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4 Individual differences in the ability to master connectives: The importance of exposure to print

Abstract: Important individual differences exist in the way language is acquired by children, and processed by adult native speakers. So far, studies demonstrating those individual differences have focused on lexical and syntactic aspects, yet not on discursive competences. However, we argue that discourse connectives are particularly well suited to investigate individual differences, as the ability to handle them lies at the interface of lexical, syntactic and discursive competence. In this chapter, we report a series of studies designed to investigate the ability of teenagers, learners and adults to use connectives typical of the written mode, and to assess its correlation with their degree of exposure to print. Taken together, these studies demonstrate that connectives that are less frequent in corpus data are also mastered less well even by adult native speakers, and that exposure to print explains the mastery of these connectives in all three groups.

Keywords: connectives, language production task, judgement task, exposure to print, author recognition test, French

1 Individual differences in linguistic competence are broad and persistent

Traditionally, experimental research in linguistics has tended to downplay the importance of individual differences, because the focus was placed on group comparisons, and variations in such designs are often ignored or treated as noise in the data (Kidd, Donnelly, and Christiansen 2007). Yet, a large number of studies have now convincingly demonstrated that these differences exist from the onset

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of language development, and that they also influence linguistic attainment several years later (Brito et al. 2016; Cristia et al. 2013). These differences concern all aspects of language development, namely the lexicon (e.g., Weisleder and Fernald 2013), syntax (e.g., Kidd 2012), and even though studies are still scarce in this domain, recent research has shown that individual differences extend to pragmatic competences as well (e.g., Matthews et al. 2018).

Moreover, individual differences are not limited to the period of first language acquisition. In fact, there are still widespread differences in the way adult native speakers process language, as well as their ultimate level of linguistic competence. Differences among adults involve the breadth and depth of lexical knowledge, which in turn affects reading patterns and reading strategies (e.g., Andrews 2015). Differences are also found in linguistic contexts involving a high degree of structural complexity, such as the comprehension of complex syntactic structures like object relative clauses (Wells et al. 2003), and the ability to resolve syntactic ambiguities (Swets et al. 2007). Compared to spoken language competences, linguistic competence in the written mode is typically even more variable among adult speakers, as individual differences are wide-ranging in reading comprehension (Braze et al. 2007) and spelling skills (Kamhi and Hinton 2001).

To the best of our knowledge, individual differences have so far not been studied extensively at the discourse level, but a few studies do indicate that individual differences may play an important role in discourse comprehension. For example, Daneman and Carpenter (1980) found that the ability of adults to correctly identify pronoun references was quite variable, and that it was linked to readers' working memory capacities. Regarding connectives, McClure and Geva (1983) found that some adult native speakers struggle to infer subtle meaning distinctions between closely related connectives such as *but* and *although* (e.g., Many people like to ski although/but skiing is dangerous), and that their judgements depend on their syntactic placement within the sentence. More recently, Scholman, Demberg and Sanders (2020) found that some adult native speakers also use contextual signals within a discourse segment (expressions such as *a few* and *multiple*) as indications that a list relation is expected in the next segment. They report that this ability is correlated with people's degree of exposure to print (we explain this factor in detail in Section 2). Even though empirical evidence is still scarce, these studies provide a good indication that individual differences do exist and that they should be investigated more systematically. The research reported in this chapter is an attempt in that direction.

In addition to these empirical findings, there are also several reasons stemming from the theoretical descriptions of connectives that lead us to expect that their mastery is likely to be quite variable, even among adult native speakers. Most importantly, as connectives' usage lies at the interface between lexical, syn-

