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**Computer-Assisted SLA**

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Background

Despite the ubiquity of technology in language learning and teaching, and a widespread

interest in its potential to enhance, and potentially transform, language education, research

in the area of technology-assisted second language acquisition (SLA) is both recent and rela-

tively limited. In this chapter we first review how the field has developed, moving away from

its earlier focus on demonstrating the ‘advantages’ of technology, to our current understand-

ing of its affordances and constraints. Next, we review the relationship between SLA and

computer-assisted language learning (CALL) and show how CALL research has increas-

ingly drawn on research in SLA and, in recent years, is starting to exert its own influence on

our understanding of SLA processes. In the following section we draw on the 10 principles

of SLA identified by Ellis (2008) to illustrate this relationship, and conclude with a number

of future directions for the field.

The use of technology in teaching languages is far from new, and language teachers have

long sought to discover how emerging technologies could be effectively used to facilitate the

language learning process. Early, bulky stand-alone tools in the 1980s gave way to the use

of networked machines in the 1990s, which were replaced with more and more sophisticated

and portable tools that allowed increased interactivity and multimedia capabilities through the

2000s and up to the present day. Modern technologies have an almost constant, stable, and fast

connection to the internet in most regions, and devices such as laptop computers, smartphones,

tablets, and wearable technologies have become much more affordable. These technologies

bring with them different affordances, that is, different possibilities and potentialities, which

means that research needs to be carried out in a range of environments to investigate the vari-

ous ways in which the technology may be used for second language (L2) learning.

It is not only the technologies that have developed over time. The methods of research-

ing these technologies have also evolved, moving from the effectiveness studies that pre-

dominated in early years through to more sophisticated studies aimed at identifying how the

specific affordances of these technologies can affect the language learning process (Reinders

& White, 2010). On face value, effectiveness studies do seem to have an important place in

determining how technology can be used in SLA. There is a danger, however, that we fall

into the trap of the ‘burden of proof’ as cited by Burston (2003), where we feel the need to

prove that using technology is more effective than not using it, due to the fact that we have

invested so much time and money in its implementation. One problem with the desire to

demonstrate the superiority of technology is that it has resulted in a body of research that

overclaims the effectiveness of technology in SLA, in many cases with unsuitable or inad-

equate research designs (see Felix, 2008, for a discussion). The question of whether technol-

ogy is effective in SLA still persists, and those who are new to the field will often doubt the

effectiveness of technology use, a fact that has no doubt been the impetus for studies such

as Grgurović, Chapelle, and Shelley’s meta-analysis (2013), which suggested that there is a

small but significant effect of using technology on L2 proficiency, in classroom instruction.

Given the efforts invested by those who implement technology in language learning and

teaching environments, the fact that technology can have a positive impact on SLA is cer-

tainly reassuring. As yet, however, little is known about the mechanisms behind the benefits

attributed to technology in this process. While general learning theories have always occu-

pied a role in CALL research, the field has relied heavily on SLA theories (Hubbard, 2008),

and as such it is not surprising that shifts in theories in SLA are often reflected in CALL as

well (Levy & Stockwell, 2006). In addition, it is becoming increasingly evident that technol-

ogy changes the language learning environment sufficiently that the role of technology itself

must be considered in the theories that are applied in CALL (Stockwell, 2014). Theories

that relate more specifically to technology use have started to be applied to CALL recently,

such as situated learning (Brown, Collins, & Duguid, 1989), which focuses on the ability

of mobile devices to interact with the environment, and dual coding theory (Paivio, 2007),

which considers the provision of input for learners through both visual and audio codes,

thereby allowing input to be processed through different channels.

