of pages accessed	**24**	**38**	**38**	**34**	**134**

As Table 7.12 shows, the four students accessed a total of 134 pages. This is more than three times the number of pages accessed for Task 1 (forty-two), and shows that the higher degree of specialization of Task 2 and the participants' lack of knowledge led to more intensive searching by all four participants. It may also show a higher awareness on the part of the participants on the complexity of translation, consistent with their learning progress.

Almost half of the 134 pages accessed were search engine results pages (SERPs) (64 out of 134, or 47.8%). In these cases, the students scanned the results but did not use any of the links provided on the SERPs. In Task 1, SERPs were only the third-most frequent type of pages accessed, or rather viewed (9 out of 41) by the student participants, and their share of the total pages accessed was thus considerably lower (22%).

In Task 2, thirty-nine web pages (29.1%) were accessed via a result link on one of the SERPs, which was the most frequent type of access in Task 1 (sixteen pages, or 39%). Another thirty-one pages (23.1%) were accessed through internal links on a website (as compared to fifteen pages, or 36.6% in Task 1). While this seems to indicate that the searching in Task 1 was more active than in Task 2, it is important to remember that, first, the total number of pages accessed was very low, and, second, Anna alone accounted

for twelve out of the fifteen internal links. With regard to the lower percentage of result links accessed in Task 2, this seems to be related to the higher number of confirmation-oriented, terminological searches.

On average, each participant accessed 33.5 pages, almost three times as many pages as in Task 1 (10.5). This number again underlines the broader range of searching in Task 2. Similarly, the average number of pages accessed per common search need type was much higher in Task 2 (7.1) than in Task 1 (2.6). A look at the average number of pages accessed per common need occurrence (as opposed to common need type) is rather telling about the difference in search range and depth between Task 1 and Task 2. In Task 1 (and excluding Bob and Daniel), the fourteen common needs occurred forty-eight times. With a total number of pages accessed of forty-two in Task 1 (which excludes the nineteen pages accessed by Bob alone), the average number of pages accessed per common information need instances is actually less than one (0.87 to be precise). In Task 2, however, this number is higher. With a total of 134 pages accessed and 54 needs occurrences, the participants' accessed on average 2.5 pages per needs occurrence.

Table 7.12 also reveals individual searching styles. Martha, Anna, and Maria all made heavy use of the results listed on the SERPs that their searches generated. Martha clicked on fifteen links on a total of four SERPs, Anna on fifteen for seven SERPs, and Maria on twenty-one links coming from nine SERPs. Laura, however, only clicked on thirteen result links from her nineteen SERPs. The very high number of SERPs that were viewed but not further used by Laura seems to confirm the earlier assumption that Laura's search behavior in Task 2 is strongly characterized by confirmation purposes.

Overall, there seems to be a higher degree of the participants' engagement with the query results in Task 2 as compared to Task 1, especially on the part of Anna and Laura. This would also be supported by the broader use of internal links by all participants as opposed to Task 1, where almost all the internal links resulted from Anna's browse searching. In Task 2, again, Anna's behavior stands out, although not as prominently as in Task 1. More than half of the internal links (sixteen out of thirty-one) were followed by Anna, which clearly indicates her preference for browsing. Anna's screen recording shows that her browsing was, in general, rather highly directed. She focused on the acquisition of background information from the CSIC website and, in addition, on finding (on the websites of CSIC and of BBC News) press releases in English that were similar to the ST. As her query containing her English translation of the press release title indicates, she seemed to have been looking for the actual English translation of the Spanish press release as well.

Maria also performed most of her browsing on the CSIC website (following four out of her eight internal links), but her video recording shows that her browsing style was mostly undirected. Martha accessed a total of five internal links (two in relation to CSIC's research institute mentioned in

the text and three concerning the term "mezclas racémicas"), and Laura a total of two internal links (one in connection with "enantiómeros" and one with "[etapas] de síntesis"). Despite the increase in the absolute number of pages accessed via internal links in Task 2, their relative decrease when compared to Task 1, as well as the complete absence of external links and site queries, shows that the participants have, in general, not moved towards a searching behavior that is characterized by a more in-depth, thematically oriented style. As further discussed in the chapter Laura and Anna might be considered the only exceptions to this.

The distribution of the total pages accessed over the common information needs shows that almost half of all pages accessed (64 out of 134, or 47.8%) were related to the five information needs shared by all four participants. In contrast, the three information needs reflecting general lexical problems only led to a total of six pages accessed. The analysis of the total pages accessed by the four participants also confirms the individual problem zones indicated previously in relation to the session lengths and total number of actions (and which were also reflected in the participants' modified queries). Thus, for Anna, the two most time-consuming information needs—"fármacos enantioméricamente puros" (8 min. 2 sec.; fifty-seven actions) and "CSIC" (4 min. 13 sec.; seventy actions)—led her to access eleven and fifteen pages, respectively. Maria accessed nine pages related to her information need "CSIC" (6 min. 44 sec.; thirty-nine actions) and seven pages for "enzima" (6 min. 21 sec.; forty actions) but invested a considerable amount of time researching these needs in relation to cancer instead of AIDS.

Laura accessed the highest number of pages for her search need "[etapas de] síntesis," which accounts for her second-longest search session (3 min. 1 sec.; twenty-six actions). Her information need with the longest search session—"separación de los enantiómeros" (4 min. 40 sec.; twenty-three actions) led to four pages accessed, and thus one less than the information need "solketal." Similarly, Martha's highest number of pages accessed was in relation to her most time-intensive information need, "enantiómeros" (7 min. 57 sec.; thirty actions). The second-highest number of pages was for "mezclas racémicas" (six pages), while the need with the second-longest session length, "Catálisis y Petroleoquímica" (2 min. 40 sec.; ten actions), only led to three pages accessed.

7.3.3.5 Query Construction, Modification, and Overall Effectiveness. As in Task 1, the analysis of both search engine queries and site queries in Task 2 allows for a more detailed, chronological view of the participants' query paths. Unlike in Task 1, however, where very few search engine queries were conducted and modified, Task 2 involved a large number of queries and a considerable amount of query refinement. What we can observe here is the fact that even if not accessed directly but via a prior Google search, reference sites (above all WR and WK) are still a primary source of information. The strong reliance on these reference sites seems to serve as a barrier to the use of more specialized lexical sources. Thus, understandably,

subject-area-specific glossaries or specialized terminological databases do not appear at all in the search paths of the participants (as they had not received any training on translation resources prior to the study).

With regard to WK, we can note that, while the students sometimes used this resource for acquiring extralinguistic knowledge, they mostly used it as a kind of bilingual corpus, often switching between the Spanish and English versions of the article retrieved. In contrast, the professional translators in Désilets's (2010) study, as well as the most expert translator in my study, never used WK to find a solution to a terminology problem but only to occasionally obtain background information on a specific concept. The web thus becomes a kind of metadictionary and, on occasion, a parallel, aligned corpus. This notion of the web-as-dictionary is most visible in Maria's query statements, which involve the combination of search terms in the source language (SL) with the explicit name of the target language (TL) in the same query. This type of query behavior is very much in line with the one she displayed in Task 1. Bob, however, like the professional translators in Désilets's (2010) study, primarily used Google "to mine the Web-as-a-corpus" (ibid.: n.p.) in Task 1. Also like the professional translators in Désilets, Barriére, and Quirion's (2007) study, Bob spent considerable time in evaluating and analyzing search results from Google to obtain an overview of the different types of translation information found and their respective contexts of usage and quality.

