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Second language fluency and its underlying cognitive and social determinants

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Abstract: In studying second language (L2) fluency attainment, researchers typically address questions about temporal and hesitation phenomena in a descriptive manner, cataloguing which features appear under which learning circumstances. The goal of this paper is to present a perspective on L2 fluency that goes beyond description by exploring a potential explanatory framework for understanding L2 fluency. This framework focuses on the cognitive processing that underlies the manifestation of fluency and disfluency, and on the ways social context might contribute to shaping fluency attainment. The framework provides a dynamical systems perspective of fluency and its development, with specific consequences for a research program on L2 fluency. This framework gives rise to new questions because of its focus on the intimate link between cognitive fluency and utterance fluency, that is, between measures of the speed, efficiency and fluidity of the cognitive processes thought to underlie implementation of the speech act and measures of the oral fluency of that speech act. Moreover, it is argued that cognitive and utterance fluency need to be situated in the social context of communication in order to take into account the role played by the pragmatic and the sociolinguistic nature of communication in shaping L2 fluency development.

Keywords: L2 fluency, second language learning, cognitive processing

1 Introduction

Discussions about how to assess second language (L2) fluency often begin by acknowledging that the meaning of the term *fluency* is quite difficult to pin down. For example, in English the word *fluency* can mean different things in different contexts. Sometimes it refers to a person's global competence or proficiency (*She is fluent in Japanese*), sometimes to the fluidity of speech (*He is a fluent public speaker*), sometimes separately to speaking, listening, reading, or writing abilities. Also, translating the term *fluency* into other languages can be difficult; French

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aisance à l'oral 'ease of speaking' focuses on the speaker's experience whereas the Spanish *fluidez* 'fluidity' focuses on the quality of the action. This variability is problematic because a meaningful discussion about fluency requires agreement on what is being talked about. The solution to this problem has typically been to narrow the focus to just one meaning. In this regard, a distinction is often made between knowledge of the L2 (e. g., of phonology, vocabulary, syntax, semantics, sociolinguistic and pragmatic considerations) and the *fluency* or fluidity with which a speaker is able to implement that knowledge (rate of speech, pausing, hesitation and other temporal phenomena). There remains, however, a deeper problem.

This deeper problem has to do with the goal one has in mind when investigating L2 fluency. Often the goal involves *describing* L2 speakers' fluidity in order to highlight differences between their speech and that of native speakers, and then (sometimes) following up with qualitative analyses to make inferences about possible reasons for the observed disfluencies (e. g., Tavakoli 2011). Such descriptions provide valuable insights into the nature of fluency and can be useful for comparing the impact of different learning experiences on fluency attainment or for studying the relationship between a particular variable (age, aptitude, ethnolinguistic identity, intelligence, learning style, personality) and fluency development. As a strategy, however, this approach has limitations; it does not address the problem of how to decide which speech features to look at or how best to operationalize them (for reviews see Kormos 2006; Segalowitz 2010). Without a principled way to narrow down choices, the field risks becoming populated by a collection of studies whose results are difficult to relate to one another and from which to draw clear generalizations. This poses a challenge for defining what constitutes progress in the field, especially with respect to developing a theory of L2 fluency acquisition. However, an alternative exists.

This alternative involves trying, from the outset, to *explain* L2 fluency. Here the aim is to identify, in a theory-driven way, the mechanisms and processes responsible for L2 (dis)fluency. An explanatory approach would make it possible to chart progress in the field; as mechanisms and processes underlying fluency phenomena become identified, the initially very large number of possible fluency phenomena to study becomes reduced. Patterns begin to emerge and fluency can be situated in the larger context of L2 acquisition as a whole. This paper reviews a framework for such an approach (originally presented in Segalowitz 2010, but discussed here in light of recent developments).

