

ESTABLISHING THE FLUENCY GAP BETWEEN NATIVE AND NON-NATIVE-SPEECH

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Abstract

Although various dimensions of speech fluency have so far generated a great deal of research interest, very few accounts have tackled the issue of the relationship between L1 and L2 fluency. Also, little empirical evidence has been provided to support the claim that language users are more fluent in their mother tongue than in a foreign/second language. This study examines the fluency gap between L1 and L2 fluency using a battery of objectively quantifiable temporal measures of speed and breakdown fluency. It also attempts to identify those temporal fluency variables which are affected by the individual way of speaking rather than the degree of automatization of speech processing and which underlie oral performance both in L1 and L2. The analysis draws on transcriptions of elicited speech samples in L1 (Polish) and L2 (English).

Keywords: L1/ L2 speech fluency, speed fluency, breakdown fluency, temporal measures of fluency, hesitation phenomena, pausing, speech rate

1. Introduction

Along with accuracy and complexity of learner language (Ellis & Barkhuizen, 2005), speech fluency has merited considerable research attention and emerged recently as a one of the most reliable indicators of L2 proficiency and progress (Brandt & Götz, 2011; Bosker, Pinget, Quene, Sanders, & De Jong, 2013; Cucchiarrini, Strik, & Boves, 2000, 2002; De Jong, Steinel, Florijn, Schonen, & Hulstijn, 2009, 2012; Götz, 2013; Hilton, 2008; Osborne, 2007, Pinget, Bosker, Quene, & De Jong, 2014). Defined as observable, real-time speech behaviour, oral fluency is described and measured in terms of a set of temporal variables related to the speed of speaking, time filled with speech vs silence and the occurrence of hesitation and repair phenomena. Previous studies into L2 fluency identified a ‘fluency gap’ (Segalowitz, 2010, p. 2) between native and non-native speech and found that the latter is produced with considerably lower speed and a higher incidence of pausing and hesitation phenomena. The gap has traditionally been ascribed to the lower degree of automaticity of L2 speech, which is processed less rapidly and smoothly. However, more recent accounts which looked more closely at the nature of the relationship between L1 and L2 fluency suggest that reliable L2 fluency measures should be corrected to accommodate baseline, temporal characteristics of L1 as the temporal characteristics of a speaker’s L2 output are a function of their idiosyncratic way of speaking as well as the degree of automatization of L2 processing. (De Jong et

al., 2012; Derwing, Munro, Thomson, & Rossiter, 2009; Osborne, 2007; Segalowitz, 2010).

This paper investigates the relationship between L1 and L2 fluency and the claim that they should be considered in conjunction. We begin the discussion by placing the notion of speech fluency in a wider theoretical context and provide the definition of fluency adopted for this study. We then identify and discuss temporal fluency measures used across learner language studies as reliable indicators of productive fluency and overview the studies looking at the relationship between L1 and L2 fluency. Finally, we attempt to determine the precise nature of the gap between L1 and L2 productive fluency on the basis of a 22,000-word dataset including L1 and L2 speech samples elicited from advanced Polish learners of L2 English (N=50). Based on the assumption that a learner's productive fluency in L2 reflects his/her baseline L1 fluency, we aim to identify the temporal variables which are characteristic of a speaker's performance in general (L1, L2) rather than characteristic of L2 performance specifically.

2. Defining fluency

Fluency is a broad, multifaceted construct which has accommodated a variety of aspects of language use and speech production. Fillmore (1979, p. 93), for example, associated fluency with overall language performance and described it in terms of an array of speech characteristics ranging from sociolinguistic appropriateness, through imaginativity and creativity in language use to more production-related phenomena such as the presence of pausing and hesitation, overall coherence and semantic density. Later definitions, which originated in learner language studies, emphasised the procedural nature of fluency and highlighted the fact that it cannot be fully accounted for in terms of a learner's linguistic knowledge but, rather, reflects a learner's ability to produce language rapidly and smoothly under the cognitive pressures of real-time processing (Lennon, 1990, 2000). This ability reflects the degree of automatization of L2 production, that is, the learner's ability to simultaneously handle syntactic, morphological, and phonological encoding processes (Kormos, 2006, pp. 154-165; Towell, Hawkins, & Bazergui, 1996). Understood in this way, fluency captures both cognitive and performance-related aspects of speech production which are indicative of a learner's overall language proficiency and progress and can serve as a useful tool for oral assessment (Chambers, 1997).

