Contributions of Tracking User Behavior to SLA Research

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ABSTRACT
This commentary discusses how tracking user behavior in CALL environments can contribute to SLA research. Despite the fact that data documenting what learners actually do in CALL activities can provide valuable insights into both second language acquisition and pedagogical design, a surprisingly large proportion of CALL studies do not report on tracking data. Key benefits of collecting and analyzing such data include ascertaining precisely what learners do or do not do and determining whether there is a relationship to learning; documenting the L2 learning process; and providing guidance to learners about how best to use CALL materials for SLA. Common reasons for not incorporating such analyses are the sheer quantity of available data and the time required to process and analyze them. For the future, as it becomes easier and to some extent automatic to collect such data, the challenge will be to refine data mining tools so that meaningful information and patterns can be discerned. This information will provide a more complete picture of how L2 learning transpires.

KEYWORDS
Tracking data, User behavior, SLA, CALL

INTRODUCTION
In SLA and CALL research, the focus on L2 production (the product) sometimes seems to take precedence over closely examining the process of L2 learning. Despite the ever expanding body of CALL research, many studies do not explicitly track user behavior, i.e., what users actually do when using software or web-based applications, either in terms of their overall behavior, such as which links are clicked, or of their minute actions, such as individual keystrokes. As a CALL developer since the early 1990s, I have always been surprised by the fact that learners do not use or learn from software in the ways that I would have anticipated or expected (see also Hwu, 2003), and as the editor of the Language Learning & Technology journal since 2000, it has often struck me that a good percentage of submitted articles simply assume that learners use all of the features that a given
software or website provides and draw conclusions based on this assumption. Documentation or evidence of learner behavior from tracking data can in fact provide a key piece of the SLA puzzle, and as a researcher, I have tried whenever possible to include this type of data in my work. It could be said that Fischer and Farris (1999) were prescient, building user behavior tracking into their multimedia authoring environment in order to determine precisely how learners interact with computers in the process of language learning.

Instead of giving a brief history of user-behavior tracking in CALL, I recommend an excellent and comprehensive survey by Fischer (2007) and, additionally, a summary of learner usage patterns by Fischer (2012). Some of the key issues discussed by Fischer are expanded upon below, including tracking as ethnographic research and tracking to inform SLA research. Important issues that will not be discussed in detail due to length constraints include: tracking as an aid to evaluating software effectiveness and to improving instructional design; tracking for the purpose of understanding learner autonomy; and comparing learner tracking with self-reported learner surveys.

Some of the major conclusions that bear repeating are the following: Fischer (2012) found that “students clearly use software in unexpected ways, often in ways that differ substantially from those envisioned by the software developers” (p. 26) and “lower level students … seem to engage in less well organized approaches to using software resources than higher-level students” (p. 26). Other conclusions from Fischer’s (2012) literature review are that the “use of student questionnaires alone is not a reliable source of information about student use of software and should be avoided as a single source of information” (p. 27) and that there is a “pervasive need for learner training” (p. 28).

In the following sections, I will discuss selected issues with regard to tracking learner actions and their importance for different aspects of language learning. Some are expansions of Fischer’s categories, and others are a reflection of my own priorities. I conclude the commentary with a discussion of directions and challenges for the future.

**TRACKING AS ETHNOGRAPHIC RESEARCH**

As Fischer (2007) astutely noted, “Computer-based tracking can be characterized as a form of ethnographic research” (p. 411). Not only can the computer collect data on how students use software, but it is becoming increasingly easy to collect the kind of observational data that ethnographers typically record, including both human-human interactions (HHI) and human-computer interactions (HCI). When the computer is used as a tool or tutor for learning, computer logs can record HCIs: mouse clicks, keystrokes, and all entries made by a learner. In addition, software that captures data from the computer monitor, including everything that the learner sees and does, documents the entire process of software or website use and not just the final product. When the computer is used as a medium for learning and communication, e.g., in the many forms of computer-mediated communication (CMC) activities available, the computer can record HHIs and store
artifacts created by learners interacting with each other.