Three ideas are central to the framework. The first comes from Goldman-Eisler (1951, 1961, 1968) whose pioneering work set the stage for subsequent research on L2 fluency. She wrote that "the complete speech act is a dynamic process, demanding the mobilization in proper sequence of a series of complex procedures and is the temporal integration of serial phenomena" (1968: 6).

Goldman-Eisler points to the central role played by cognitive mechanisms in shaping the temporal phenomena of oral fluency and she draws attention to how these mechanisms are organized into a dynamic system. The second insight comes from Rehbein (1987) for whom being fluent "means that the activities of planning and uttering can be executed nearly simultaneously by the speaker of the language" (p. 104). Rehbein points to the rapid speed, automaticity and efficiency of the underlying mechanisms responsible for fluent L2 speech. Finally, Meisel (1987) emphasizes the importance of the communicative acceptability of the speech act, that is, its communicative fit according to the expectations of the interlocutor. Taken together, these three insights suggest that the study of L2 fluency needs to focus "on features of L2 performance that are reliable indicators of how efficiently a speaker is able to mobilize and temporally integrate, in a nearly simultaneous way, the underlying processes of planning and assembling an utterance in order to perform a communicatively acceptable speech act" (Segalowitz 2010: 165). This goes well beyond that of describing and documenting fluency phenomena, and it has implications for how to approach questions about L2 fluency in a systematic way.

2 L2 utterance, cognitive and perceived fluency

For the perspective presented here, we first need to distinguish among three aspects of L2 fluency – L2 utterance fluency, L2 cognitive fluency, and L2 perceived fluency.

2.1 L2 utterance fluency

L2 utterance fluency refers to the fluidity of the observable speech as characterized by measurable temporal features, such as syllable rate, duration and rate of hesitations, filled and silent pauses, and including what Skehan (2003) has identified as breakdown fluency and repair fluency. Often such features can be operationally defined in more than one way (Hilton 2014; Kormos 2006; Segalowitz 2010) and indeed, for some features debate exists about how best to do this. For example, De Jong and Bosker (2013) recently addressed the problem of how to choose the lower threshold (minimum duration) for defining disfluent silent pauses, long believed to be an important marker of oral fluency. As they pointed out, until recently researchers have used a wide variety of lower thresholds, from 100 to 1000 milliseconds. De Jong and Bosker (2013) analyzed

the speech of L2 speakers of Dutch performing a variety of speaking tasks. They looked at how speakers' pause rates correlated with a vocabulary size measure of overall proficiency as a function of 21 different lower cut-off thresholds (20, 50, 100, and then up to 1000 milliseconds in 50 milliseconds steps). They found that a minimum duration threshold of around 250–300 milliseconds yielded the highest correlation between silent pause rate and L2 proficiency, peaking around $r = -0.53$ (lower pause rate associated with greater vocabulary size). When silent pauses were defined by shorter or longer duration thresholds, the correlations were much weaker. Interestingly, in contrast to silent pause *rate*, mean pause *duration* did not yield significant correlations with vocabulary size. This study represents an important advance in fluency research because, for the first time a cognitive measure of L2 proficiency (here, vocabulary size) was used to justify selection of a particular operational definition of an utterance fluency feature (here, the minimum duration for defining silent pauses) and to demonstrate its superiority over competing operational definitions (the other proposed cut-off threshold levels). This finding moves the discussion of how utterance fluency reflects cognition from speculation to empirical test. Moreover, the strategy of looking at the association between a cognitive measure and an oral fluency measure led to the conclusion that silent pause *rate*, and not mean silent pause *duration*, was the relevant pause feature to focus on.

2.2 L2 cognitive fluency

L2 cognitive fluency refers to the fluid operation (speed, efficiency) of the cognitive processes responsible for performing L2 speech acts. This includes not just the articulatory act itself but the mobilization and temporal integration of mental processes that give rise to the utterance (Goldman-Eisler 1968). These cognitive processes thus include the speed and efficiency of semantic retrieval, the handling of the attention–focusing demands inherent in utterance construction, operations in working memory, among others.