In fact, it is this definition of fluency as real-time spoken performance occurring under psycholinguistic and temporal constraints, which, under a variety of labels, has underpinned the conceptualisation of fluency in the majority of recent studies of learner language. Götz (2013), in her book-length investigation of fluency in native and non-native speech, uses the term 'productive fluency' which she equates with automaticity of speech production (p. 13). She further suggests that productive fluency is achieved through a range of processing strategies which include, among others, hesitations and disfluencies observable in a person's speech. Segalowitz (2010) insists on separating the mental effort needed to produce smooth, effortless speech from the features of actual, spoken performance and makes a distinction between cognitive and utterance fluency. The former is defined as fast and efficient mobilisation and coordination of distinct

cognitive resources which allow the speaker to plan the utterance, find appropriate lexical and grammatical means for expressing the message and articulate it in the desired phonetic shape (p. 48). The latter captures the observable temporal features of spoken output and reflects the operation of the underlying cognitive speech production processes (p. 50). It is worth noting that, here, the fluency of the speaker is kept apart from the fluency of a speech sample, which, as Segalowitz himself contends, is the only domain of fluency that lends itself to a scientific investigation.

An interesting attempt at operationalising utterance fluency has come from Skehan (1998, 2003, 2009; see also Tavakoli & Skehan, 2005). Resting on the premise that cognitive effort invested in speech production affects different aspects of oral performance, Skehan (1998) distinguishes between speed, breakdown and repair fluency. In his account, speed fluency refers to the length and density of linguistic units produced, breakdown fluency denotes the number, length and location of pauses whereas repair fluency stands for the number of false starts, mis- and re-formulations, self-corrections and repetitions. Elaborating on Skehan's framework, Towell (2012, pp. 55-56) explains that speed fluency depends on the storage and recall of linguistic information in/from memory systems, while breakdown and repair fluency show the extent to which the learner can rely on what has been stored and whether he/she has developed strategies for dealing with communication breakdowns.

Skehan's tripartite classification has become fairly influential and has been adopted in a number of learner language studies. The author himself and his colleagues applied it in their 'Ealing project' series of studies investigating the effect of task-design on task-performance (Foster, 2001; Foster & Skehan, 1996, 1999, 2013; Skehan & Foster 1997, 1999, 2005, 2012). More recently, the speed/breakdown/repair fluency distinction inspired a number of accounts following the CAF (complexity, accuracy, fluency) paradigm (Housen, Kuiken, & Vedder, 2012).

The perspective on fluency adopted in this paper conforms to the definition of utterance fluency put forward by Segalowitz (2010) and Skehan's distinction between speed, breakdown and repair fluency. Here, fluency is seen as a purely 'phonological phenomenon' (Housen, Kuiken, & Vedder, 2012, p. 5) which constitutes one of many aspects of a learner's overall language performance/proficiency which include the speed of speaking as well as the number, length and location of hesitation phenomena. Seen in such light, fluency encompasses observable features of actual utterances which can be investigated and measured in terms of a set of objective and quantifiable time-related variables. The following section outlines these variables.

3. Measuring fluency

The production of speech in a second/foreign language is a demanding task and the effort needed to deploy and synchronise the cognitive resources needed to initiate and sustain speech production is reflected in the degree of smoothness and rapidity of a learner's oral performance. Different potential temporal markers of fluency have been put forward to differentiate between more and less fluent speakers and speech samples. It has been argued that a fully comprehensive fluency measurement battery should incorporate the following aspects of speech: time filled with speech vs silence, the speed

of speaking, dysfluencies and repair phenomena and the length of uninterrupted stretches of discourse as an indicator of automaticity (Koponen & Riggensbach, 2000; Skehan 2003, p. 8). However, there has been little consistency across research studies in the selection of specific temporal measures of fluency. Depending on the definition, methodology and the goals of a study, a wide variety of temporal variables have been employed to provide an assessment of learner fluency. Table 1 provides an overview of the range of measures of temporal fluency used in most recent studies of learner fluency.

