Contents lists available at ScienceDirect

System

journal homepage: www.elsevier.com/locate/system

Technology-assisted L2 research in immersive contexts abroad

Silvia Marijuan [a, *], Cristina Sanz [b]

[a] World Languages and Cultures Department, California Polytechnic State University, Bldg. 47, Rm. 28, 1 Grand Avenue, San Luis Obispo, CA 93407, USA
[b] Department of Spanish and Portuguese, Georgetown University, Bunn Intercultural Center 403 A, 37th and O Streets, N.W., Washington D.C. 20057, USA

ARTICLE INFO

ABSTRACT

The recent technological shift in Second Language Acquisition (SLA) research has expanded our understanding of L2 development. Today, SLA research is equally as interested in the product of learning (accuracy) as in the cognitive processes that underlie changes in performance. Technological tools are necessary to investigate both, especially cognitive processes, which are more difficult to identify without precise procedures. The Study Abroad (SA) domain has echoed this trend. SA researchers have sought to explore the influence of the immersive experience on L2 development by combining concurrent data elicitation techniques — latency, eye-tracking, event-related potentials — with assessments of L2 performance, often in conjunction with measures of individual differences. In this article, we examine the contributions from recent cognitively-oriented SA studies that employ these techniques. We also include an overview of other technological resources employed in non-cognitively oriented studies, such as online surveys, blogs (i.e., public discussions and posts meant to be shared), and e-journals (i.e., on-going personal reflections), which have proved useful when answering important question related to learners' motivation, identity, and intercultural competence. We conclude with recommendations for future research.

© 2017 Elsevier Ltd. All rights reserved.

1. Introduction

Stimuli presentation, data acquisition and data analysis have become faster, more precise, and robust ever since computer technology was first incorporated into Second Language Acquisition (SLA) research. Today, most empirical studies in SLA include possibilities that would be unthinkable without the use of a computer, such as randomization, highly controlled delivery of experimental conditions, or stimuli presentation that adapts to learners' responses (e.g., Sanz & Morgan-Short, 2004; Stafford, Bowden, & Sanz, 2012). The progressive inclusion of novel techniques (e.g., eye-tracking, ERP), experiment-generating open-source software (e.g., PsychoPy, Pierce, 2007), and fine-grain analytic tools (e.g., R environment, Core Team, 2017) has resulted from the growing interdisciplinary collaboration between researchers in SLA and in neighboring fields, such as cognitive psychology and cognitive neuroscience, disciplines that rely on sensitive procedures to tap into the workings of the human mind — that is, the phenomena underlying language processing and language learning. SLA scholars

---

* Corresponding author.
  E-mail address: smarijua@calpoly.edu (S. Marijuan).

ascribing to a cognitive framework want to move beyond assessing learners' L2 growth traditionally operationalized as accuracy to understanding how they process the L2 in real time and how those processes differ depending on specific learning conditions and individual variables (Sanz, Morales-Front, Zalbidea, & Zárate-Sández, 2015). Naturally, researchers are also interested in how processes change as experience with the target language increases.

It is now widely accepted that technological advances addressing L2 learners' performance as well as underlying processes can advance our understanding of the role that internal factors, including individual differences (IDs) (e.g., working memory, WM), play in L2 development as they interact with external factors (e.g., learning context). Whereas many studies have shown that changes in accuracy also correlate with changes in processing (e.g., Godfroid, Boers & Housen, 2010; Lado, Bowden, Stafford, & Sanz, 2014; Smith, 2010), others have shown that L2 learners in different learning conditions can exhibit differences in processing even when accuracy remains statistically comparable (Morgan-Short, Steinhauer, Sanz, & Ullman, 2012; Sanz, Lin, Lado, Bowden, & Stafford, 2009). What this range of findings tells us is that the learning of a non-primary language is a complex phenomenon that requires a multipronged approach to understand it. The combination of offline and online measures will help us better address *what* learners can do and *how* they do it under specific learning conditions, including classroom and immersive contexts, and on specific linguistic tasks (e.g., reading sentences, judging grammaticality), all while including individual differences in the picture. Because each measure will yield different information, the researchers' choice will have an impact on the type of inferences researchers can make.

The implementation of technology in the design of SLA research has had a healthy influence on the Study Abroad (SA) domain, which is now also collecting multiple sources of online and offline data to better understand linguistic development in immersive contexts. These studies are the focus of the present article, which is structured as follows. First, we provide an overview of the main online procedures used in current SA research, addressing their suitability to investigating the effects of immersive contexts on L2 development. The challenges and limitations of each procedure are also considered. We then discuss the insights generated by SA studies that have combined online and offline data in their research design. Finally, we briefly detail ways in which surveys and other internet platforms have been used in more qualitative, SA research to collect information on student motivation and program choice, for example. Of interest to practitioners, we also suggest how these tools can be used to help prepare students prior to departure and to improve group dynamics and information flow while abroad. We conclude with ideas for other areas of SA research that might benefit from designs that include technology in order to answer new questions of interest in this growing field.

2. Online techniques for research on L2 processing: characteristics

A reflection of the current growth in the implementation of online techniques in SLA is the number of published literature reviews (e.g., Frenck-Mestre, 2005; Leow, Grey, Marijuan, & Moorman, 2014; Roberts, 2012; Sanz & Grey, 2015; Siyanova-Chanturia, 2013), as well as the increasing number of publications relying on these methods (See Fig. 1). In this section, we review the characteristics, challenges, and limitations of the three most popular online techniques currently being used in SLA, two of which are behavioral – reaction time and eye-tracking – and one of which is neural– event-related potentials – and discuss why they are well suited to investigating the effects of immersive contexts on L2 development.

2.1. Reaction times (RTs)

Reaction time (RT), also named *response time* or *response latency*, or *latency* is probably the most widely used measure of behavioral response. Measured in milliseconds, latency derives from the time elapsed between the presentation of a given stimuli and the response to the stimuli. Cognitive psychologists agree that there are three basic types of RTs; they can be combined: *simple reaction times* (subjects respond to stimuli), *recognition reaction times* (elicited in tasks with two types of stimuli, one of which functions as a distractor, that is, a "go/no go task"), and *choice reaction times* (subjects have to select a
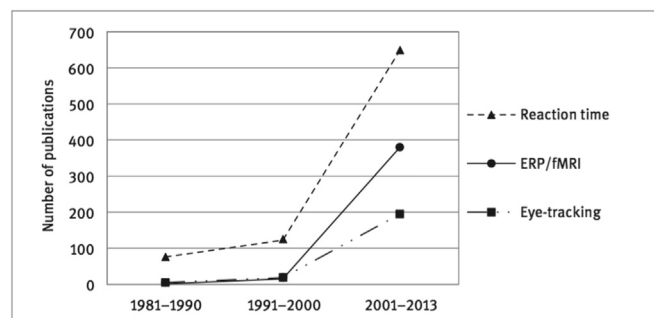

Fig. 1. Publication rates across decades in *Linguistics and Language Behavior Abstracts* (*LLBA*) and *PsycINFO* databases using common keywords for *eye-tracking*, *ERP/fMRI*, and *reaction time* paired with *second language* and *bilingualism* keywords.
Source: Sanz et al, 2015