Before continuing to explore cognitive fluency as it relates to utterance fluency, it is important to contrast the cognitive fluency under discussion here from two other kinds encountered in the literature. One of these concerns the fluency of *general-purpose* cognitive control processes involved in the regulation of all mental activities and behaviours, including in the L1. These include monitoring and updating operations in working memory, shifting focus of attention between mental sets, and inhibiting or overriding responses, among others (Miyake and Friedman 2012). The fluidity (speed, smoothness, efficiency) with which these processes operate can vary across individuals and are treated as

relatively stable person characteristics. These individual differences may explain some of the variability across individuals in the L2 (e. g., poor general working memory has been shown to affect L2 learning; Linck et al. 2014; Williams 2011), but individual differences in *general*-purpose cognitive processing alone cannot explain disfluency that is *specific* to the L2 (e. g., slower lexical access in L2 than L1; Segalowitz and Freed 2004). For this reason, the focus needs to be on *L2-specific* modes of cognition that might underlie L2 utterance fluency.

Of course, measures of some cognitive skill related to L2 processing, for example speed of lexical access in the L2, are likely to also pick up on aspects of related, general-purpose skills (e. g., aspects of lexical access that are not specific to any given language). This is certainly true for utterance fluency, where people's general speaking style (e. g., speech rate tendencies) can result in L1 and L2 utterance fluency measures correlating with each other (De Jong et al. 2013). Thus, for example, some aspect of L2 speech rate may partly reflect a habitual way of speaking, in addition to an aspect that is L2-specific. The same is most certainly likely to be true for measures of cognitive fluency (Segalowitz 2010). Because the L1 is highly overlearned and practiced, L1 performance can be thought of as providing baseline levels of cognitive and utterance fluency characteristic for each individual. L1 measures thus provide a good way to control for such potential confounds and can be used to obtain *L2-specific* measures (e. g., by residualizing the L2 data against L1 data). Using L1 measures as baseline has other benefits. It helps to control for individual differences in handling particular task demands that are otherwise unrelated to language. For example, individuals may differ in basic motor speed when pressing a reaction time panel or differ in intelligence, motivation, or personality in ways that affect task performance, thereby adding noise to the data. For all these reasons, research needs to focus on L2-*specific* measures of cognitive fluency and utterance fluency, something that is still not common practice in fluency research.

The other kind of fluency not to be confused with the cognitive fluency under consideration here is *subjective cognitive fluency*. This refers to the idea that when people perform cognitive acts they often have a sense of the ease with which they carried them out, such as the ease of recalling a word or recognizing a picture (Tversky and Kahneman 1973; Unkelbach and Greifeneder 2013). These experiences can sometimes be misleading to the person having them and result in cognitive illusions, such as believing that a stimulus that feels very familiar must have been recently presented when in fact it had not. Such cognitive illusions – and the subjective experiences of cognitive fluency that give rise to them – may even play a role in L2 fluency development by, say, affecting motivation to learn or to use the target language in a given situation (see Segalowitz 2010). However, the mechanisms underlying these subjective

experiences must be distinguished from the cognitive mechanisms that give rise to the observable features of utterance fluency.

Returning now to L2-specific cognitive fluency, there are several promising candidate measures to consider, among them speed and efficiency of making word-meaning links, operationalized respectively as reaction time (RT) speed and RT stability (coefficient of variability (CV) of RT; Segalowitz and Segalowitz 1993). Note that De Jong and Bosker (2013), in the study cited earlier, used a proficiency-related cognitive measure, namely L2 vocabulary size, to evaluate a potential utterance fluency measure. Vocabulary size, however, is not a cognitive *fluency* measure. It is a knowledge measure, although it may be strongly associated with cognitive fluency (and even with spoken fluency; Hilton, 2008). It would be interesting, therefore, to see whether a cognitive *fluency* measure would support, perhaps even more strongly, the specific results obtained in De Jong and Bosker's (2013) study. Regarding the RT and CV measures, initial support for these as L2 cognitive fluency measures comes from a study by Segalowitz and Freed (2004). They obtained RTs and CVs from a visual word semantic categorization (living-nonliving) task and found them to be associated with L2 fluency (degree to which speech was free of filled pauses). In that study, the cognitive fluency measures were L2-specific (residualized against the L1) but the utterance fluency measures were not (L1 oral measures were not available). (For more recent discussion of RT and CV as predictors of L2 proficiency, see Ankerstein 2014, and Lim and Godfroid 2014).