Over the past several years, however, there has been an indication that studies on the role

of technology can inform SLA theory as well. As an example, the use of technology prob-

lematises the distinction between learning and teaching and the notion of ‘instruction.’ Most

people would probably consider the use of a news website by a classroom teacher to be a

form of instruction. If that same website was used by a student not enrolled in any classes, it

would probably not be considered a form of instruction. But how about a website that offers

self-study language learning resources? Clearly some of the ‘instruction’ in such cases could

be programmed into the website and it could be argued that a form of instruction does indeed

take place. More questionable would be the case of a website designed to pair learners for a

language exchange. In this case the site creates certain conditions for learning to take place

but there is no actual instruction. Clearly, when it comes to technology, the lines between what

does and does not constitute instruction are not clear (see Loewen, 2015). For the purposes of

this chapter, however, we focus primarily on cases where technology is used for direct instruc-

tion. We include all uses of technology, including those not drawing on computers, but use the

commonly used term ‘Computer-Assisted Second Language Acquisition,’ or CASLA. In the

next section, we will focus on some of the current issues that occupy the field.

Current Issues

The earlier focus on demonstrating the superiority of CALL compared with ‘traditional’

instruction has given way to an understanding (in accordance with Kranzberg’s first law of

technology; 1986) that technology is neither beneficial nor detrimental in and of itself. Instead,

the field has more recently concerned itself more with identifying when and how technology

can be used to enhance learning and teaching. Reinders and White (2010) synthesise these

 ‘affordances,’ or potential, contextually determined, and contextually dependent benefits of

using technology, and distinguish between organisational and pedagogical affordances. The

results of their study are summarised in Table 20.1.

The organisational affordances relate to potential benefits for the instructional context,

such as by reducing the cost of delivery (for example, when students engage in computer-

supported self-study), or by making learning and teaching opportunities more widely avail-

able (for example through the use of online resources that can be accessed without time and

space constraints). Pedagogical affordances include the ability to provide opportunities for

situated learning (i.e., learning in context, for example through the use of mobile devices),

opportunities for supporting learning in ways not previously possible (such as through online

monitoring of student progress) and by enabling learners to control different aspects of the

learning process directly (for example by determining the sequence, pace, and method of

learning). However, Reinders and White (2016) argue that the realisation of such affordances

depends on local factors; for example in the case of learner control and empowerment, tech-

nology has in many cases not had a significant impact because its transformative potential

has not been realised due to other aspects of the learning and teaching ecology not allowing

a significant shift in learners’ and (mostly) teachers’ expectations about the role of formal

education. In other words, understanding the impact that technology can have on language

acquisition depends on a deep understanding of all factors involved. This is the focus of the

next section of this chapter.

Empirical Evidence

The large body of research built up in the field of CALL over the past several decades is tes-

timony to the interest in the use of technology in the process of acquiring different aspects of

a L2, including reading (Chun, 2006), writing (Kessler, Bikowski, & Boggs, 2012), listening

Table 20.1 Affordances of CALL

Organisational

affordances

Improved access

Storage and retrieval of learning behavior records and outcomes

Sharing and recycling of materials

Cost efficiency

Pedagogical

affordances

Improved authenticity of L2 input

Improved interaction between learners, between learners and native speakers, as

well as between learners and instructor

Situated learning (e.g., the availability of technology outside the classroom to

support language use)

The use of multimedia

New forms of learning and teaching activities

Nonlinearity (e.g., through hyperlinking of texts)

Alternative forms of (giving and receiving) feedback

Monitoring and recording of learning behavior and progress

Greater control over the learning process

Empowerment of learners and teachers by enabling them to make independent

choices about their own learning (Jones, 2003), speaking (Valle, 2005), vocabulary (Fuente, 2003), grammar (Sauro, 2009)

and so forth. Overviews of research in this area may be found in Levy and Stockwell (2006),

Stockwell (2012) and Thomas, Reinders, and Warschauer (2013), and reveal the sophisti-

cation of the range of studies carried out. The research varies widely not only in the tech-

nologies and the underlying pedagogies used, but also in the focus of the research itself,

including attitudes to technology (e.g., Ayres, 2002; Winke & Goertler, 2008), patterns of

engagement (e.g., Milligan, Littlejohn, & Margaryan, 2014), and, of course, acquisition of

different aspects of a L2.