Furthermore, similar to Task 1, there is a clear trend among the four students to click one of the first three (sometimes five) search results listed on the SERPs. Results that are further down the list of the SERP tend to be ignored.

Two possible other uses of search engine queries and results—the identification of suitable parallel texts and the confirmation of tentative translation solutions—are present in Task 2 (unlike in Task 1), yet they are rather rare and often unsuccessful. With regard to the search for parallel texts, a rather typical pattern (also in Task 1) involves clicking on the first search link, briefly scanning the document accessed, and modifying the query, which seems to reflect the rather unplanned search statements among the students.

The second application (i.e., the confirmation of tentative solutions) becomes visible in Laura's search style. She uses this technique often and to a rather positive effect. Furthermore, Laura creates rather long queries (i.e., queries containing a relatively high number of individual search terms). What she seems to be doing is to use key terms from the ST as lexical filters, thereby reducing the body of search results to documents dealing with all these terms and, most likely, with the same topic as the ST.

While Laura's searching style is almost exclusively characterized by the use of keywords as lexical filters, Anna—who along with Laura carried out the greatest amount of background research of all students—shows a more browsing-dominated approach concerning a number of search needs. Maria also combined browse searches with search engine queries (the latter being

most dominant). However, a closer look at her search paths shows that her searching became significantly sidetracked on two occasions, first with regard to the misspelling of her query "SCIC" (instead of "CSIC") and second concerning her search for "enzima," for which she accessed a total of seven cancer-related sites (instead of AIDS-related sites) before abandoning her search. Furthermore, many of her search paths show that, like in Task 1, she was primarily interested in retrieving equivalents only.

Overall, the results discussed previously illustrate a broad spectrum of online search behaviors for the four students. On the one side of this spectrum, we find the rather undirected, shallow searching style of Maria. On the other side, we find Laura, who displayed a more mature approach that is characterized by a more critical, hypothesis-driven, context-oriented search style. Compared to Task 1, Laura's search behavior clearly evolved, exhibiting a type of interactionistic style similar to that of Bob. In my opinion, this evolution can be partly attributed to a learning effect (i.e., her better understanding of the translation process). The two other participants of the study, Martha and Anna, fall within these two poles, with Martha tending to focus more on linguistic phenomena and Anna showing signs of an approach similar to, yet perhaps not as consistent as, Laura's.

7.3.4   Browse Searches

In addition to the total pages accessed via search engine queries, all the students, except for Laura, reaccessed some of the websites they had already visited (as a result of the queries they had previously conducted) to browse for information concerning some of the thematic information needs. These browse searches represent a different type of search—that is, one that involves reaccessing information at a later point in time for additional or new research on specific search needs—hence are treated separately from the browse searches conducted as a result of pages directly accessed by search engine queries.

This type of browse searching led the students to access a total of thirty-four pages. This is eleven more than in Task 1, where Anna was the only one of the student participants carrying out browse searches (Bob also carried out browse searches in Task 1). In Task 2, Anna accessed by far the most pages via browse searching, clearly indicating her desire to gather background knowledge on the topic dealt with in Task 2. Her twenty-three pages accessed is exactly the same number as for Task 1, but while these twenty-three pages were spread over five information needs in Task 1, there were four for Task 2.

The remaining eleven pages accessed as a result of browse searching correspond to Maria (nine) and Martha (two). As mentioned previously, Laura did not conduct any browse searches at all, focusing rather strongly on query modification as a means of securing background knowledge instead. The information need that generated most browse searches was the acronym "CSIC," with twelve pages accessed exclusively by Anna.

7.4   SEARCH OUTCOMES

7.4.1   Adopted Solutions, Rationales, and Web Pages

Despite the students' frequent visits to dictionary sites during their search processes, the analysis of the websites adopted shows a clear trend away from the dominance of dictionaries as sources of outcomes in Task 1. While in Task 1, twelve out of the twenty-six pages adopted by the four students were from online dictionaries (WR and RAE), in Task 2 only five out of the total thirty-one adopted pages were dictionaries. Each student adopted one solution from a dictionary site, except for Maria who had two. The most frequent site adopted was WK, which led to a total of nine adopted solutions, three each for Martha, Anna, and Maria. In Task 1, only four out of twenty-six solutions were adopted from WK.

The homepage of the institution that issued the ST for Task 2 was also frequently used for the students' solutions. In particular, six solutions were adopted from the CSIC website, two each by Martha and Maria, and one each by Anna and Laura. By comparison, the site of the authoring institution of the ST in Task 1, Greenpeace, was only used in two cases. A further six solutions were based on the information provided on SERPs, but in this case only Anna and Laura (three each) used this type of resource (in Task 1, only Bob, but none of the students, adopted solutions from SERPs). Furthermore, Martha, Maria, and Laura each adopted one solution from commercial websites. Laura, finally, was the only student to adopt solutions (two) found in online editions of academic journals.

Overall, the four participants used less resource types for Task 2 (six) than for Task 1 (eight). The types of resources used in Task 1 but not in Task 2 were online discussion forums, academic websites (.ac.), and nonprofit sites (.org). As mentioned previously, the only resource type in Task 2 that was not used by the four participants in Task 1 concerns SERPs.

The individual solutions and the rationale for the selected websites provided in the OSRs confirm a trend already visible in Task 1—that is, that the students solved terminological needs primarily via WK. A second way of deciding what possible solution to employ can be seen in Laura's behavior. Unlike the other students, Laura frequently based her selection of solutions on Google searches and the resulting SERPs. Laura's choice of outcomes seems to indicate that many of her searches were guided by hypotheses as to what results to expect (i.e., she used web resources in general and SERPs in particular for verification purposes). Anna, in some cases, shows a similar approach. In general, however, and like Martha, she relied primarily on WK for her final solutions.

For Maria, WK was also the most frequent resource, but she also adopted solutions from two online dictionaries. Her rationales indicate a less critical approach to the possible quality of the information source or the exact nature of the information need. While Maria's information search and

evaluation behavior can be considered rather shallow, Laura shows a very different approach to not only finding but also choosing among solutions. She often based her decisions on having found the solutions in relevant parallel texts or in similar contexts. Furthermore, her rationale for her translation of "CSIC" shows that in her decision-making process, the translation brief played an important role as well.

Finally, the frequency with which a given search term appears, a strategy also used by Bob in Task 1, was given only once as a rationale for adopting a specific solution. This concerns Anna's choice of translation for "CSIC."

7.4.2   Search Success

In Task 2, the students' assessment of the successfulness of their queries is highly positive. Out of the thirty-one solutions, twenty-six (83.9%) were considered successful by the four students. In Task 1, this number had been 73.5%. The remaining five solutions in Task 2 were considered to be "not quite" successful (16.1% as compared to 20.6% in Task 1). None of the solutions for Task 2 was considered unsuccessful by the students (as opposed to 5.9% in Task 1).