tactic and discursive skills, they raise specific challenges within each of these domains. First, in the lexical domain, connectives encode procedural rather than conceptual meaning, contrary to most other lexical items (Sperber and Wilson 1993). One of the main characteristics of procedural meaning is that it is typically harder to bring to consciousness (Wilson 2011). Because of this, the meaning of connectives is difficult to learn explicitly, and must be inferred based on their usage. In this respect, learning the meaning of a connective is more akin to learning a grammatical rule than a lexical item. The implicit characteristic of such learning leaves more room for incorrect interpretations, at least compared to explicitly learning concepts related to lexical items. At the syntactic level, connectives often serve to link complex clauses. Sometimes, their use involves the embedding of a clause through subordination, placing a high cognitive load on syntactic processing. Even when such embedding is not required, connectives often link segments that are remote from each other within the text and cover large spans of texts, placing high demands on working memory. Finally, at the discourse level, the role of connectives is to explicitly indicate the type of discourse relation holding between discourse segments (e.g., Halliday and Hasan 1976). However, in most cases, no one-to-one mapping can be made between connectives and relations. In fact, many connectives can convey several discourse relations depending on context. Thus, mastering all these connectives involves the ability to form complex form-function mappings, which has been shown to be problematic, at least for non-native speakers (Zufferey and Gygax 2017).

In addition to all the previously mentioned difficulties, the category of connectives raises yet another challenge. In most Indo-European languages, the repertoire of connectives is vast, and regularly includes from one hundred to several hundred connectives. For example, the French lexicon of connectives Lexconn (Roze, Danlos, and Muller 2012) contains 328 entries. Yet, in the spoken mode, few of these connectives are frequently used (Crible and Cuenca 2017). A large proportion of these connectives is therefore mostly bound to the written mode. As we argued above, individual differences may be particularly acute in this mode. We can therefore expect that these connectives give rise to important individual variations in the way they are mastered. Yet, studies assessing the role of connectives for language processing and comprehension (e.g., Traxler et al. 1997; Canestrelli, Mak, and Sanders 2013) have mostly focused on connectives frequently used in speech. The role of connectives from the written mode remains therefore largely unexplored. In this chapter, we will focus precisely on these connectives, and the difficulties they create compared to connectives frequently used in speech.

In a nutshell, all the arguments presented above regarding the complexity of connectives and their link to the written mode lead us to expect a high degree of individual variation in the ability to use and understand them. In this chapter, we

present several experiments from our laboratory that have actually assessed this variability in adult native speakers (Section 3), teenagers (Section 4) and learners (Section 5). But before turning to the presentation of these experiments, we introduce in the next section the notion of exposure to print, and discuss its role as a variable explaining individual differences in many aspects of linguistic competences.

2 Exposure to print: How important is it and how is it measured?

Studies of individual variations have strived to identify the factors at the foundation of linguistic abilities. In the domain of language processing, studies have focused on the relationship between language competences and other cognitive abilities such as working memory capacity (e.g., Caplan and Waters 1999) and executive control (e.g., Vuong and Martin 2014). In the domain of language acquisition, a frequently tested social factor is the socioeconomic status of families (e.g., Hoff 2003). For adults, one of the most common factors analyzed is the degree of familiarity that people have with the written mode, measured through their degree of exposure to print. This factor has turned out to be a strong predictor for a wide array of linguistic and even cognitive skills, as we now outline.

First, a high exposure to print is linked to better sentence processing ability and superior performance on verbal portions of the ACT test (Acheson, Wells, and MacDonald 2008). In addition, relations between the degree of exposure to print and reading skills are found for all age groups from kindergarten to university students, and the role of exposure to print as a predictor of oral language skills grows stronger as children get older: while exposure to print accounts for 12% of the variance in oral skills for kindergarteners, it goes up to 34% for university students (Mol and Bus 2011). Thus, the role of exposure to print tends to become more prevalent with age, as time spent reading also increases with age. Higher exposure to print is also linked with more efficient reading skills in older readers in their seventies (e.g., Payne et al. 2012).

Exposure to print has also been related to a better vocabulary and world knowledge for both university students and older adults (Stanovich, West, and Harrison 1995), as well as to orthographic competence (Stanovich and West 1989). Interestingly, exposure to print does not only improve spoken and written language skills in readers' mother tongue, but also influences competence in second language learning. More specifically, exposure to print in L1 is linked to L2 reading comprehension, L2 decoding, L2 writing, and L2 listening/speaking competence (Sparks et al. 2012).