Another cognitive fluency measure proposed to underlie L2 utterance fluency is flexibility in the control of *linguistic attention* (Segalowitz 2010). This relates to the way grammatical elements (e. g., spatial prepositions; conjunctions) direct attention to relationships between elements within utterances. Linguistic attention flexibility can be operationalized as a switch cost measure (in milliseconds) obtained from an alternating runs experimental design (Rogers and Monsell 1995). Using this design, Taube-Schiff and Segalowitz (2005), Segalowitz and Frenkiel-Fishman (2005) and more recently Duncan, Segalowitz and Phillips (2014) have shown, in different ways, that linguistic attention is related to L2 proficiency. In these experiments, participants performed two different but closely related tasks in a sequence that involved repeats and shifts of attention focus. For example, in Taube-Schiff and Segalowitz (2005), in Task A participants had to judge the verticality meaning (ABOVE/BELOW) of sentence fragments containing phrases such as *over the spot*. In Task B the same participants judged the proximity meaning (CLOSE/DISTANT) of sentence fragments containing phrases such as *near the place*. The tasks were sequenced to repeat and shift in the pattern ...AABBAABB... so that on half the trials attention focus was on a repeat of the previous task type and on half the trials attention focus had to shift. The RT difference between shift and repeat trials

provided an index of attention focus flexibility. The results revealed an L2-specific cognitive shift cost – that is, a linguistic attention effect. This study, however, looked only at the relationship between L2 linguistic attention and L2 proficiency, and not L2 utterance fluency as such, something future research could address. It is reasonable to suppose that linguistic attention skill underlies some aspects of utterance fluency. This is because speaking fluidly requires shifting attention focus continuously while packaging information to make the utterance unfold properly. Poor cognitive control of linguistic attention may thus underlie aspects of L2 utterance disfluency (see Segalowitz 2010, for fuller discussion).

To date, RT speed and stability measures of cognitive fluency have always been obtained from visual, receptive tasks (i. e., judgments of visually presented words or sentence fragments). In contrast, utterance fluency measures are based on oral production tasks. This potential mismatch merits some comment. The cognitive tasks used are generally very simple and would not seem to pose modality-specific challenges (e. g., visual perceptual difficulties) that are otherwise unrelated to the language performance of interest. For example, in the task aimed at measuring lexical access (e. g., Segalowitz and Freed 2004), participants are simply asked to indicate whether *boat* refers to a living or nonliving object. In the task aimed at measuring sentence construction skill (Lim and Godfroid 2014), people have to indicate, for example, which word – *does* or *he* – best continues the sentence fragment *I wonder what*…. Moreover, while these cognitive tasks do have a receptive aspect – namely, the stimulus must be read – they nevertheless also possess a production aspect in that one must mentally generate a word's meaning or mentally construct a sentence or sentence fragment. Also, these tasks are relatively free of articulation demands (they do not require oral production) and therefore they overlap little in demand characteristics with the tasks yielding the utterance fluency data. For these reasons, RT speed and stability measures of performance are suitable for studying the cognitive fluency underlying L2 speech production.