Human-computer interactions are often reported quantitatively, e.g., in terms of how many times a user looks up words in a dictionary or consults multimedia glosses while reading a text (Bland, Noblitt, Armington & Gay, 1990; Chun & Plass, 1996). Learners’ actions can also be analyzed to try and determine the underlying strategies and navigation behavior that learners are employing (Chun, 2001) or to document which of the components or features of a program or website are most frequently used (or not used) and thereby also categorize users in terms of organized or chaotic patterns of behavior (Fischer, 2007, 2012; Heift, 2002). In investigating whether learner behavior might be related to the proficiency level of the learner, Fischer (2012) found that “individual variability effectively overshadowed patterns of student use based on level of general proficiency or specific achievement” (p. 22) and that “there seems to be little overall relationship between program use and achievement” (p. 24). This latter finding is somewhat surprising and invites further investigation.

Human-human interactions via CMC have become commonplace in the 21st century, not only for the purpose of L2 learning but in our daily lives. Starting with applications such as e-mail, bulletin boards, instant messaging and text chat, and progressing to Web 2.0 applications such as forums, blogs, wikis, social networking sites, video chat, virtual worlds, and multiplayer games, tracking data is easily compiled. It is more difficult to determine how to analyze the huge volume of information that is readily available; qualitative or mixed methods are typically employed. Innovative methodologies are welcome, e.g., Smith (2008), who suggested that chat data does not always fully reflect what is happening in negotiated interaction. In addition to the chat log file, Smith observed that screen captures of the interactions revealed the entire process of what learners typed, changed, and finally left in their chat logs, showing self-repairs that did not appear at all in the final “product.” Of particular importance for the present and future is a principled analysis of all of the types of CMC being used, e.g., synchronous, real-time interactions archived in video recordings and videoconferencing, which make authentic spoken language less ephemeral than it used to be when it was not as easily recorded. This kind of “automatically” tracked data adds to our database of ethnographic information as well as to our challenges to interpret it.

**TRACKING TO STUDY SLA PRINCIPLES**

In addition to the ethnographic information that tracking provides, Fischer (2007) acknowledged that “one of the most valuable uses of tracking in CALL lies in the investigation of SLA principles” (p. 419). In particular, he addressed input enhancement, negotiation of meaning, corrective feedback, noticing the gap, sociocultural learning, hypothesis testing and metalinguistic reflections and found in his literature survey that collection and analysis of tracking data played an instrumental role in the studies cited. The studies “have not only confirmed the operation of fundamental SLA principles but have also extended our understanding of these principles” (p. 426).
Briefly, the highlights of the studies’ results include the following. In terms of input enhancement, “perceptual saliency has an impact on students’ behavior but … it is functional saliency (e.g. elaborating word meanings and grammatical features with multimedia annotations) which has an impact on students’ learning” (p. 420). With regard to negotiation of meaning, CMC, with its inherent trackability, has come to dominate much of CALL research. In addition to the opportunities to negotiate meaning, written CMC has also been found to be more conducive to focus on form than oral communication in that it results in greater accuracy; chat logs have revealed some evidence of uptake and that learners tend to focus on the meaning of individual lexical items. Many CMC studies are based on sociocultural theory (Warschauer, 2005), emphasizing the social dimensions of the L2 learning situation, and have “elucidated important cultural aspects of the process” (p. 423) including differences in cultural norms of communication.

In SLA research, the concepts of conscious attention and noticing have been widely investigated, and within CALL, evidence of the effects of noticing and of corrective feedback have been found in a number of CMC studies. Examining CMC transcripts has revealed instances of noticing lexical items, grammatical mistakes, and even pragmatic distinctions between formal and informal terms of address. In addition, L2 learners have made use of recasts provided by native- and nonnative-speaking partners in CMC sessions. Hypothesis testing and metalinguistic reflection have also been found to be important for SLA and are reflected in user behavior data (e.g., Heift, 2003; Glendinning & Howard, 2003).

FUTURE OUTLOOK

To expand upon the SLA principles reported on by Fischer (2007) and how tracking can contribute to increasing our understanding, it might be useful to frame the discussion in terms of four main SLA theories/perspectives: psycholinguistic SLA, interactionist SLA, sociocultural SLA and ecological SLA (see Thorne & Smith, 2011).