Author	Scope of the study	Measures of fluency
Dechert (1980)	- longitudinal investigation of the development of learner fluency as a result of a study abroad	- total of pausing time
Raupach (1980)	- case-study of individual learners' fluency profiles in L1 (French and German) and L2 (English)	<ul style="list-style-type: none"> - position of filled and silent pauses across clauses - speech rate (number of syllables per minute) - frequency of hesitation repetitions - frequency of self-corrections
Lennon (1990)	<ul style="list-style-type: none"> - investigation of the development of learner fluency as a result of a study abroad - identification of objective indicators of fluency by relating raters' judgements of fluency to objectively quantifiable fluency measures 	<ul style="list-style-type: none"> - pruned and unpruned speech rate (pruned speech rate refers to the total of words produced per minute including repair words such as repetitions, self-corrections, reformulations) - total of filled pauses - total of self-corrections - total of repetitions - percentage of self-corrected words as a function of unpruned words - filled and unfilled pauses as a function of total speaking time - mean length of speech runs - filled pauses per T-unit (T unit is defined as "one main clause plus any subordinate clause or non-clausal structure that is attached to or embedded in it" (Hunt, 1970, p. 4)) - unfilled pauses per T-unit - percentage of T-units followed by a pause

Author	Scope of the study	Measures of fluency
Towell et al. (1996)	- the role of the proceduralisation of linguistic knowledge in the development of learner fluency	<ul style="list-style-type: none"> - speech rate (syllables per minute) - phonation time ratio - the percentage of time spent speaking as a percentage proportion of the time taken to produce the speech sample - articulation rate (syllables per second minus pausing time) - mean length of runs (mean number of syllables between pauses)

Table 1. Measures of temporal fluency in learner language studies.

Kormos (2006, p. 163) provides a summary of the available temporal fluency measures along with practical information concerning the way they are established. Overall, she identifies ten independent ways of quantifying productive fluency which, between themselves, capture both the temporal nature of fluency and the area of repair. Apart from the temporal measures presented in Table 1, the following potential indicators of fluency are listed in her inventory: the number of filled/unfilled pauses per minute, the mean length of pauses, pace - the number of stressed words per minute, space - the proportion of stressed words to the total number of words and the number of disfluencies per minute. Ellis and Barkhuizen (2005, pp. 156-157) offer a slightly different perspective on the issue. The authors emphasise the need to maintain a clear distinction between temporal variables such as speech rate, number of pauses, pause length, length of run and hesitation phenomena such as false starts, repetitions, reformulations, replacements. Drawing on Skehan's (1998, 2003, 2009) distinction between breakdown and repair fluency, they claim that these two dimensions of fluency represent such diverse aspects of speech production that they require separate treatment.

In view of such a great number of temporal measures available, a question arises about which of the proposed indicators reflect utterance fluency most reliably and accurately. A number of studies have attempted to address this issue by relating fluency scores obtained from subjective fluency ratings with the actual quantifiable characteristics of learner speech. Despite vast methodological differences in terms of procedures used for speech elicitation and pause annotation, rater experience, number and proficiency level of the participants, there appears to be some degree of consistency in the identification of the most reliable fluency measures. In particular, research suggests that measures related specifically to the speed of speaking and the amount of pausing are relatively good predictors of perceptive fluency. One variable which consistently correlated with high perception scores across a number of studies is speech rate (Derwing et al., 2004; Kormos & Dénes, 2004; Rossiter 2009). However, the findings of the most recent studies relying on automated identification of pauses in speech (Cucchiaroni et al., 2000, 2002; De Jong et al., 2009) reveal a more complex picture. Some provide further evidence for the validity of speech rate as a relatively good predictor of productive fluency. Others add other dimensions of fluency such as phonation time ratio for beginner students, mean length of run for intermediate learners

(Cucchiarini et al., 2002), percentage of silent pauses per word, and percentage of self-corrections or self-repairs per word (De Jong et al., 2009).