In sum, L2 cognitive fluency is the rapid and fluid mobilization of the complex cognitive procedures referred to by Goldman-Eisler (1968), and this includes the automatization of these processes which Rehbein (1987) called the nearly simultaneous execution of planning and uttering activities (corresponding to Levelt's (1989, 1999) formulator and articulator levels of the speaking process). Both L2 cognitive fluency and L2 utterance fluency can be operationalized and measured in both L2 and L1 contexts, thus making it possible to obtain L2-specific measures of each. In this way, L2 fluency can be unpacked into two separate but related components – cognitive and utterance fluency. Before continuing discussion of these two and the proposed framework, however, it will be useful to consider one more dimension of L2 fluency – fluency as experienced by the listener/observer.

2.3 L2 perceived fluency

While the framework discussed in this paper focuses on L2 utterance and L2 cognitive fluency, it is important to consider briefly L2 *perceived* fluency and to distinguish it from L2 utterance fluency. L2 perceived fluency refers to subjective judgments of L2 speakers' oral fluency. Researchers often use such judgments to assign fluency levels to the L2 speakers under study (Bosker et al. 2012; Derwing et al. 2004; Préfontaine et al. 2015). Perceived fluency can reflect something about the objective characteristics of oral fluency. For example, Préfontaine (2013) collected fluency measures from L2 learners' of French, using three different speech elicitation tasks. She found that native speakers' ratings of L2 fluency correlated significantly with the L2 speakers' self-ratings of their fluency, and that these self-ratings did correlate significantly with objective utterance fluency measures. The strength of these significant correlations varied as a function of the speaking task, ranging from around 0.31 to around 0.65, indicating that perceived fluency is reliably related to objective measures of utterance fluency but that nevertheless there remains a great deal of variance in the objective measures not accounted for by the perceived fluency measures. It should also be recognized that an interlocutor's perception of and judgment about a speaker's fluency could potentially have an impact on the course of an interaction. For example, if an interlocutor's perceptions are somehow communicated to the speaker, this might lead the speaker to reallocate the amount of attention devoted to speech, thereby influencing the fluency and other characteristics of the L2 output. For theoretical perspectives relevant to this point see Michel (2011), Robinson (2011), and the volume edited by Housen et al. (2012). In sum, research on the topic of perceived fluency is important for at least two reasons. One is that it is useful to understand what speech features listeners focus on when drawing conclusions about a speaker's L2 fluency and proficiency. The other is that listeners' judgments of an L2 speaker's fluency may in some circumstances affect how speaker and listener interact, with consequences for the speaker's fluency.

That said, from the perspective of the framework under discussion here, it is nevertheless important to keep in mind that perceived fluency can only provide a *subjective* measure of utterance fluency and is only moderately associated with the objective measures of oral fluency. Moreover, measures of perceived fluency are seldom, if ever, adjusted to take into account fluency in the speaker's L1 (presumably because the speaker is assumed to be maximally fluent as a native speaker), despite the importance of this adjustment for obtaining L2-specific measures. For these reasons, perceived fluency is not an appropriate way to assess utterance fluency if the goal is discover links between cognitive fluency and utterance fluency.

3 A framework for understanding L2 fluency

So far, discussion has focused only on how to identify L2-specific utterance fluency features, especially those related to L2-specific aspects of cognitive fluency. Such identification will yield a catalogue of utterance features that goes beyond simply describing speech because it will also specify the connections between these features and their cognitive underpinnings. However, while useful, such a catalogue is nevertheless somewhat limited. These L2-specific cognitive-utterance fluency associations should also be situated within in a broader, theoretical perspective that can provide a basis for understanding the challenges that fluency poses to learners and possible routes for overcoming these challenges. As a step toward creating this broader perspective, it is useful to consider two ideas in particular. One comes from a *usage-based* approach to language acquisition and communication, and the other comes from a *transfer appropriate processing* approach to memory.