The five solutions that were considered "not quite" successful are reported by Martha and Maria. Both shared doubts about their solutions for the information need "antibióticos beta-lactámicos." In addition, Martha had doubts about her solutions for "enantiómeros de un fármaco" and "mezclas racémicas," while Maria was not entirely content with her solution for "CSIC." Unlike Martha and Maria, both Anna and Laura considered all their solutions successful.

A comparison of the students' self-assessment of their solutions with the opinion of the assessors shows that Anna's and Laura's confidence in their adopted solutions was well justified. In all sixteen cases (eight for each of them), the assessors agreed with the students' self-assessments. Moreover, the assessors considered highly successful Laura's translation of the press release title, in which she replaced the culturally specific item "CSIC" with the more general adjective "Spanish" to indicate the provenance of the scientist featured in the press release (she also adopted the appropriate style for news headlines). This decision reflected the translation brief demands (i.e., the needs and expectations of the TT addressee, the British public), or, as Laura mentions in her OSR, "what would be meaningful to a British reader."

In general, Anna's and Laura's self-assessment is in line with their rating of their satisfaction with their adopted solutions and the difficulty of the reported problems (see 7.4.3). Both the high level of confidence and the high success of their solutions clearly seem to be a reflection of the extensive background research that both students carried out. In Martha's and Maria's cases, there is less confidence in the adopted solutions and also more discrepancy between self- and external assessment. Martha considered four out of her seven reported solutions as "not quite" successful and three as

successful. In three cases, her assessment matches that of the external assessors, but in four, it does not. In two of these instances—"CSIC," which she omitted in her translation, and the missing hyphen in "anti-AIDS"—the external assessment was more negative than her own. Nevertheless, in the two remaining instances ("antibióticos beta-lactámicos" and "[mezclas] racémicas"), the assessors were more satisfied with Martha's solutions that she was herself.

This type of understatement is even more prominent in Maria's case. She considered three of her eight solutions as "not quite" successful, and in all three cases the assessors considered her solutions successful. Of the remaining five solutions, which Maria had all considered successful, the assessors confirmed her assessment in four cases. Only in one case were the assessors less satisfied than Maria herself.

7.4.3　Search Satisfaction and Difficulty

The students' assessment of the degrees of difficulty of the information needs researched and of their own satisfaction with the adopted solutions shows that overall the four participants were more satisfied with the solutions for Task 2 (perhaps as a result of increased self-confidence) than with the ones for Task 1, and that they found the information needs researched to be less difficult than those of Task 1 (cf. Table 7.13 for a comparison).

Table 7.13 also shows that the increase in overall satisfaction and the decrease in the average degree of difficulty are attributed to Anna and Laura. In both categories, Anna and Laura show significant differences to Task 1. This is most visible in the case of Anna, who was "very satisfied" (score of five) with every single one of her eight reported adopted solutions in Task 2. She also reported that all her needs were very easy to research (score of one). Laura's values are nearly identical to those of Anna. She also reported eight search needs and adopted solutions, and for seven of them, she assessed the degree of satisfaction as very high and the degree of difficulty as very easy. The only slight exception here is the information need "solketal," which she rated four for satisfaction and two for difficulty.

Table 7.13　Degrees of Satisfaction and Difficulty per Participant (Task Comparison)

	Degree of Satisfaction		Degree of Difficulty	
	Task 1	Task 2	Task 1	Task 2
Martha	4.86	4.14	1.43	1.71
Anna	3.50	5	2.75	1
Maria	3.40	3.5	3.6	4
Laura	4	4.86	2	1.14
AVERAGE	**3.94**	**4.37**	**2.45**	**2**

While both Anna and Laura were more satisfied with their solutions for Task 2 and found the search needs less difficult to research than in Task 1, Martha and, above all, Maria show different developments. In Martha's case, however, the degree of satisfaction is still very high (average of 4.14, as compared to 4.86 in Task 1), and her assessment of the degree of difficulty of the search needs in Task 2 is still below 2 (1.71, as compared to 1.43). While Martha seemed to be slightly less confident in her solutions for Task 2, Maria's self-assessment actually shows a slight increase in her degree of satisfaction (3.5, as compared to 3.4 in Task 1). However, she found the search needs in Task 2 more difficult than in Task 1 (as compared to 3.6 in Task 1). The values for Task 2 clearly show the differences between Maria on the one hand and Martha, Anna, and Laura on the other hand when it comes to assessing the difficulty of Task 2.

The information needs that were considered to pose the biggest challenge to the four students and that were shared by at least two of them are "enantiómeros," "Catálisis y Petroleoquímica," and "enantiómero 'R,'" all having an average difficulty score of three.

The least difficult information needs were "llevar a cabo" and "fármacos enantioméricamente puros" with a score of 1 (in both cases, though, these needs were only reported by two of the four participants). Conversely, these two needs also resulted in the highest degrees of satisfaction among the participants who reported them (average of 5). Two information needs reported by all four participants, "CSIC" and "solketal," also received high satisfaction scores (average of 4.5).

8 Summary of Findings and Perspective

In light of the numerous findings of this study, it seems appropriate to summarize the main results in one last chapter. Although this has already been done within the individual data analysis in Chapters 6 and 7, the most important aspects of this investigation will be discussed here in context. This discussion is based, first, on the type of interactions observed between the research attributes of the study and the participants' web search behaviors, and second, on the relationship between said behaviors and translation problem-solving performance. Regarding the latter, the summary of the findings will be further complemented by an assessment of the possible implications of the study for teaching. Finally, some methodological observations will be made and possible avenues for future research proposed.

8.1 INTERACTIONS BETWEEN RESEARCH ATTRIBUTES AND WEB SEARCH BEHAVIORS

Profiling the participants based on the user attributes selected for the study facilitated the assessment of their general levels of translation and web search expertise, as well as their overall level of domain knowledge for each translation task. This, in turn, allowed for the establishment of various correlations between the selected attributes (including task-related ones) and the participants' web search behaviors for translation problem solving. We should remember at this point that this study was not designed to control variables and that its findings apply to a specific research and pedagogical context; hence, any potential causal relationships should be regarded as hypothetical, thus leading only to the most tentative of results and conclusions. This call for caution should of course not undermine the value of the study. In line with the principles of grounded theory, the main results obtained are presented within an open-ended framework that provides the ground for the generation of hypotheses. These will, I hope, encourage and enable further exploratory research, as well as experimental studies aimed at testing some of the hypotheses generated in this chapter.

8.1.1   Translation Expertise

The findings of the study show that, in contrast to other studies where translation experience was not found to necessarily correlate with translation performance (e.g., Gerloff 1988; Jääskeläinen 1996; Jensen and Jakobsen 2000), the participants' past experiences with and declarative knowledge of translation generally correlated with their procedural behavior (or translation performance). Bob was found to be the most experienced and knowledgeable participant of all, followed by Daniel and the four translation students. Their approaches to translation and the quality of the translations they produced support this finding, showing considerable differences not only between Bob and Daniel but also among the translation students themselves.

Interactions between translation expertise and web search behaviors were most notably felt in connection with the participants' choice of online information sources to address their various information needs. Overall, the translation students' choice of online information sources was (naturally) restricted by their lack of knowledge about and training in the use of translation resources, such as specialized dictionaries, glossaries, terminology databases, and parallel texts. The student participants also lacked experience in the analysis of translation-related information needs, which would help explain why they (including Daniel, the PhD student with three years of casual translation experience) frequently used the same information sources to address their search needs. In contrast, Bob, the participant with the highest level of translation expertise, used a wide variety of resources.