In sum, although to date research has not identified a single, universal set of temporal measures of fluency for learner language, some of them have been empirically validated by correlations with human ratings of fluency. The measures which have obtained such validation in large-scale, methodologically rigorous analyses of both L1 and L2 speech include speech rate and articulation rate for speed fluency and mean length of runs for breakdown fluency (Kormos & Denes 2004; De Jong et al., 2009). At the same time, little consensus has been reached as regards the more calibrated measures of pausing phenomena. Therefore, in this study we adopt the three measures which correlate highly with perceptions of fluency (speech rate, articulation rate and mean length of runs). Additionally, in view of the lack of consensus regarding breakdown fluency measures we adopt a wider set of measures of pausing time including the total and length of filled and silent pauses. Speech rate (SR), which denotes the actual speed of speaking, is expressed in the number of syllables per second and is computed by dividing the total of syllables by the total of seconds including pauses. Articulation rate (AR) is established by dividing the total of syllables by the total of seconds excluding pauses. For breakdown fluency, we look at mean length of run (MLR, measured in number of syllables, total of silent and filled pauses and length of silent and filled pauses (in seconds). MLR, which is a measure of pause frequency in relation to words produced, is calculated by dividing the total of syllables by number of runs.

One other major observation that has emerged from the studies into L1 and L2 fluency (see for example Raupach, 1980; De Jong et al., 2009) is that some aspects of L2 fluency may in fact be attributable to a person's individual, idiosyncratic speech characteristics which pervade this person's oral performance in any language and are not specific to the learner's performance in a particular language. In other words, it has been suggested that the analysis of L2 fluency cannot be completely divorced from analysing fluency in L1. We will look into this issue more closely in the next section.

4. L1 vs L2 fluency

Depending on what exactly is meant by 'native language', two approaches to the relationship between native and non-native speech fluency can be distinguished. One possibility is to consider L2 fluency from the point of view of the target language as a model and analyse it in terms of its deviation from L1 standards. Here, a gap can be identified between speech fluency of L2 learners and that of the native users of a given language. In fact the claim, that even very advanced L2 learners are not as fluent in the target language as their native counterparts has been accepted by most studies at face value. Empirical evidence substantiating this assumption can be found in Kahng (2014). Kahng compared the temporal variables of English native speech and non-native speech of Korean learners of English and reported that they differed in terms of speed, length of run, repairs, and silent pauses. In fact, in this study higher frequency of silent, clause-internal pauses in L2 data emerged as one of the most prominent differences between native and non-native speech, which, as Kahng concluded, is consistent with the claim that pauses within clauses reflect processing difficulties. In the second perspective, L2

fluency is perceived from the point of view of a learner's mother tongue, in which the learner is considerably more fluent. Here, a gap can be observed between the speaker's high fluency in his native language and lower fluency in the target one.

The ensuing discussion is based around the second perspective on learner fluency in which the terms 'L1' and 'native language' are used with respect to a learner's mother tongue. We first consider the ways in which productive L2 fluency departs from L1 standards and then look at some reasons why it is so. Finally, possible areas of overlap between L1 and L2 fluency identified across research studies are discussed.

As regards the differences between learner L1 and L2 fluency, the general assumption is that the former surpasses the latter. Overall, compared to learners' native speech, their L2 oral performance has been found to be slower and interrupted by more and longer pauses and hesitation phenomena (Raupach, 1984; Wiese, 1984). Taking specific temporal measures of fluency into consideration, it has been reported that speech rate values for L2 tend to deviate from the native values. For example, Hincks (2008) compared the speech rate of Swedish learners of English when speaking their L1 with that of L2 and reported a statistically significant drop in speech rate (23%) in her L2 data. She obtained similar results for the mean length of run, which turned out to be 24% shorter than in L1 (as measured in the number of syllables uttered between pauses) (p. 22).