The results of these studies have also been quite varied, an outcome that is hardly sur-

prising considering the complexities and variables involved in the learning process. Fur-

thermore, empirical measures of SLA in both CALL and non-CALL contexts are typically

limited to one or two specific skills or areas that can be measured through the instruments

that are used, meaning that individual studies can give us only a glimpse into certain smaller

aspects of the larger phenomenon of L2 learning. It is also important to note that, as pointed

out by Felix (2005), focusing only on the outcomes of research into SLA through CALL

is unlikely to give a clear picture of how and why learning takes place, and there is a need

to also investigate the processes of learning in order to understand more fully the role that

technology may play, hence the recent interest in research syntheses and meta-analyses in

this area (e.g., Grgurović et al., 2013; Sauro, 2011).

An important area of research is the provision of (conditions for) interaction with other

people through various forms of computer-mediated communication (CMC). Research into

CMC for language learning has undergone transformations that largely follow technical

developments, and have included text chat (Lai & Zhao, 2006), email (Stockwell & Har-

rington, 2003), audioconferencing and videoconferencing (Wang, 2004), and more recently,

social networking (Mok, 2012). Other forums that have allowed interaction between stu-

dents and their interlocutors have included virtual worlds (Toyoda & Harrison, 2002) and

video games (Peterson, 2012). Each of these forms of CMC brings different combinations

of the affordances listed in the previous section, and has the potential to impact different

language skills and areas as a result of the mode of communication (i.e., textual, visual, and/

or oral), and the degree of synchronicity (e.g., synchronous videoconferencing vs. asyn-

chronous email). Studies have shown that communication through CMC bears a number of

similarities to face-to-face language, specifically in terms of the presence of negotiation of

meaning. As Bower and Kawaguchi (2011) point out, however, the textual nature of many

forms of CMC tends to make learners more likely to notice differences between the language

that they produce and that of their interlocutors, and this may enhance opportunities for

acquiring the target language.

Non-CMC language learning activities have typically seen the role of the computer as

either a tutor or a tool (Levy, 1997). In a tutor role, the technology provides feedback to

learners based on their output, and there is a teaching presence based on some form of

instructional design that is evident in the way that material is presented to the learner and in

the nature of the feedback provided. Studies of this type have included investigations of sim-

ple online authoring activities such as Hot Potatoes (Shawback & Terhune, 2002) at one end

of the spectrum, through to Intelligent CALL systems that analyse and adapt to individual

learner abilities (Heift, 2013) at the other end. There have been a number of studies that have

shown positive outcomes from learners engaging in CALL-based activities; and although

there has tended to be a stronger focus on areas such as vocabulary (Stockwell, 2007), speech

recognition software, grammar (Heift, 2003), listening, and reading, recent years have seen

a steady increase in work in other more production-based areas such as writing (Chen & Cheng, 2008) and speaking (Elimat & Abu Seileek, 2014) as well. As mentioned earlier,

research has moved away from simply determining whether or not CALL is as effective or

more effective than non-CALL; instead more recent research has been concerned with iden-

tifying the individual attributes of CALL that are more likely to lead to SLA. Studies such as

the foregoing have suggested that learners will benefit from having sufficient feedback that

can help them to target problem areas, and that having options to suit different learner styles

means that these tools can be more useful to a wider range of learner proficiencies, language

learning styles, and learner goals.

Thus, technology has been used in an enormous range of ways to take on a mediating

role between interlocutors, a teaching role where it evaluates learner output and provides

feedback, and a utilitarian role serving as to support the learning process. The effectiveness

of technology in promoting L2 acquisition depends on a number of interrelated factors, but

it is possible to consider several principles that are likely to lead to enhanced opportunities

for learners, as described in the following section.