The fact that some of the students did not always distinguish between various resources based on different types of information needs and goals seemed to result, in turn, in a rather highly iterative or repetitive type of online search behavior that was characterized by frequent repeat visits to the same site (primarily reference sites) and, in the case of the two nonnative speakers of English (Anna and Maria), to repeat searches as well.

Having said that, a closer look at task-related factors—in particular the degree of text specialization—suggests that increased task complexity (along with increased translation experience) had a bearing on students' choice of information sources. While in Task 1, the students and Daniel frequently or entirely limited their online searches to either a regular bilingual dictionary or a Spanish monolingual dictionary, Bob only resorted to a monolingual dictionary once, favoring instead the use of frequency checks in Google, parallel texts, and encyclopedic information. That is, Bob's range of search behavior was wider than that of the students and Daniel. The only exception here was Anna, the student with the most translation-training experience, who combined the use of a single dictionary with selected encyclopedic information and several parallel texts.

In Task 2, however, the students' use of information sources increased, thus involving slightly more variation than in Task 1. That is, their range

of search behavior was wider than in Task 1. In particular, there was a slight increase in the range of dictionaries and a shift towards encyclopedic information sources (namely, Wikipedia) was observed. In addition, in the case of Laura, a move towards the use of parallel texts was observed. Most likely, it was the broader nature of Task 1 that led most participants to search primarily for linguistic information (which would explain the dominant use of dictionaries). The exceptions here are, again, Bob and Anna, who also searched for extralinguistic information (i.e., thematic and cultural content). In contrast, the more specialized nature of Task 2, as well as a better understanding of the translation process, seemed to lead most students to seek, to a lesser or greater extent, both linguistic and extralinguistic information (as illustrated by the shift towards the use of Wikipedia and, in some cases, parallel texts).

Interactions between translation expertise and web search behaviors were also observed regarding the participants' search styles, particularly in terms of their engagement with web content. In Task 1, for example, Bob spent more time on average searching and reading the content retrieved for his thematic searches, while most students generally spent less time doing so, mainly as a result of their interest in retrieving equivalents as opposed to acquiring background knowledge as well. As already indicated previously, the only exception was Anna, who also searched for background information and read content to address some of her thematic needs. In terms of searching styles, this translated into Bob and Anna displaying a more interactionistic type of online search style—that is, one characterized by their engagement with or consumption of selected web content—than the other participants. These latter, in contrast, generally displayed a typically shallow online search style that was characterized by checking and comparing and that mainly resulted from a desire for fast and easy access to information.

In Task 2, where the average session lengths generally increased for most information needs (except for the least technical ones) and students, their searching styles continued to be primarily motivated by their desire for fast and easy access to information aimed at retrieving equivalents. Laura, however, like Anna, showed a different searching style, also interacting with the web content she accessed to address some of her thematic needs. While Anna did so via browse searching (like in Task 1), Laura favored Google searches, for which she used source-text (ST) keywords as lexical filters to construct simple, yet rather long, query statements. This helped her constrain the body of search results to documents dealing with these terms and, oftentimes, with the same topic as the ST. In my opinion, Laura's online search evolution can be attributed not so much to task-related factors but to a learning effect (i.e., to her better understanding of the translation process). Anna also showed considerable progress in her translation performance for Task 2. In the case of Martha and Maria, their translation learning curves were less steep than those of their fellow classmates and became more

visible towards the end of the introductory course on scientific and technical translation.

Perhaps another sign of Laura's evolution can be found in her reaction to the translation assignment in Task 2. Here, she used the translation brief as a decision-making criterion for omitting a specific cultural element in her translation of the ST title, so as to make it more meaningful for target readers. Similarly, Anna (in Task 1) also showed an awareness of the possible implications of the translation assignment by using the sociocultural knowledge she acquired through her background research to translate the ST title in a way that would be highly meaningful to target readers. In the case of Martha and Maria, no explicit translation instances could be found in either of the two tasks that would reflect the use of the brief as a decision-making criterion for translation.

8.1.2   Task Attributes

Based on the previously mentioned tentative results, one could argue that task-related factors appear to have had a bigger impact on the participants' range of search behaviors (which significantly increased in Task 2 for all four students) than on their depth of research (where only Laura's and Anna's research was notably deeper). The total number of pages accessed in each task supports the fact that the students' range of search behavior was wider in Task 2 than in Task 1. While they accessed relatively few pages in Task 1 (an average of 2.63 pages per search need), in Task 2 they accessed an average of 7.05 pages per information search need. Subsequently, the average number of pages that each student accessed to address all of their search needs was considerably higher in Task 2 (33.5 pages per student participant) than in Task 1 (10.5 pages).

This significant increase in numbers can be attributed, once again, to differences in topics and degree of specialization. In this regard, Byström, for example, claims that a common finding in information-seeking (IS) studies "is that task complexity (considered on a job level) increases the use of information sources . . . regardless of the type of source," which suggests that "there is more information processing involved in more complex work" (2002: 582). In this study, the increase in the overall completion time for each task is another indicator of the increased level of complexity and information processing required in Task 2. While the students' average completion time for Task 1 was 69 min. 16 sec., their average completion time for Task 2 was 95 min. 37 sec. As the text for Task 2 was shorter than that for Task 1, the increase in total time for each participant could in fact be taken as an indicator of increased task complexity.

Furthermore, Byström, in her study of information sources of varying task complexity, found that "the acquisition of certain information types in connection to different levels of perceived task complexity reveals that the increase of task complexity leads to the need for more information types"

(ibid.: 589). She also observed that "the more complex the task and the more information types involved during task performance, the higher the number of information sources used" (ibid.). In addition to these aspects, a *higher awareness* on the part of the students of the complexity of translation could also help explain their broader and more intensive use of (different) sources of information in Task 2.

Task-related factors also seemed to have had an impact on the participants' choice of initial search actions. The findings of this study show that in Task 1 there was little or no variation in initial search actions across the six participants. Bob almost entirely used search engine queries to initiate all his searches, while the students and Daniel chose to initiate all or almost all of their searches using direct addresses, regardless of the type of information needed. In other words, the participants with the least translation (and search) expertise started their searches from the known, while the most expert translator (and searcher) preferred to initiate his searches with the unknown.

In Task 2, however, the students' choice of initial search actions was wider than in Task 1 and involved a combination of direct address searches (to access reference sites) and search engine queries. This could be explained by the fact that the text for this task included more specialized terms and cultural elements than that of Task 1, for which some of the students seemed to consider research in regular dictionaries to be unsuitable. Consequently, they shifted some of their initial search actions from fact-based resources (i.e., reference works) to more open-ended searches in Google.

The fact that the students frequently initiated their searches by directly accessing known (reference) sites is somewhat consistent with the findings of previous web search studies, which show that known sites are important for regular searches. According to White and Iivonen, users have been found to "start their searches from known sites and visit known sites many times during their searches . . . or over time" (2001: 723). This is also true for the students in this study, who resorted to known sites (mostly dictionary sites) not only at the beginning of their searches but also during their search processes in both tasks. Furthermore, as a general pattern (especially in Task 1), most of the students typically carried out search engine queries only when their dictionary searches failed to provide them with satisfactory answers. Similarly, albeit in an entirely different context, Byström and Järvelin found that the participants in their IS study (a group of municipal workers in Finland) generally used more fact-based resources for lower complexity tasks, while they used more general sources for higher complexity tasks (1995: 208). In this regard, White, Matteson, and Abels point out that "dictionaries are factually based so translators' use initially of dictionaries is comparable to the fact-based sources used by the municipal workers. When the dictionaries do not provide acceptable answers, the translators move beyond them to different types of resources" (2008: 591).