Kormos (2006, p. 154) explains the fluency gap between L1 and L2 in terms of three areas of language knowledge and processing in which L2 learners lag behind L1 users:

This difference might be caused by a number of factors such as the deficient knowledge of L2 lexis, syntax, morphology, and phonology, attentional resources needed for suppressing L1 production procedures, and greater demands on self-monitoring.

The major issue raised in this study is the question of whether, and if so, to what extent, L1 productive fluency is related to the learner's productive fluency in L2. Some preliminary evidence of a correspondence between some dimensions of oral fluency in L1 and L2 comes from the early studies into the pause patterns of learner language. Deschamps (1980, p. 255), for example, reports that pause patterns found in a learner's mother tongue are transferred to their foreign/second language. Similarly, Raupach (1980, p. 263) observes that patterns in pause length and distribution may result from a person's individual style of speaking and so, are likely to permeate both L1 and L2 speech. However, he also notes that, despite some overlap in pause patterns, overall, L2 speech is marked by a higher incidence of pauses and other hesitation phenomena. De Jong et al. (2009, 2013) use automated speech analysis to investigate the relationship between L1 and L2 spoken performance. In their first study, De Jong et al. (2009) note significant L1-L2 correlations for speech rate ($r=.27$, measured in syllables per second), length of pauses within and between utterances/number of filled pauses/words per second (from $r=.52$ to $r=.76$) and phonation time ($r=.64$), but not for the number of silent pauses. In a subsequent study, De Jong et al. (2013) seek to establish whether L1 fluency behaviour should be considered when investigating L2 specific measures of L2 fluency. Using separate measures for speed and breakdown fluency, they found high L1-L2 correlations for syllable duration ($r=.37$) and silent pause duration between AS-units ($r=.76$) and concluded that measures of L2 fluency should be adjusted for L1 behaviour

(p. 17).¹ Derwing et al. (2009) is another example of study which found high L1-L2 correlations for number of pauses per second and speech rate in Russian, Ukrainian and Mandarin learners of English. They emphasise that “a close relationship between a speaker’s L1 and L2 temporal characteristics would suggest that fluency is governed by an underlying trait (p. 533).”

To conclude, in order to provide accurate and reliable descriptions of learner oral L2 performance, L1 fluency data need to be obtained first as a reference or a baseline. In other words, we hypothesise that L2 fluency is not L2 specific but results from an individual, idiosyncratic speech differences.

5. The study

The paper investigates the L1-L2 fluency gap by comparing a number of temporal measures indicative of speed and breakdown fluency in L1 and L2. The second objective of the study is to determine if any aspects of learner L1 productive fluency can be used as the basis to predict L2 speech behaviour.

The following research questions have been formulated for the purpose of this analysis:

1. Is there a fluency gap between L1 and L2 productive fluency? What is the nature of this gap in terms of temporal measures of fluency (SR, AR, MLR, number and length of pauses)? Is location of pauses across syntactic units/boundaries a factor?
2. To what extent are temporal fluency measures in the learners’ L1 valid indicators of L2 proficiency? Are any of the temporal variables characteristic of a speaker’s performance in general (L1, L2)?

5.1 Participants

45 undergraduate students (29 females, 16 males) from the University of Warsaw participated in the study. They were all enrolled in the second year of a teacher training college and worked towards their BA degree in teaching English as a Foreign Language. All of them are of Polish origin speaking Polish as their mother tongue and English as a foreign language. The majority received formal instruction in English for 12.3 years on average. The level of L2 proficiency was not controlled for. However, the curricular requirements specified for the teacher-training college in question expect its students to reach B2+/C1 level (CEFR) with the completion of the first year of study. Participants were given extensive information about the character and purpose of the research and signed written consents to participate in the study.

¹ Foster et al. (2001, p. 365) define an AS-unit as “a single speaker’s utterance consisting of an independent clause, or a sub-clausal unit, together with any subordinate clause(s) associated with either.”