Pedagogical Implications

For this section we draw on the list of principles by Ellis (2005, 2008) in which he proposes

10 ‘generalisations’ of research findings from SLA studies that language educators can use

as the basis for classroom instruction. We use these principles as a starting point to review

studies in CASLA that have been carried out in these areas.

Principle 1: Instruction needs to ensure that learners develop both a rich repertoire of

formulaic expressions and a rule-based competence.

One of the closest links between technology and SLA research has been through the

development and analysis of corpora. The use of fast computers has enabled the identifica-

tion of chunks or formulaic expressions that occur frequently in native-speaker language,

and this has informed both the development of instructional materials and the types of lan-

guage that classroom teachers introduce and assess (Granger, Gilquin, & Meunier, 2015).

Learner corpora have given insight into the way that learner differences impact acquisition,

and also how language develops over time (Myles, 2007). In addition, learner-generated cor-

pora can raise student awareness and independence. By guiding learners to search, analyse

and/or create corpora, common patterns of language use can be identified, as well as their

underlying rules discovered.

Principle 2: Instruction needs to ensure that learners focus predominantly on meaning.

Perhaps the most widely acknowledged contribution of CASLA research has been in

the area of CMC where chat transcripts and other forms of online communication (e.g.,

videoconferencing and the use of virtual worlds) have been extensively investigated,

drawing on theories of SLA. More recently, researchers have also started to explore com-

munication in social networks (Tran, 2016) and digital games (Cornillie, Clarebout, &

Desmet, 2012). Findings confirm the importance of a focus on meaning on SLA and the

ways in which the affordances of different forms of online communication (e.g., synchro-

nous vs. asynchronous, written vs. spoken), different task conditions (with or without

time pressure, with or without access to resources such as online dictionaries, etc.), affect

learning outcomes (Lamy & Hampel, 2007; Sauro, 2011). An increasingly large body of

research now also exists that shows the role of technology in facilitating meaningful and

meaning-focused interaction outside the classroom (see Benson & Reinders, 2011 for a

compendium of such research).

Principle 3: Instruction needs to ensure that learners also focus on form.

The ability for technology to allow focus on form has long been cited as a potential ben-

efit for language learning (Warschauer, 1996), and it is not surprising that there has been a

good deal of research investigating the modes and nature of feedback that enable learners

to focus on form. A recent in-depth discussion of the issue of feedback and focus on form

has been carried out by Ware and Kessler (2013), who outline three modes through which

feedback can be provided to learners. The first of these is face-to-face, where feedback is

provided by either the teacher or peers directly to the learner based on their digital output,

such as writing in a word processor or participation in chat. In other words, although the

output is created digitally, the feedback from the teacher or peers on this digital output is

provided to the learner face-to-face. The second mode is through human feedback that is

delivered electronically. As with the previous mode, this feedback is provided by either the

teacher or peers, but this time the feedback is provided through means such as chat, email

or a learning management system, rather than directly face-to-face. While learners engaged

in communication with others through CMC typically focus on meaning rather than form

(Bower & Kawaguchi, 2011), the shift can be moved somewhat more toward form in tandem

learning (e.g., Kabata & Edasawa, 2011). The degree of synchronicity has also been shown

to have an impact on the degree to which learners focus on form, with synchronous types

of communication such as chat being more lexically focussed than asynchronous forms of

communication such as email (Stockwell, 2010). The third type of feedback that Ware and

Kessler (2013) describe is computer-generated feedback. This refers to feedback that can

provide automated scoring for quiz-type activities for vocabulary (e.g., Stockwell, 2007)

or grammar (Heift, 2003), evaluation of writing (Chen & Cheng, 2008), speech recognition

software (Elimat & Abu Seileek, 2014) or automatic transcription software (Bonneau &

Colotte, 2011) that can be used in pronunciation training. Thus, technology enables focus-

sing on form to be achieved through activities targeting specific areas of the L2 such as syn-

tax, lexicon or pronunciation that are automatically scored and evaluated, as well as through

direct teacher intervention during CALL-based tasks and activities or through computer-

mediated interaction with the teacher or other learners.