That both professional and student translators tend to rely on dictionaries (regardless of their format) as a primary source of consultation is perhaps not so surprising. The joint research project carried out by the National Research Council of Canada and the Université du Québec en Outaouais on translators' use of tools and resources shows, for example, that although corpus-based tools (e.g., translation memories, bilingual websites) "have made it into the mainstream . . . **they have not misplaced Termino-lexicographic tools**" such as dictionaries, terminology databases, and lexicons (Désilets 2010: n.p.; cf. Palomares Perraut and Pinto Molina 2000: 111).

8.1.3   Web Search Expertise

Correlations between the participants' web search experience and their web search knowledge could only be established for Bob and Daniel. However, only Bob's experience with and declarative knowledge of online searching correlated with his procedural online search behavior (or web search performance). In Daniel's case, no such correlation could be established given the little research he conducted online, which was limited to the use of a single bilingual dictionary. The students' past experiences with online searching correlated neither with their declarative knowledge of web searching nor with their procedural behavior. That is, in this study, extensive use of the web for IS purposes did not necessarily correlate with sophisticated use.

Interactions between web search expertise and web search behaviors were most notably felt in connection with the participants' query construction and modification abilities to locate relevant information on the web. In particular, the findings obtained suggest that different levels of web search expertise correlate with various conceptions of how search engines work, as well as with the effectiveness with which query statements are expressed and refined. As indicated in previous chapters, users depend on their understanding of search engine features in order to transform questions into appropriate search query syntax. The student participants, who had little web search expertise, typically favored simple queries, sometimes using natural language in their queries and frequently over- or underspecifying their search requests. When they did not find satisfactory results, they sometimes replaced, added, or subtracted terms but rarely made use of search operators or query modifiers—except for some phrase searches—for query refinement. At other times, they tried new search paths or gave up their searches altogether.

Furthermore, they generally used few query terms in their pursuit of relevant results—their searches averaged 2.44 terms per simple query in Task 1 and 2.38 terms in Task 2—and typically accessed one of the first three (in some cases, five) results displayed on the SERP. This suggests that "problem coverage," defined by Désilets as the "probability that at least one relevant solution is found in the top 10 results," seemed more important to

students than "precision," or the "probability that a proposed solution is relevant" (2010: n.p.). This was also true for the professional translators in Désilets's study, who found aspects of "recall"—"i.e. the percentage of all relevant solutions proposed by the resource"—to be important as well, albeit to a much lesser extent than problem coverage and precision (ibid.). In this study, the students' rather simple query behavior appeared, in turn, to reflect their misconceptions about how search engines work, above all, by showing considerable trust in these tools (more specifically in Google).

The previously mentioned results seem to be more or less in line with those obtained in other web-searching studies, which found that "users prefer rather simple search statements and do not plan their searches" (White and Iivonen 2001: 724). Web searchers have also been found to use relatively few query terms—generally two or three keywords per search (e.g., Carpineto and Romano 2012; Battelle 2006; Jansen, Spink, and Saracevic 2000)—rarely construct complex or advanced queries (Jansen, Spink, and Saracevic 2000), and "easily modify their query statements, give up the old ones, and try new ones" (White and Iivonen 2001: 724). Jansen, Spink, and Saracevic (2000) also found that the average number of pages accessed by users is 2.35 and that most searchers do not access any results past the first SERP. Based on these findings, one could hypothesize that the typical profile of a regular searcher involves shallow searching, which, at first, may suggest "an unsuccessful, uninformed, or lazy form of behavior" (Nicholas et al. 2006: 210). However, for the students in this study, this type of online search behavior was often successful for retrieving translation equivalents, mainly by using the web as a type of metadictionary and, on occasion, as a parallel, aligned corpus. Shallow searching was not always successful, however, for retrieving relevant background information on the web that could be efficiently used for translation purposes.

On this basis, and considering translators' extensive use of the web as an external resource for seeking both linguistic and extralinguistic information, one could argue that (student) translators would ideally need to develop online information skills that go beyond mere shallow searching and that are closer to an expert, interactionistic, and deep searching style. Bob's online search expertise, for instance, was highly visible in his query construction and modification patterns. He would always create advanced queries by combining one or more phrase searches with other query terms or the site modifier—that is, he would plan and specify his searches according to his information needs and goals—and follow result links or come back to the main SERPs to modify his advanced queries until he found the desired information. His query statements thus seemed to reflect not only his web search expertise but also his translation expertise, as he always used ST keywords as lexical filters, sometimes combining them with keywords retrieved from online documents to acquire relevant thematic content (and not just linguistic information). As mentioned previously, Laura developed a similar type of query behavior for Task 2—that is, she used more precise search terms, most likely as a result of her translation learning progress.

8.1.4   Domain Knowledge

In this context (i.e., the selection of terms for search purposes), it should be noted that users' levels of search experience and domain knowledge have been found to affect their selection of search terms (Hsieh-Yee 1993). Furthermore, the search terms from a user's domain knowledge along with those from the system's output seem to be the terms that prove most successful for retrieving relevant content (Spink and Saracevic 1997). In this study, domain knowledge (i.e., the remaining user attribute) did not seem to have a particular bearing on the participants' selection of query terms, as these were mostly determined by the STs themselves.

Nevertheless, both domain knowledge and task-related factors appeared to have had a combined effect on the participants' amount and type of information needs. In general, it was possible to observe that the higher the level of *perceived* domain knowledge, the lower the number of information needs and the less specialized the nature of these needs. Daniel, for example, who in Task 1 declared his level of ST domain knowledge to be "high," had the lowest number of information needs (five) of all six participants. These needs were all of a general lexical nature (i.e., they did not involve any specialized concepts or ideas mentioned in the text). Similarly, Martha, who had the second-lowest number of information needs (seven) in Task 1, also declared her level of domain knowledge to be "high." Her information needs were also of a general lexical nature, with only two needs involving the search for background information. Laura, whose information needs were higher (eleven in total) than Martha's and Daniel's, declared her level of domain knowledge as sufficient to understand most of the subject-specific words, expressions, or ideas mentioned in the text. Her needs were also of a general lexical nature and did not involve any thematic searches. Bob, who researched a similar number of information needs (ten) as Laura, declared his level of knowledge as "low." His search needs were mostly of a thematic nature. Anna also declared her level of domain knowledge as "low" but had almost twice as many information needs (nineteen) as Bob. However, similar to Bob, some of her information needs involved thematic searches. Maria, finally, also declared her level of domain knowledge as "low." She had the highest number (twenty-nine) of information needs, none of which involved thematic searches. Differences in linguistic ability and translation directionality, among other factors, would seem to explain the higher number of information needs experienced by Anna and Maria (i.e., the two non-native speakers of English among the students).