5.2 Data and procedure

The data used in the study include recordings and transcriptions of elicited speech samples (topic-prompted long-turns) in L1 and L2 (9,790 and 12,578 words respectively). Participants responded to the same personalisation task first in their mother tongue and later in L2. The tasks were selected by participants (see Appendix 1 for a list of topics used as prompts). The recording sessions were spaced apart by 60 days to avoid a task repetition effect. The recordings were then transcribed manually by the author. To detect silent pauses, a visual representation was obtained for each speech sample using PRAAT software (Boersma & Weenink, 2005). Following a well-established research tradition (Freed, Segalowitz, & Dewey, 2004; Goldman-Eisler, 1968; Segalowitz & Freed, 2004), the pause status was assigned to periods of silence or non-verbal fillers whose duration equalled 250 milliseconds or more. Syllables were counted consulting the original recording when necessary using the syllable identification criteria proposed by Gimson and Cruttenden (1994, pp. 48-51). Pause boundaries were assigned and pause duration measured manually. The length of pauses was indicated in text using square brackets. A distinction was made between filled and unfilled pauses, which were colour-coded in the transcripts. A set of temporal input values were established for each sample which included overall speech time, pausing time, total of syllables, total of runs between pauses and total of pauses (filled and silent). Seven temporal fluency variables were selected to provide an account of L1 and L2 speech fluency. Skehan's (1998, 2003, 2009) three-element fluency paradigm - speed, breakdown and repair fluency was adopted for reasons indicated earlier in this study (section 2). It needs to be noted that repair fluency measures were excluded from the scope of the study as a relatively high number of samples in L1 (53%) and L2 (80%) contained none or very few self-corrections, re-/mis-formulations or repetitions. Speed fluency was computed as speech and articulation rate (SR, AR). Breakdown fluency was computed as mean length of run (MLR), total of silent as and filled pauses and length of silent and filled pauses (in seconds). Paired sample T-tests were conducted to compare the temporal fluency values in L1 and L2 and determine if the resulting differences approach the level of significance. Pearson product-moment correlation coefficients were calculated to gauge the relationship between L1 and L2 fluency measures.

5.3 Results and discussion

The first research question formulated in this study seeks to establish if there is a gap between L1 and L2 fluency and examines the nature of this gap. To address this question, speech samples obtained from participants in Polish (L1) and English (L2) were analysed in terms of a set of temporal measures of fluency (SR, AR, MLR, number and length of pauses) and the values obtained were compared to reveal the differences between the temporal aspects of L1 and L2 speech production.

The results of this part of the analysis are illustrated in Table 2. The first five variables (length and total of filled/silent pauses and MLR) are indicative of breakdown fluency, whereas the last two (SR, AR) express speed fluency. Mean values of each of the variables were calculated. To provide a straightforward, numerical illustration of the

L1-L2 fluency gap, these means were juxtaposed and a percentage difference between the higher and lower value was calculated. Paired sample T-tests were used to establish whether the differences in the temporal fluency measures in L1 and L2 approach the level of significance. Let us consider the results in more detail.

	paired sample T-test	mean for L1	mean for L2	L2 vs L1
length of silent pauses	p<.0001	10,7	22,1	+52%
total of silent pauses	p<.0001	14,8	27,5	+46%
mean length of runs	p<.0001	14,2	8,5	-40%
total of filled pauses	p<.001	11,177	17,555	+36%
length of filled pauses	p<.005	8,79	13,292	+34%
speech rate	p<.0001	3,986	2,706	-32%
articulation rate	p<.0001	5,388	3,758	-30%
total time	p<.0001	75,042	115,353	+35%

Table 2. Temporal fluency measures in L1 and L2.

As regards the differences between L1 and L2 temporal fluency scores, the paired T-test returned significant scores with the p-value ranging from <.0001 for most of the analysed variables to p<.05 for length of filled pauses. These results suggest substantial differences between L1 and L2 speed and breakdown fluency. This is confirmed further if we look at the differences between average L1-L2 mean values for each of the temporal variables. Considering the amount of time spent in silence, silent pauses in L2 were longer (by 52% on average) and occurred more often (by 46%) than in L1. The same applies to filled pauses, which in L1 speech occurred more frequently (by 36%) and lasted longer (by 34%). There are further differences concerning the number of syllables which the speakers managed to deliver in an uninterrupted fashion, that is, without pausing. In L1, the average MLR equals nearly 14 syllables between pauses, whereas in L2 it was 8.5 syllables. In terms of speed fluency, L1 and L2 speed fluency values have revealed a similar pattern, with both L1 speech and articulation rate exceeding L2 values by nearly 70%.