3.1 A usage-based approach to language acquisition and communication

Up to this point, the discussion of L2 fluency has been largely decontextualized from the social and communicative situations in which language is acquired. What is missing is recognition of Meisel's (1987) point that speech acts must also have good communicative fit with interlocutors' expectations. Tomasello's (2003) usage-based approach to language acquisition provides a way to repair this (see also Barlow and Kemmer 2000, on usage-based theory in applied linguistics). Tomasello (2003) and Lieven and Tomasello (2008) point out that, normally, when people speak to each other, they engage in two important activities. The first is to establish joint attention, that is, getting each other to attend to objects, ideas and their inter-relationships in a specific way. People communicate not (only) about specific things and ideas, but about perspectives and ways of construing the world (e. g., *The man stood in front of the tree* conveys a different perspective from *The tree was located behind the man* even though both describe the same basic scene). The linguistic tools for establishing joint attention include, among other things, grammatical devices for conveying a particular perspective of the situation being talked about (here, insights from cognitive linguistics and construction grammar theorists are especially relevant; see Fauconnier 1994; Goldberg 1995; Langacker 1987, 1991; Talmy 2008). The second activity that interlocutors engage in is that they try to read and convey

messages about social intentions (e. g., is the message meant to be informative, an admonishment, supportive, sarcastic, solicitous, etc.). The social message is a subtext conveyed in parallel with the main cognitive message. People always try to deal with the social message, even if it does not seem to be the main focus of the conversation. In sum, according to this attention/intention perspective on the nature of language communication, normal communication involves interlocutors attempting to establish joint attention and reading each other's social intentions.

Tomasello (2003) and Lieven and Tomasello (2008) developed this attention/intention perspective in terms of its implications for L1 acquisition. With respect to L2 acquisition, the question of interest here is how these attention/intention demands of communication might have an impact on a person's ability to speak fluently. There are two important points to consider here. One concerns the linguistic knowledge needed for carrying out the attention/intention functions of communication, and the other the role played by the attention/intention aspect of communication in memory retrieval. Regarding linguistic knowledge, to achieve a high level of fluency one clearly needs to master the target language's devices used for establishing joint attention and for conveying and reading social intentions. Establishing joint attention will require vocabulary knowledge for naming objects, events and their properties plus knowledge of the structural devices for appropriately conveying a perspective on the relationships among what is named (knowledge of how function words convey relationships, of word order conventions, agreement patterns, etc.). Conveying social intentions will require knowledge of the sociolinguistic and pragmatic dimensions of language use – choice of register, register shifting, idioms and fixed expressions, prosody, etc. Poor knowledge of these aspects of the target language could compromise the ability to communicate fluently by leading to inefficient word searches and awkward attempts to produce appropriately structured utterances. Beyond this, however, there is a second, less obvious way that the attention/intention aspect of communication may have an impact on L2 fluency. This brings us to the topic of transfer appropriate processing in memory retrieval.

3.2 Transfer appropriate processing

Transfer appropriate processing refers to the idea that "memories are represented in terms of the cognitive operations engaged by an event as it is initially processed, and that successful memory retrieval occurs when those earlier operations are recapitulated" (Rugg et al. 2008: 340; see also Danker and Anderson 2010; Roediger et al. 2002; Roediger and Guynn 1996; Tulving

and Thompson 1973; Wing et al. 2015). This means a person's memory for recently learned information is linked to representations of the perceptual and cognitive activities that were engaged in when acquiring the information earlier. This is why, for example, during recall we often remember "irrelevant" pieces of accompanying information, such as what we were doing at the time we learned something. Transfer appropriate processing has the following implication for a framework for thinking about L2 fluency. Fluent speech requires rapid, smooth retrieval of information for formulating and articulating the intended message (Levelt 1989, 1999). This retrieval takes place under communication conditions that normally involve having to handle attention/intention demands that were described earlier. According to the principle of transfer appropriate processing, retrieval at the time of need will be facilitated (become more rapid, smooth, efficient) if, at the time of original learning, the learner also had to deal with attention/intention demands similar to those required at the time of need. An implication of this idea is that developing fluency requires L2 learning that takes place in genuinely communicative contexts, that is, contexts that include dealing with the attention/intention demands of normal communication.