In Task 2, the number of information needs increased for Anna (twenty-one) and Laura (nineteen) but decreased for Maria (twenty-three) while remaining the same for Martha (seven). Anna, Maria, and Laura all declared their ST domain knowledge to be "very low." Martha, however, indicated that her level of domain knowledge was sufficient to understand several specialized concepts and ideas mentioned in the text. Furthermore, while Anna's and Laura's search needs involved the search for both linguistic and

extralinguistic information, Martha's and Maria's searches primarily concerned the search for linguistic information. That is, the various types of information needs appeared to influence the types of research conducted online.

Both the type of research and the amount of time spent online, finally, seemed to have had an impact on translation quality. Anna and Laura, who in Task 2 conducted both linguistic and extralinguistic research and experienced the highest increase in research time compared to Task 1 (13% and 20% respectively), produced better-quality translations than Martha and Maria, who primarily conducted linguistic research and experienced the lowest increase in research time (3% and 8% respectively). These results seem to be somewhat in line with previous findings (e.g., Krings 1988; Gerloff 1988; Jääskeläinen 1990) that suggest that translation quality is related to the amount of time and effort invested in translation processing—of which documentary research is an essential part.

8.2   IMPLICATIONS FOR TRANSLATOR TRAINING

Perhaps one of the most significant implications of the previously mentioned tentative results from a didactic perspective refers to the importance of teaching translation students—early on in the curriculum—(a) the diversity of (online) resources available for translation and (b) how to select adequate resources based on different types of problems or information needs. As previously shown, the student participants typically used reference sites (mostly dictionaries) as their first port of call in searching for both linguistic and thematic (specialized) information—that is, they did not always base their selection of specific information sources on specific types of information needs (or goals pursued). This is true particularly for Task 1. Moreover, while in Task 2 the range of information sources generally increased, with students showing a greater awareness of the appropriateness of specific resources for specific information needs, reference works continued to be the most dominant resource type. Similarly, Massey and Ehrensberger-Dow report that the findings from their pilot study

> on linguistic and extra-linguistic resources indicate potentially important discrepancies in resource use between instructors and students. While the instructors appear to prefer reviewed or authoritative resources such as published printed and electronic dictionaries or terminology databases for linguistic research, this seems to be less important as a criterion for students. Students show a greater inclination than instructors to use multilingual resources for both linguistic and extra-linguistic research, but use monolingual dictionaries and special search facilities rather less. On the basis of these findings, it could be said that the instructors possess a greater awareness of the appropriateness and

reliability of resources for specific problem types, in these respects coming closer to accepted best practice in translation-specific information behavior than the students (2011a: 198).

Overall, the students of this study tended to rely on online bilingual dictionaries as their initial source of consultation, thus typically carrying out search engine queries only when their dictionary searches failed to provide them with satisfactory answers. A look at how students used the bilingual dictionary WordReference.com—which was the dictionary most frequently used by three of the four students—shows the limits of this particular resource. While most of the students' problems were solved successfully, an analysis of the unsuccessful solutions shows that uncritical reliance on solutions offered in online bilingual dictionaries led to poor translation solutions in some cases. This fact—most likely due to an oversupply of (perhaps poorly contextualized) possible translation solutions—continues to highlight the importance of training translation students in the use of dictionaries in different formats (i.e., in print, electronic, and online forms).

The fact that the students sometimes misused general online bilingual dictionaries by trying to find information on acronyms, allosemic words, and collocations thus seems to confirm Varantola's hypothesis (1998: 198) that student "translators try to find non-dictionary type information in dictionaries because it is not readily available in other sources"—and I would add that this is especially so with regard to free online dictionaries of a less authoritative nature than print and electronic dictionaries. Furthermore, the analysis of unsuccessful solutions resulting from the consultation of online dictionaries suggests that polysemous words caused particular difficulty for the novice students of this study. As mentioned previously, it is often the abundance of choice in dictionary entries that causes users to select inappropriate solutions. Here, translator training would benefit from emphasizing more strongly the need to cross-check dictionary search results, both within the dictionary accessed and within selected parallel texts. In this study, background research involving the use of several resources, such as reference works and parallel texts, in fact led to the most successful translation solutions among students, in particular where interaction occurred between the students and the texts accessed, and where effort and time was invested in acquiring background knowledge.

Overall, the findings of the study seem to highlight the need for formal training in the use of appropriate resources—and the formulation of effective search statements—based on question analysis (i.e., information needs analysis), an aspect also supported by Massey and Ehrensberger-Dow's (2011a) pilot study. Here, particular attention would ideally need to be paid to the more or less open (i.e., nonfactual) versus closed (i.e., factual) nature of information needs (or questions asked), as well as the predictability of sources of information for providing suitable answers. As White and Iivonen point out, these two question characteristics may have an impact

on users' choice about their initial "Web search strategy," which, in turn, "has implications for the continuation of the search" (2001: 722–723). The results arising from this study seem to support this claim. Comparing the initial search actions of Task 2 (for which some of the students searched both for linguistic and extralinguistic information) with those of Task 1 (for which most students sought linguistic information only), a major shift away from direct address searches was identified. While in Task 1, almost three-quarters (74.6%) of all initial search actions involved the use of direct addresses to visit known dictionary sites, this number fell to 50% for Task 2. Instead, for Task 2, all four students carried out 48.15% of their combined initial search actions in the form of search engine queries.

Nevertheless, as shown earlier, students' attempts to transform questions into appropriate query statements were not always successful, mainly as a result of their lack of understanding of search engine features, as well as the lack of planning searches according to specific information goals. Given that the keyword search approach to information seeking and retrieval (IS&R) is considered the most powerful method to finding information online, the sooner students are exposed to the features of various search engines (including metasearch engines), the better. The findings of this study point in particular to two training needs in this area: (a) knowledge about search engine performance for data retrieval as opposed to information retrieval, and (b) the use of search engine features to efficiently construct (advanced) queries for finding relevant information on the web. In this context, and as discussed at the beginning of this study, the importance of integrating online information skills in the translation curriculum has long been recognized by the teaching community. In their survey of information literacy instruction in Spain, Pinto Molina and Sales Salvador found, for instance, that, "well ahead of the rest of the items, the translation and interpreter trainers see the first need of a specialized translator as being the skill of information search (68%). This is followed by subject knowledge (34%), which is, after all, the product of a sound global information competence that is continually being enriched and updated for whatever field of expertise" (2008a: 61). However, when teachers were asked which elements they thought needed to be added to the curriculum where they felt "students had not yet acquired the necessary [information] skills," they suggested "reinforcing knowledge of *documentation techniques in general*" (ibid.) and of information search in particular (ibid.: 62). Concerning the latter, Pinto Molina and Sales Salvador state that "teachers are no doubt aware that their students tend to conduct their information searches in an intuitive fashion, low on structuring and only vaguely systematized, and suppose that a search engine like Google 'knows everything'" (ibid.). In this study, a high degree of trust in this search engine was also observed.