On the basis of the data presented in Table 2, a number of inferences concerning the nature of the L1-L2 fluency gap can be drawn. When producing speech in L2, learners speak more slowly, pause more often and for longer periods of time than when they produce speech in their mother tongue. It needs to be noted at this point that while the results for speech and articulation rate are fairly straightforward, the pausing differences need to be approached with caution. It is widely accepted in fluency research that

pausing affects native as well as non-native speech (Raupach, 1984; Lennon, 1990). A distinction needs to be made between ‘natural, clause boundary pauses’ which are part and parcel of any communication and ‘disruptive, core internal pauses’ which might reflect the degree of cognitive effort related to speech production (Götz, 2013, p. 20). In other words, it is not just the matter of how often or for how long a speaker pauses, but of where exactly in the structure of discourse these pauses emerge.

Therefore, the second part of the first research question concerned the location of pauses across syntactic units. Here, our aim was to establish differences in pause location in L1 and L2 data. We hypothesised that the distribution of pauses in L1 and L2 data varies, with the latter being more abundant in hesitation pauses violating clause structure boundaries, which would be indicative of a higher processing effort exerted when producing speech in L2. Table 3 illustrates the results.

	paired sample T-test	mean number of pauses in L1	mean number of pauses in L2	L2 vs L1
hesitation pauses	($p < .0001$)	9	14	+42%

Table 3. Mean number of hesitation pauses in L1 and L2.

Paired T-tests showed significant differences ($p < .0001$) between L1 and L2 data with respect to the occurrence of hesitation pauses. The difference between L1 and L2 performance is quite striking with nearly twice as many hesitation pauses identified in the L2 dataset (14 pauses per sample on average) compared to L1 (9 pauses per sample on average), which amounts to a considerably higher (by 42%) incidence of clause-internal pauses in L2 data. To provide further insight into the issue, we established the proportion of hesitation pauses in the total of pauses in the L1 and L2 speech samples (Table 4).

	L1	L2
hesitation pauses	19%	48%

Table 4. Hesitation pauses as percentage of the total of pauses in L1 and L2.

The results in Table 4 show that hesitation pauses constitute 19% of the total of pauses in L1 and nearly half (48%) of all the pauses in L2 data. These numbers suggest that L2 speech production is characterised by more frequent clause-internal pausing than L1 speech. Similar findings were reported by Kaghni (2014) who found that L1 and L2 speech exhibit a striking difference in the frequency of pauses within clauses, which is considered to reflect difficulties in speech production processing. In any case, the distribution of hesitation pauses across L1 and L2 data adds weight to our earlier observation that language users need to pause considerably more often when speaking L2 than L1. The data from Tables 3 and 4 indicate additionally that in L2 these pauses

more often cut across clause boundaries violating the syntactic structure of spoken discourse.

The second research question put forward in this study seeks to identify those temporal aspects of L1 fluency which might constitute the ‘underlying trait’ (Derwing et al., 2009, p. 533) of a speaker’s oral performance and so, are manifested in any language produced by a language user. To investigate the nature and strength of the relationship between L1 and L2 measures of fluency, Pearson product-moment correlation coefficients were established for each of the temporal measures of L1 and L2 speech. It was hypothesised that positive correlations between the values in L1 and L2 would suggest that they are consistently related and express a language-independent, individual speaker characteristic rather than a language-specific production phenomenon. In other words, high positive correlation values for speed and breakdown fluency measures in L1 and L2 would indicate that the speakers who speak fast in their mother tongue, tend to speak fast in a foreign language and that the speakers who pause more often and for longer periods of time in L1 are bound to do it in L2. Clearly, this reasoning is based on the assumption that the participants are already fairly fluent in L2 as their L2 knowledge is already consolidated and proceduralised and the processing of L2 automatised. Table 5 illustrates the results of this part of the analysis.

	significance level	correlation coefficient
speech rate	p<.05	r=0.382
articulation rate	ns	-
MLR	ns	-
total of silent pauses	ns	-
length of silent pauses	ns	-
total of filled pauses	ns	-
length of filled pauses	ns	-

Table 5. Relationship between L1 and L2 temporal fluency measures.