Incidentally, the attention/intention aspect of communication may have implications for L2 fluency researchers regarding how best to obtain speech samples in an ecologically valid manner. Most researchers attempt to elicit speech by using tasks that aim to be authentic or genuine in some way with respect to real world communication. Does this mean that speech elicitation tasks in L2 fluency research should always include an attention/intention aspect in their design? This question is important because it is known that the nature of a speech task can affect speech production (Tavakoli and Foster 2008; Tavakoli and Skehan 2005). Thus, it would be useful to know whether utterance fluency changes as a function of the presence or absence of the attention/intention demands (compared to story recall, text reading or other minimally interactive tasks). A challenge facing researchers, of course, will be to include attention/intention demands while keeping the elicitation task as controlled as possible.

Putting it all together, the framework that emerges can be summarized as in Figure 1. The core phenomena addressed by the framework are L2-specific speech features that characterize L2 fluency and the L2-specific cognitive operations associated with those speech features. Disfluent execution of these cognitive operations is what underlies L2 utterance disfluency. It is experience in using the language that sharpens the learner's cognitive-perceptual systems so that these cognitive operations become rapid, efficient and fluid, resulting in speech output that is fluent. For this cognitive fluency to develop, however, there must be repeated experiences in producing speech. Because the need to be fluent normally arises in interactive social contexts characterized by the

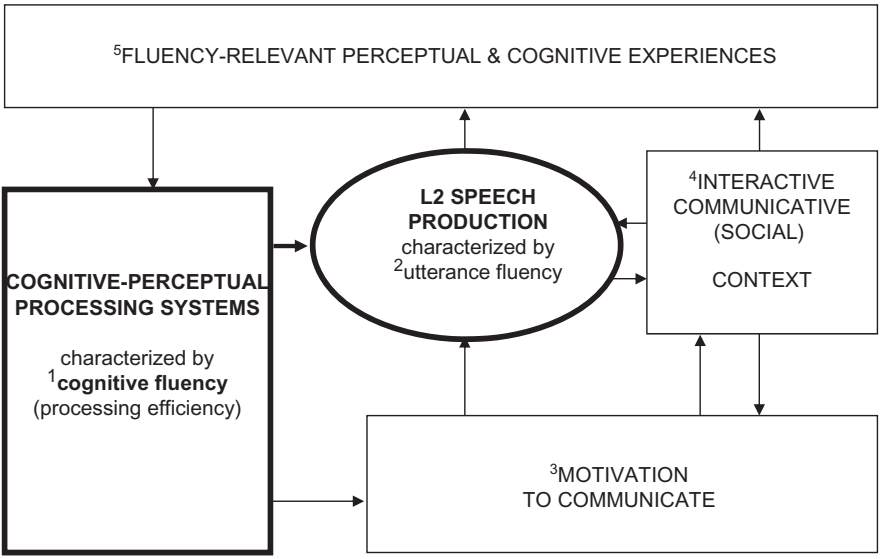

Figure 1: Framework for L2 fluency (from Segalowitz 2010: 164, Figure 7.1).
Notes: [1]Cognitive fluency features include processing speed, stability and flexibility in the planning, assembly and execution of utterances in terms of lexical access and the use of linguistic resources (linguistic affordances) to express construals, handle sociolinguistic functions, and pursue psychosocial goals. [2]Utterance fluency features include speech rate, hesitation and pausing phenomena, etc. [3]Motivation includes willingness to communicate, beliefs about communication, language and identity, and the concept of the L2-Self. Motivation influences speech production and the selection of social contexts in which to speak. [4]The social context influences speech production by setting the cognitive task demands associated with communication and is the source for learning about linguistic affordances. [5]Experiences include frequency of exposure, opportunities for repetition practice, etc.