The teachers in Pinto Molina and Sales Salvador's survey also emphasized that to improve information literacy instruction, we need closer coordination between instructors of information literacy and those of specialized

translation (and interpreting) (ibid.: 64). They further remarked that the teaching of documentary research should be extended "with additional instruction" throughout the entire translation curriculum (ibid.). Another suggestion made—one I am particularly keen on—relates to the need to "consolidate" and "extend" (online) information skills "within each specialized translation field, on the basis of closer links to professional practice and employing a more applied approach with the use of case studies" (ibid.). The findings of my study suggest, for example, that successful query construction depends not only on knowledge about search engine features but also foremost on the selection of key ST terms and the planning of search statements based on thorough question analysis (i.e., information needs analysis). This calls, in line with the previous proposals, for a highly applied and contextualized approach to the teaching of (online) information skills within translation practice courses, thus enabling students to develop and enhance said skills through meaningful and experiential learning.

Such an applied approach to the teaching of (online) information skills would, in turn, facilitate a transversal approach to the teaching of specialized translation. As González Davies points out, "if specialized translation is taught across a wide range of text types, domains and sub-domains, and if special emphasis is placed on documentary research skills in such a way that the knowledge acquired in one translation course can be applied to a large extent to another, then the knowledge gap between various types of specialized translation would be reduced" (2003: 15, my translation). Indeed, if we are to teach our students to deal with different areas of specialization, text types, and topics, our focus should perhaps shift from the acquisition of specialized knowledge in several domains to the generation of information skills that will enable (student) translators to deal with various fields of expertise. This approach would further allow for existing information literacy models—such as information literacy for translators (INFOLITRANS; Pinto Molina and Sales Salvador 2008b)—to be integrated into practical translation activities.

8.3   METHODOLOGICAL OBSERVATIONS AND FUTURE RESEARCH

As mentioned at the beginning of this book, one of the secondary goals of this investigation was to assess the usefulness of the main data-collection tools employed (i.e., the online search report [OSR] and the screen recorder), both with regard to their value in teaching and in research. Overall, the OSR was very positively received by the student participants of this study for its didactic merits. The individual elements of this report encouraged students to reflect more thoroughly and more critically on the nature of the problems they faced, the decisions they needed to take, and the options they were presented with. Hence, the OSRs became tools supporting the

constant decision-making processes involved in translation. Furthermore, they raised the participants' awareness of perceived problems in general and of the importance of problem detection and solving in particular. The students also praised the didactic usefulness of the reports for supporting their web-searching processes, especially when it came to evaluating the content found on the web.

Nevertheless, despite the OSRs' apparent positive didactic value, it is the very nature of written reports that potentially reduces their value as a research tool. As indicated earlier, the presence of any type of problem report heightens students' metacognitive levels of awareness, thus introducing an unnatural element into the translation process, which in turn threatens the reliability and validity of this tool. The use of OSRs in this study underlined other general problems associated with written protocols reported in other studies (e.g., Gile 2004; G. Hansen 2006; Pavlović 2007, 2009). This includes the fact that the OSRs not only represented an additional, time- and energy-consuming task for the students, but also were seen by some of them as interfering with and disrupting the actual translation process. Hence, it would be advisable to instruct students to complete the reports after their translations. This could, however, lead to difficulties associated with the recall of information due to limited short-term memory capabilities, a phenomenon that one of the students of this study commented on. Pavlović, for instance, remarks that students are not likely to "recall all the problems they encountered, solutions they considered, resources they consulted, or the reasons for their final decisions" (2007: 182).

Problems of information recall could partially explain another aspect of written reports that may negatively impact on their value as research tools—that is, the question of the thoroughness and completeness of the reporting. Here, a lack of detail is not necessarily the main concern (a lot of the OSR entries were indeed very detailed). The problem rather lies with the question of what gets reported in the first place and what not (ibid.)—that is, what is considered a problem and what not. In this study, a pattern was identified of students not reporting general lexical problems for which they were mainly looking for confirmation (or "reassurance") of already-existing tentative solutions.

The interview data further show that three of the four students—primarily the two nonnative speakers of English—omitted to report the information needs that they considered unproblematic. The more general nature of the unreported needs in fact seems to support the assumption that the participants tended not to report on searches that involved unproblematic processing and that primarily aimed at confirming preexisting solutions. Thus, taking only the reported search needs into account, it was possible to observe that all participants had a similar number of more or less problematic items (generally associated with technical terms) in both tasks. In contrast to the original position adopted in this study, in which IS was thought to be motivated by the need to solve a (translation) problem, the results obtained

appear to support Case's statement that IS is sometimes motivated by "a desire to simply have more or less of some quality; more information; stimulation, or assurance; or less uncertainty, boredom overload, or anxiety" (2008: 88). In other words, the findings of my study suggest that the notion of "problem" does not necessarily refer to something serious or difficult (cf. Jääskeläinen 1993; Séguinot 2000a; Sirén and Hakkarainen 2002).

The fact that the unreported searches were mostly carried out by the nonnative speakers of English also appears to reinforce previous suggestions that (student) translators generally feel less confident in L2 translation than in other directions (Kiraly 2000b; Pavlović 2007). One would therefore concur with Pavlović that "[h]aving a wealth of external resources at their disposal and being able to use them well is likely to help students deal with [their] insecurity" in L2 translation (2007: 193). However, this insecurity, or lack of confidence, does not necessarily have to be a bad thing. As Massey and Ehrensberger-Dow point out, "there is a risk of overconfidence and complacency when people translate into their L1" (2010a: 137). In contrast, when people translate into their L2, they may feel the need "to be more cautious and check resources for unfamiliar terms" (ibid.). A look at some of the translation solutions adopted by the native speakers of English in my study indicate that a more thorough browsing of English parallel texts would have contributed to a higher number of successful translation solutions for these participants.

With regard to more general questions of research methodology, the fact that unproblematic needs did not show up in the OSRs and were only spotted through the screen recordings (and confirmed in the interviews) stresses the need for methodological triangulation. Overall, the OSR has shown to be an excellent didactic tool that raises students' awareness of both translation and web-searching processes and encourages them to critically reflect on their decisions. They are useful research tools, but they need to be complemented by other tools to obtain a more complete picture. Furthermore, as suggested previously, it would seem reasonable to employ written reports after the translation process has been completed so as to reduce their disruptive impact on said process. While leaving the completion of reports for the end would entail the risk of losing some of the information, these tools are, as Gile (2004) points out, still able to collect data in a highly systematic way.

Regarding the use of the screen recorder, this has proved to be an excellent research instrument in this study. The software running in the background of the students' computers was highly unobtrusive, with students seemingly unaware of its presence (one of the students was even checking her personal e-mail while recording continued). The interview data confirm this claim, with the students stating that they forgot about being screen recorded and that this tool did not "bother" them in any way. An aspect of screen recorders that in my opinion is worth studying in the future is their didactic potential. That potential has been indicated in studies carried out by Pym (2009), Kujamäki (2010), and Angelone (2013), among others,

in which students first have their translation processes recorded and then watch said process on-screen (and eventually compare these with those of professional translators), an exercise that, again, raises students' metacognitive levels of awareness, inviting and enabling them to critically reflect on their working styles (cf. Enríquez Raído, 2013).

On a more general level, and to conclude my reflections on methodology, the type of research that I carried out as part of this study (i.e., process-oriented research) left me with the general impression that one must cut down a whole forest to create a single toothpick. The amount of data generated even with a small cohort is rather overwhelming and suggests, at least to me, that process research is better carried out by a team of researchers as opposed to solo researchers. Moreover, studies like mine become much more useful when they can be and are transferred to other context-dependent research settings. Here, I find the approach taken by Susanne Göpferich (2009b, 2010) and her colleagues in the TransComp project to pool research data in a dedicated database especially useful, as it would offer chances for cross-institutional research and allow for the comparison of several data sets.