As can be seen in Table 5, the only temporal variable which was found to be positively and significantly correlated in both languages is speech rate ($r=.382$, $p<.05$). These results suggest that the higher the speed of speaking in L1, the higher the speed of speaking in L2. In other words, the correlation provides some evidence that those participants who tend to speak fast in their L1, also speak fast in their L2 and that perhaps the speed of speaking is an individual feature of an individual’s speaking style rather than the characteristic of his/her performance in a specific language. However, it needs to be noted that the correlation is not very strong, suggesting the relationship between speech rate in L1 and L2 is not very strong either. As it was already observed, the available research studies have shown that speech rate is among those temporal measures of fluency which consistently correlate positively across L1 and L2 data (see the discussion of De Jong, 2009, 2013 and Derwing et al., 2009 in section 3), which is confirmed by our research findings.

As can be seen in Table 5, other fluency variables related to breakdown fluency (total and length of filled and silent pauses, MLR) returned non-significant values providing no evidence for the relationship between L1 and L2 breakdown fluency measures.

Taken together the results obtained in the course of our analysis provide some useful insights into the relationship between L1 and L2 speech fluency. First of all, the scores of temporal fluency we looked clearly suggest that language users are less fluent in their second/foreign language than in their mother tongue. The fluency gap identified in the course of this investigation is quite striking provided that the participants were fairly advanced learners of English. Speech rate was identified as the one temporal fluency variable which pervades both L1 and L2 speech. Further research needs to be conducted to provide evidence for this relationship.

6. Conclusion

The study reported in this paper focused on the relationship between L1 and L2 speech fluency. We looked at oral L1/L2 contributions of Polish learners of English and analysed them in terms of a set of preselected speed and breakdown fluency measures. We found statistically significant differences between L1 and L2 temporal fluency scores which provide a clear and objective illustration of the fluency gap between L1 and L2 productive fluency. Our results indicate that L2 speech is slower and interrupted by more hesitation phenomena as evidenced by a lower speech and articulation rate, a greater number of filled and silent pauses, greater duration of filled and silent pauses and shorter fluent runs between pauses. Also, statistically significant differences were found between the number of syntactic boundary pauses L1 and L2 data. In fact, we provided evidence that L2 performance is marked by more hesitation pausing than L1 performance. This suggests that L2 speakers need more planning time due to increased processing demands caused by insufficient language resources and poor automatization of L2 speech production. As far as the second research question is concerned we found a moderately strong positive correlation between L1 and L2 speech rate suggesting that the speed of speaking might result from an individual speaking style. No significant correlations were found for the measures capturing hesitation phenomena suggesting these might result from the degree of overall L2 control.

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Appendix 1

1. Talk about your most treasured possession. /Opowiedz o najbardziej cennej rzeczy jaką posiadasz lub przedmiocie, do którego jesteś szczególnie przywiązana/y. Adapted from Inside Out, Student's Book Upper intermediate p. 32, own translation.
2. Talk about your life at the age of eight./Opowiedz o tym jak wyglądało twoje życie w wieku około 8 lat. Adapted from Inside Out, Student's Book Intermediate p. 49, own translation.
3. Talk about a situation when you did something for the first time./Opowiedz o sytuacji, kiedy robiła/eś coś po raz pierwszy. Adapted from Inside Out, Student's Book Advanced p. 87, own translation.
4. Talk about a moment when you felt the rush of adrenaline./Opowiedz o momencie, w którym poczuła/eś przepływ adrenaliny. Adapted from Inside Out, Student's Book Intermediate p. 38, own translation.
5. Talk about a movie that impresses/disappointed you./Opowiedz o filmie, który zrobił na Tobie duże wrażenie lub kompletnie cię rozczarował. Adapted from Inside Out, Student's Book Upper intermediate p. 108, own translation.