For each of the four perspectives above, Chun (2011) summarized research results to date and suggested future directions for study. I will build on these with specific reference to the potential contribution of learner tracking. First, from psycholinguistic/cognitive perspectives, as reported in the literature, computer tracking facilitates the gathering and recording of evidence about the effects of psycholinguistically relevant instructional design features (e.g., enhanced input, variety of feedback, types of help, written interaction). Tracking behavior in online learning tasks provides evidence of what learners know (their language ability) at a given point in time, their individual differences in using CALL software or the Internet, as well as their learning processes and strategies. For the future, tracking research in neurolinguistics (e.g., brain imaging) and psycholinguistics (e.g., eye-tracking) seems promising for moving SLA forward. Smith (2012) reports on eye-tracking studies of corrective feedback, and the same technology could provide eye gaze fixation data, which could be used to study noticing or attention. This type of tracking would definitely contribute to operationalizing
these psycholinguistic SLA constructs that have been relatively elusive to measure. Studying frequency of input and the process of automatization will also be facilitated by tracking, but that would require tracking of all input that a learner receives, and all of the actions, activities, and interactions that a learner engages in. New methodologies for parsing and analyzing this kind of data will be needed.

Second, although there currently exists a substantial body of research on CMC in interactionist approaches to SLA, newer technologies such as audio- and video-conferencing provide richer samples of language production as compared to text-based output. Not only can the process of spoken interaction be studied, but the dynamic nature of spoken language, including intonation, use of gestures, facial expressions, and body language can be captured and analyzed. Furthermore, the entire process, including false starts, self-repairs, and interruptions can all be documented and used to show learners how they are a natural part of conversation and how they can sometimes be effective communication strategies.

Third, for sociocultural and cultural historical approaches to SLA, CMC in all forms (asynchronous, synchronous, written and spoken) allows for authentic interactions that can be easily recorded and analyzed (see Thorne, 2003). Although analyses are time consuming and labor intensive, these artifacts provide evidence of how L2 learners negotiate for meaningfulness, reflect on and develop their identities, and increase their intercultural communicative competence. For the future, Web 2.0 social networking applications will continue to serve as both tools and as the medium for the development of L2 and cultural learning, and the boundaries between instructed SLA and naturalistic learning will become blurred.

Finally, ecological approaches to SLA focus on issues of agency, identity, voice, and how learners interact with and influence their environment. The trend is to look beyond the language classroom or language learning software/websites to study how learners develop L2s and themselves as multilingual speakers. This will be more difficult to track and study, not from a technical standpoint (as every action that a user makes on a computer can be or is currently being tracked), but from a methodological standpoint of what to do with the massive amount of data that is available.

In looking ahead, Johnson, Adams and Cummins (2012) project that data-gathering tools and analytic techniques will emerge as critical for studying student engagement and performance. These data mining tools are the future tracking tools that can deal with the complexity and abundance of information that dynamic learning environments in general will generate, and should contribute to CALL and SLA research in particular.

CONCLUSION

In conclusion, in early CALL applications, it was necessary to build user tracking into the software (Chun & Plass, 1996; Fischer & Farris, 1999), and analyzing user actions and navigation in web-based programs was painstaking (Chun, 2001). Studies revealed certain psycholinguistic SLA processes that were observable or inferable. With CMC and Web 2.0 applications, the end user is a much
more integral part than in Web 1.0 applications, and user behavior is tracked automatically on the multitude of technological devices being used, not only actions performed but geographic location as well. The social nature of Web 2.0 will contribute further to interactionist and sociocultural perspectives of SLA. For the future, we can look forward to Web 3.0 applications, e.g., the so-called semantic web and augmented reality, and the kinds of information that Web 3.0 will provide will be helpful in tracking ecological aspects of SLA. The semantic web “is about common formats for integration and combination of data drawn from diverse sources” (http://www.w3.org/2001/sw/) and augmented reality provides information about the surrounding real world that users interact with and manipulate in real time. L2 learners and their interactions with technology and the world will be easily tracked, but the daunting challenge will be to develop principled methodologies for explaining and analyzing what the actions mean for language or culture learning.

REFERENCES