Principle 4: Instruction needs to focus on developing implicit knowledge of the second

language while not neglecting explicit knowledge.

Ellis and Shintani (2014) conclude that “instruction needs to be directed at developing

both implicit and explicit knowledge, giving priority to the former” (p. 23). In other words,

there is a need to provide opportunities for learners to develop their knowledge of vocabu-

lary and grammar, while at the same time having sufficient opportunities for natural inter-

actions, which has been argued may play a role in developing implicit knowledge (e.g.,

DeKeyser, 2003). There have been a few recent attempts at examining how technology can

be used in developing both implicit and explicit knowledge. AbuSeileek and Abualsha’r

(2014), for example, looked at how different types of computer-generated feedback could

promote learners’ language development through writing essays, while Andringa and Cur-

cic (2015) examine the role of explicit instruction on how learners process L2 information

online. They provided a brief explanation of a grammatical rule to approximately half the

subjects in their study, and found a positive impact of this explicit instruction on syntacti-

cal acquisition.

Principle 5: Instruction needs to take into account the learner’s built-in syllabus.

Ellis (2005) suggests that learners are more likely to acquire a L2 more effectively and

efficiently if they receive instruction that is “compatible with the natural processes of acqui-

sition” (p. 15). In order to determine individual learners’ developmental levels, teachers

typically need to make assumptions about where learners might be in their built-in syllabus,

or alternatively teachers need to provide broad enough language input that learners can

extract the input that suits their needs. Technology has the potential to provide opportunities

for learners at different points in their development through the provision of multiple path-

ways (Ros i Solé & Mardomingo, 2004). Using technology can allow learners to undertake

activities in a nonlinear fashion, where the content can be covered in an order that suits the

learners’ own individual needs and preferences. Therefore, learners can make choices in the

learning process in a way that gives them freedom to undertake learning depending on their

own built-in syllabus. While of course learners may not be explicitly aware of where they

are in their own development, they will likely have a sense of what they feel is too difficult

or too easy, and as such may be able to decide on engaging in content that they perceive as

being appropriate to their learning needs. The way in which these choices are made avail-

able to learners is, of course, very dependent upon the instructional design, and there is a

need to bear in mind this important affordance when designing applications for CALL, and

capitalise upon it as much as possible.

Principle 6: Successful instructed language learning requires extensive second lan-

guage input.

The advent of the internet in the early 1990s had an enormous impact on the availability

of authentic input in the L2. Known retrospectively as Web 1.0, this resource typically took

the form of static web pages in the initial stages, such as news and other informational sites,

making it possible for learners to have access to large quantities of authentic target language

input. Of course, one limitation with this type of authentic input is that it is targeted at native

speakers, and as such it is often too difficult for learners of a lower or intermediate level

of proficiency. Nonetheless, there are resources available in many languages (albeit pre-

dominantly English) that have been simplified for language learners. One example of this

is BBC Learning English, which provides a simplified version of news and human interest

reports, along with learner support, such as vocabulary glosses and subtitles, in various other

languages. A major goal that remains for teachers is designing learning activities that take

advantage of the large range of authentic materials that are available in order to have suf-

ficient input that is appropriate to the learners’ proficiency levels.

Technology affords other sources of L2 input as well. The most obvious of these is CMC,

where learners can receive input that is delivered through multiple modes and that is modi-

fied during interaction, depending on communication needs (Blake, 2000). This language

input can be either textual (i.e., text chat or email) or aural (i.e., audio- or videoconferenc-

ing), and as such learners can develop both reading and listening skills depending on the type

of CMC they are engaged in. A benefit that has been cited for textual forms of CMC is that

they can allow the learner to focus more on language input and output in that they have time

to use tools such as dictionaries in processing the content of a received message, and at the

same time can review the content of a message before sending it to the interlocutor (Blake,

2013). Video and audio conference, in contrast, place a greater burden on learners to process

input and to produce output in real time, and thus have been shown to result in a greater lexi-

cal focus and are more suited to learners of a higher proficiency (Stockwell, 2010). Added to

this is the dimension of multimodality, where textual, oral, and even graphic modes of CMC

may be used in a single communication act (Hampel & Hauck, 2006). The use of multiple

modes makes it possible for learners to activate different knowledge bases that can assist in

facilitating acquisition of the L2.