Finally, also in relation to research transferability, it would be very interesting to see similar studies that would involve minority languages, or languages that are less widely used on the Internet. As Pavlović (2007) has shown with regard to Croatian, and as supported by Massey and Ehrensberger-Dow's (2011a) study, the use of the Internet by (and, I would add, its usefulness for) translators depends on the language pairs involved in the translation process. Despite this and other caveats, however, I am confident that the emerging research into the information behavior of (student) translators is clearly moving in the right direction.

Notes

NOTES TO CHAPTER 1

1. In May 2012, the Spanish Ministry of Education, Culture, and Sport listed a total of twenty-four universities offering undergraduate programs in translation and interpreting studies.
2. While in Spain most undergraduate programs in translation and interpreting still maintain the four-year course structure following the adaptation to the European Higher Education Area (EHEA), undergraduate programs in translation and interpreting offered by other European institutions typically consist of three years of study.
3. Pinto Molina and Sales Salvador (2007, 2008a, 2008b) also examine translators' information literacy, albeit from the perspective of translation-oriented documentary research. Similarly, White, Matteson, and Abels (2008) address professional translators' information behaviors within the domain of information science.

NOTES TO CHAPTER 2

1. When referring to the term "translation process," we should not forget, as House points out, that "we are dealing here not just with an isolable process but rather with a set of processes, a complex series of problem-solving and decision-making processes" that are constrained by a number of semantic, pragmatic, and situation-specific factors (2000: 150).
2. For an overview of empirical studies that explore translation units and strategies by other types of verbal and nonverbal introspective methods, see section 4.1. For a discussion of translation units from a linguistic perspective, see Dragsted (2004: 11–23).
3. Most of the TAP studies discussed here differ in terms of subjects (language learners, bilinguals, student translators, professional translators, or combinations of these), languages involved (German, French, and English), translation directionality (L2–L1 translation and vice versa), text types (e.g., administrative texts, magazine articles, and tourist brochures), text production (written vs. oral), and translational aids (with or without access to them).
4. It should be noted, though, that Scott-Tennent, González Davies, and Rodríguez Torras's study of translation strategies is based on student data elicited by means of written protocols as opposed to verbal ones. In completing the former, the participants of their study had to explicitly identify translation

problems and explain the strategies applied to solve said problems. Consequently, the distinction between conscious and unconscious processing becomes more feasible, or less complex, with written protocols than with verbal ones where subjects do not necessarily verbalize all their problem-solving strategies.

5. Here and as Zabalbeascoa suggests, "[i]t seems useful to distinguish 'behavioural' strategies from 'mental' activity, where the former would include actions that could be observed directly by the researcher" and the latter include "the thought processes that can only be detected indirectly by noticing indicators or symptoms (hesitations, mumblings), or otherwise by means of interviews and think-aloud protocols, or by special equipment that can track neural activity" (2000: 120).

6. While Jääskeläinen does not explicitly define what she means by research, it seems fair to assume that she refers to the consultation of sources other than monolingual and bilingual dictionaries—in this case, the encyclopedias and parallel texts available to the subjects of her study.

7. An exception to this type of experiment is the protocol study that Britta Nord carried out in 1997 and published as a PhD thesis in 2002 on translators' use of printed dictionaries and other types of printed reference material (in particular various types of auxiliary texts and encyclopedias). Whereas this study reports on the "usage frequency, usage occasion, usage reason, usage query, choice of aid, and usage consequences" (B. Nord 2009: 204) of the translation aids used by a total of thirteen professional translators, Nord's 2009 revision of her study focuses on three parameters only, namely, "translators' needs, translators' skills, and the usefulness of dictionaries and other types of translation aids" (ibid.: 214).

8. Livbjerg and Mees realize that the great deal of time spent checking problems for which students had solutions from the very beginning could be "an artefact of the experiment" (ibid.: 145). While the authors do not elaborate on this point, it seems fair to assume that students might have felt the need to consult dictionaries simply because these were available to them for editing and revising purposes during the second part of the experiment.

NOTES TO CHAPTER 3

1. According to the February 2012 Pew Internet and American Life Project survey, "Google continues to dominate the list of most used search engines," with 83% of search engine users employing this tool (Purcell, Brenner, and Rainie 2012: 4). The second "most cited search engine is Yahoo, mentioned by just 6% of search users." When this question was last asked in 2004, "the gap between Google and Yahoo was much narrower, with 47% of search users saying Google was their engine of choice and 26% citing Yahoo" (ibid.).

2. See Aula (2005: 31–44) for an overview of the various solutions that can be used to support query formulation and refinement, as well as to facilitate the evaluation of results.

3. See http://www.googleguide.com for a description of a wide range of search operators, as well as useful information on query input and result evaluation.

4. According to Battelle, "a major hurdle to the rise of the Semantic Web has been standards" for specifying which tags are the right ones for which web pages, thus emphasizing that "the nearly limitless possibilities of the Web do not lend themselves to top-down, human-driven solutions" for classifying content (2006: 265). However, what Battelle refers to as "the Force of the

Many," made it possible for a new type of tagging system to emerge—that is, "one based not on any strict, top-down hierarchy [e.g., that of directories], but rather on a messy bottom-up approach" (ibid.: 266) that allows users to tag web content and share those tags with other users (cf. 3.2.2).
5. The information in this table was adapted from Austermühl 2001: 64–66 and the University of Auckland Library 2008: 8.

NOTES TO CHAPTER 4

1. See Jakobsen (1998, 2003), Hansen (2002b), O'Brien (2005), and Englund Dimitrova (2006) for studies focusing on the pausological analysis of translation cognitive activities. See Göpferich (2008: 48–51) for a more detailed discussion of the pausological study of writing and translation.
2. See Göpferich (2008: 56–63) for an overview of different eye-tracking studies in translation, as well as a detailed discussion of various types of eye movement measures and eye-tracking data formats. See also the eye-tracking studies included in O'Brien (2010).

NOTES TO CHAPTER 5

1. Although experience in translation is not a formal requirement for enrolling in a translation practice course, most students who have taken the Spanish translation course in the past were familiar with translation through either previous training experiences or (in)formal translation jobs.
2. They were also invited to use their own reference material either in printed or electronic form in class. However, only one student brought an electronic dictionary once throughout the entire semester.
3. Pseudonyms are assigned to the research participants for two main reasons: First, to guarantee their anonymity and, second, to be consistent with the research approach (i.e., grounded theory) and the main research method (multiple-case study) that I adopted in my investigation. In this regard, and as Jääskeläinen points out, the use of fictional names emphasizes "the fact that we are dealing with real people with human characteristics, and not with impersonal letters or numbers" (1993: 117). The latter is commonly used in experimental or quasi-experimental research, while the former is typical of case study research.
4. See, however, sections 4.1.2 and 4.1.3 for a discussion of the potential impact that a specific reporting format may have on the type of data collected, as well as for an overview of the main disadvantages of using problem-solving reports for research purposes.

NOTE TO CHAPTER 7

1. Data from Task 1, used for comparison purposes only, includes the data obtained from the four students.

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