attention/intention demands of communication, by the principle of transfer appropriate processing learning should also take place in contexts involving attention/intention demands if learning experiences are to facilitate fluency development. The figure also shows that motivation plays a role fluency development. Motivation not only energizes learners to use the L2, it can also shape the nature of the communicative situations in which learners use the L2, which may or may not be optimal for promoting fluency. Moreover, motivation itself can be enhanced or diminished by the learner's subjective experience of trying to use the L2, both in terms of the cognitive effort involved and in terms of certain psychological experiences regarding self and identity (see Dörnyei [2009] and Henry [2015] on the development of the *L2-self* in L2 motivation, and Segalowitz et al. [2009] on the link between fluency and ethno-linguistic

identity). If learners' cognitive and social experiences result in increased motivation to communicate, then they will engage in more L2 use, creating a positive feedback loop in the cognitive-perceptual processing system that enhances cognitive fluency, leading to improved utterance fluency and more successful L2 encounters. Thus, as shown in the figure, L2 fluency is the outcome of the operation of a dynamical system where cognitive, motivational, social, sociolinguistic, pragmatic and psycholinguistic considerations interact in complex ways (for more on dynamical system theory applied to L2 issues, see: de Bot and Larsen-Freeman 2011; Larsen-Freeman and Cameron 2008; and Larsen-Freeman 2015).

4 Conclusion

The framework presented here can be summarized in terms of three main points.

(1) *Identifying the features of L2 fluency to study*. In order to identify the features of L2 fluency that are truly reflective of how a speaker handles the L2 as opposed to other co-occurring demands, it is important to distinguish among three different aspects of fluency – utterance, cognitive, and perceived fluency. Of central concern in the framework presented here are measures of utterance fluency that correlate highly with measures of cognitive fluency, thereby pointing to cognitive operations that underlie L2 speech production. Moreover, measures of utterance and cognitive fluency should, ideally, be made as L2-specific as possible by controlling for corresponding measures in the L1, to avoid confounds with general cognitive and language abilities and with abilities related to handling task-specific demand characteristics. Focusing research in this way will yield a set of L2-specific utterance fluency features that are related to the fluency of underlying L2-specific cognitive processes.

(2) *Situating L2 fluency in a larger theoretical context*. In order to go beyond simply describing L2 fluency, it is important to locate discoveries about the cognitive-utterance fluency associations mentioned above in a theoretical context that can address how experience might shape fluency acquisition. Two considerations for this were presented. The first, derived from a usage-base theory of language acquisition, is that when learners develop L2 fluency through communicative experiences, what is learned is embedded in a neurocognitive environment of operations for establishing joint attention and for reading social intentions. The second, derived from psychological research on memory, is that memory retrieval is facilitated when the neurocognitive environment (the set of cognitive operations in play) that

exists at the time of need matches in significant ways the neurocognitive environment that existed at the time of learning. Thus, the cognitive demands encountered at the time of learning should match as much as possible the anticipated future demands when there will be a need to retrieve what was learned. Because these future demands will arise in the context of normal communication, the relevant cognitive operations are those associated with handling the attention/intention aspects of communication. An implication of this view is that the cognitive underpinnings of L2 fluency are affected by the cognitive consequences of engaging in social interaction during learning.

(3) *Viewing L2 fluency as reflecting the operation of a dynamical system*. The view outlined above suggests that the cognitive operations underlying utterance fluency are themselves affected by fluency-relevant experiences shaped by social interactions, motivational states, and subjective experiences associated with using the L2. From this it follows that that L2 fluency attainment is the outcome of the operation of a complex system of mechanisms and processes that are dynamically interacting at all times. The implication here is that to investigate the nature of L2 fluency one needs to take into account the many factors contributing to its development.

In sum, understanding the determinants of L2 fluency requires an appreciation of the cognitive underpinnings of L2 fluency phenomena, and this in turn requires an understanding of how these cognitive factors themselves are intimately bound up in the social-motivational matrix in which language learners find themselves.

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