Principle 7: Successful instructed language learning also requires opportunities for

output.

The role of the internet has changed significantly in recent years, largely as a result

of the emergence of Web 2.0, which enables individuals to not only access information

from the internet, but also to post information and to communicate with one another using

various CMC tools. One of the primary advantages of these recent developments is that it

makes it far easier for individuals to make contact with others, regardless of geographical

location. Communication can take place on a one-to-one basis, such as through email,

messaging or video chat, but technology can also enable information to be disseminated

to a larger, and at times unknown, audience as well. As described earlier, CMC has been

widely cited in CASLA research, and there are various tools that can be used to provide

learners with opportunities to produce both written and oral output. There have been

demonstrated differences in the quantity and quality of the language produced through

synchronous CMC and asynchronous CMC, where synchronous CMC tends to be syn-

tactically simpler and more lexically focused than asynchronous CMC (Stockwell, 2010).

How to capitalise pedagogically on these differences, however, remains a challenge for

teachers.

These developments have also made it possible to post information that can be

accessed by a larger audience, through such forums as blogs (e.g., Pinkman, 2005) and

wikis (e.g., Kessler & Bikowski, 2010), and research into blogs and wikis has indicated

that learners have experienced motivational advantages through communicating to an

authentic audience. The last few years have also seen an increase in the use of social

networking as a potential forum for facilitating learner output as well, and more studies

are appearing that examine not only the nature of learner output in these forums, but have

also made it apparent that there are cultural factors that need to be kept in mind regarding

the acceptance of technology in different cultural environments (e.g., Mok, 2012; Liu,

2013). Needless to say, however, technology has opened up the classroom to allow com-

munication to extend beyond just between fellow students and the teacher to a range of

interlocutors, providing opportunities for both oral and written language output in varied

genres and contexts.

Principle 8: The opportunity to interact in the second language is central to developing

second language proficiency.

The importance of interaction for SLA is widely recognised (Gass & Mackey, 2015)

and numerous studies have demonstrated the benefits of negotiation, the provision of

negative feedback, and the meaning-oriented nature of L2 interaction, among others.

Many technology-mediated environments are predicated on the notion of social interac-

tion, with social networks being the most visible example. Participation in social net-

works has been shown to increase students’ sense of ownership, meaningful interaction,

and identity-building, as well as students’ motivation (Mills, 2011; Toetenel, 2014), as

has the impact of the interaction in digital games (Peterson, 2012; Reinders & Wattana,

2015). It appears digital games increase students’ willingness to communicate, and the

amount and range of language they produce as a result. Another, much longer established

form of interaction is afforded through online language exchanges, whereby CMC tools

enable L2 learners to connect with other L2 learners, or—more commonly—where L2

learners can connect with native speakers of another language, who in turn are learning

their interlocutors’ first language. This type of interaction has been shown to have ben-

efits for both language acquisition, as well as the development of intercultural competence

(Lamy & Hampel, 2007).

Principle 9: Instruction needs to take account of individual differences in learners.

CALL has long been used to personalise instruction to learners, in order to take individual

differences into account. Where classroom instruction is necessarily limited in the ways it

can cater to learners with different backgrounds, aptitudes, interests, and so on, CASLA

resources can be used to (1) identify such differences and (2) tailor instruction accordingly.

While early predictions, particularly in the area of iCALL, or intelligent CALL, claiming that

computers (at that time) would take over most language instruction, have been proven to be

overblown, some definite advances have been made.

In particular in the area of language testing, computer-adaptive testing, where learners’

responses to previous items determine the difficulty of subsequent ones, has now come to

be used widely in language testing (Tseng, 2016). Similarly, computerised diagnostic tests

(which may or may not use adaptivity) are able to quickly determine a learner’s approximate

level (Poehner, Zhang, & Lu, 2015).

In terms of social and affective differences impacting on learning, CASLA has been used

to support learners in manipulating their learning experiences based on their own prefer-

ences, and to guide them in developing the skills necessary to do so, thus providing both

the ‘learner training’ and ‘flexibility’ Ellis and Shintani (2014) refer to. Online self-access

resources (Reinders & Darasawang, 2012) allow learners to take some degree of control over

their learning while still being guided. A similar approach is the use of Personal Learning

Environments (or PLEs; Plastina, 2015), which use commonly available communication

tools to support learners in goal setting, monitoring their progress, and building portfolios.

An important feature of such environments is their social aspect, which allows learners to

connect with peers, outside of the language classroom.

The use of CASLA resources has enabled language instruction to adopt a flipped

approach (Hung, 2015) whereby classroom time is used to provide individual support,

while learners work on tasks appropriate to them and prepare for classroom time either on

their own or with peers. Materials and resources that can be accessed outside of the class-

room and that provide automated feedback free up the teacher to work on other things.

However, it could be argued that the most important contribution of CASLA to better

accommodating learner differences has been to provide educators and learners with the

tools to allow them to extend formal education to nonformal (related to formal educa-

tion but separate from it) and informal (unrelated to formal education) spaces 1 (Benson,

2011). Through this extension, learners have access to a much wider range of learning

opportunities, provided not just in the way the teacher deems appropriate, but that can be

adjusted by learners themselves.

Principle 10: In assessing learners’ second language proficiency, it is important to exam-

ine free as well as controlled production.

CALL can involve written or spoken language conducted either with other people (i.e.,

CMC) or directly with the computer. As described earlier, CMC may include text chat,

email, audio chat, video-conferencing, social networking, and digital games, and the nature

of the language produced will depend very much on the assigned tasks. Communication

tasks through CMC would generally be considered as a forum for free language production,

and there has been quite extensive research into these types of activities and their impact

on SLA (e.g., Monteiro, 2014; Stockwell & Harrington, 2003; Tare et al., 2014). These

studies have shown that learners engage in similar behaviours that are exhibited in face-

to-face contexts, but that the mode of communication has an impact on the complexity and

accuracy of the language produced.

Controlled production tends to occur when learners interact directly with the computer

itself. Both written and oral production can fit into the category of pattern matching,

where only a limited number of responses to a prompt are considered acceptable. These

responses typically take the form of a short answer to a question, or sentence-level trans-

lation (e.g., Heift, 2003). Alternatively, interacting with the computer can also include

continuous production, where language can be analysed for features such as grammati-

cality and style (see Ware & Warschauer, 2006). Oral production depends heavily on

automatic speech recognition (ASR), which converts oral output into textual form so

that it can be parsed for use in either pattern matching or continuous forms of analysis.

Speech recognition is an area that shows a good deal of promise, and while there are still

limitations with the accuracy of recognition of language produced by nonnative speakers

(Warren, Elgort, & Crabbe, 2009), developments are occurring rapidly to overcome these

difficulties (Ross, 2015).

The ways in which technology can be used to enhance L2 acquisition have shown to be

broad, but the same basic principles of best practice for instructed SLA can still be applied.

This is not to say that the role of technology should be ignored, but the fact that technol-

ogy will necessarily make a difference to the overall learning environment must be kept

in mind (Levy, 2000; Stockwell, 2012). That is to say, that when technology is introduced

into the equation, it will have some impact on the ways in which learners interact with

the content, with other learners, or with the teacher. In saying this, however, the ultimate

aim of learning a language remains the same, and technologies can be used to facilitate

this provided instruction takes into consideration the affordances of the technology and

the environment.

Future Directions

There are three broad areas where technology is likely to have a significant influence on

the way people learn languages in the coming years, and where there exists an urgent need

for research to understand how learners interact with and can benefit from the technologies

that are being used in their language learning contexts. Rather than attempting to pinpoint

the always-changing technologies, instead in this section we identify three broad areas of

affordances that new developments offer.

Mobility

Probably the most developed of the three areas is our understanding of the benefits of

mobility on language acquisition. Reinders and Pegrum (2016) propose a framework for

evaluating MALL (mobile-assisted language learning) resources and identify a range of

affordances, such as their ability to extend learning beyond the classroom, the opportunities

for social interaction, and options for personalising learning, among others. What is not well

understood, however, is how learners use mobile resources for the purpose of learning, and

how teachers can best support learners in this endeavor.

Augmentation

Relevant in the context of MALL as well as more broadly in education in general, Atkinson

(2010) cites Semin and Cacioppo (2008, p. 140) as saying that “a sea change in research and

theory” has occurred where now much greater recognition exists of embodied, extended,

and distributed forms of cognition. The former sees cognition as grounded in and intricately

linked to bodily movements and states. Extended cognition (Clark & Chalmers, 1998) sees an

interdependence between the mind and its environment. Distributed cognition further recog-

nises that knowledge can be held in networks, with each element in a network having access

to the knowledge but only in relation to other elements in that network, resulting in greater

efficiency (Clark, 2008). Theories of embodied, extended, and distributed cognition offer

an alternative to cognitivist views of language acquisition. As learners have ever-increasing

access to tools and resources to help them acquire and use the language, this is likely to have

a significant impact on how (and even if) languages are learned (in particular as machine

translation, natural language processing, and related technologies become more powerful).

Mobile technologies, for example, with their affordance for situated learning, allow learn-

ers to be offered context-specific vocabulary, or pragmatically appropriate conversational

language (Pegrum, 2014). The use of touch and gestures for interacting in CALL can also be

beneficial for language learning (Reinders, 2014), and haptic feedback has potential for pro-

viding alternative forms of input enhancement and correction (Reinders, 2014). Virtual and

augmented reality tools enable the seamless combination of physical and digital resources,

so that, for example objects in a room can be ‘annotated’ with their foreign language transla-

tion, as learners interact with them, wearing headsets or other forms of wearable computing.

Ubiquity

There is considerable discussion at present about the potential for disruption from ‘the

internet of things’ (IOT) and related technologies. IOT refers to the connection of physi-

cal devices, such as cars, fridges, syringes, and door handles, to the internet, and estimates

range from 20–100 billion connected devices by 2020 (Evans, 2011). The first applications

are starting to be seen in health, for example by monitoring outpatients’ medicine intake or

tracking the location of equipment in hospitals. The potential of IOT for education is only

just starting to be explored with the first projects looking at the ways in which rooms can

recognise learners and track attendance, and where items such as books can record and report

usage and achievement, or even adjust content depending on performance or the location

where the learner is at a given time.

What all these areas have in common is that they extend language learning beyond

the classroom, as well as beyond formal education. As a result, it is likely that learning

will become not only more of a lifelong (spanning one’s lifetime) but also a lifewide (not

confined to a particular location, such as a school) activity. Technology will increasingly

allow learners to gain access to learning opportunities that are not only increasingly var-

ied, but also increasingly connected to other learners, and increasingly individualised. The

impact of these developments on SLA offers a fascinating and as yet underexplored field

of research.

Note

1. Benson distinguishes between these as follows: “non-formal education often refers to classroom or school-based programmes that are taken for interest and do not involve tests or qualifications, while

informal education refers more to non-institutional programmes or individual learning projects”

(2011, p. 10).

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