Exposure to print is also linked to better performances in other cognitive skills such as theory of mind abilities. Comer Kidd and Castano (2013) studied the link between mental state attribution competence and exposure to print, as reading may attune readers' sensitivity to interpersonal issues, a capacity underlying theory of mind skills. Their results indicated that reading fictional texts (as opposed to texts pertaining to other discourse genres) was linked to better theory of mind abilities, as measured in a variety of standard tests such as the reading the mind in the eyes test.

In all the studies discussed above, the degree of exposure to print was measured using variants of the Author Recognition Test (ART), developed by Stanovich and West (1989) in order to provide a more objective measure compared to self-assessments that typically lead to socially-desirable biases. This test is very easy to administer, as it simply consists of a list of real and fake literary authors that people are asked to recognize. Half of the list usually comprises names of real authors, and half comprises fake author names. Participants' scores on the test are computed by subtracting incorrectly identified fake names to correctly identified real ones. We have used different versions of the Author Recognition Test in the experiments we now turn to, and we therefore discuss its effectiveness as a factor explaining individual differences in the ability to use connectives.

3 Invididual variations among adult native speakers

It is often the case in studies on first language acquisition and second language learning that a group of adults is included in the experimental design in order to provide a gold standard of connective competences, against which the performance of children and learners is compared. These studies thus make two implicit assumptions about adults, but none of which may turn out to be fully correct. First, adults are presumed to be fully competent, and second, they are presumed to represent a homogenous group. Traditionally, the adults included in psycholinguistic experiments were groups of university students in linguistics or psychology participating for course credits. These students indeed represented a linguistically highly proficient and rather homogenous group. However, things have radically changed recently with the arrival of online recruitment platforms such as Prolific (Palan and Schitter 2018), which have given researchers easier access to a larger pool of participants from more diverse backgrounds (even though a lot of university students are still present on these platforms). This new recruitment method has opened new avenues of enquiry for the study of individual variations among adults. And indeed, many recent studies reporting individual variations

were conducted on participants from these platforms (e.g., Scholman et al. 2020; see also Blochowiak and Grisot this volume, chapter 3).

This is also the recruitment method that we used in an experiment designed to assess the existence of individual variations in adult native speakers' ability to master connectives typical of the written mode (Zufferey and Gygax 2020a). This experiment targeted the ability of adult native speakers to discriminate between correct and incorrect uses of four French connectives from the written mode. We tested a group of 60 participants, all recruited on Prolific. The four French connectives included in this experiment were chosen because they enabled us to assess the role of several factors that could potentially affect participants' ability to use them. These connectives were *aussi* to convey a consequence relation (similar to *therefore* in English), *en outre* to convey an additive relation (similar to *in addition* in English), *en effet* to convey a causal relation (the best equivalent in English is *for*, but bear in mind that these two connectives are also quite different in several respects), and *toutefois* to convey a concessive relation (similar to *however* in English).

The first factor that could affect participants' ability to use these connectives according to the literature is the degree of cognitive complexity of the relation they encode. This factor has indeed been found to play a role in the order of acquisition between relations (Evers-Vermeul and Sanders 2009), and the online processing of sentences containing connectives (Traxler et al. 1997; Canestrelli et al. 2013; Zufferey et al. 2018). According to Sanders, Spooren and Noordman (1992), connectives' meaning can be decomposed into four primitives (basic operation, order of the segments, polarity, and source of coherence), with each of them having two possible values. For each primitive, one of the values is deemed to be cognitively more complex than the other. For example, the values for the primitive of polarity are 'positive' and 'negative', and negative relations are considered to be more complex than positive ones (see, for example, Morera et al. 2017 for an empirical validation of this claim). Each of these dimensions are cumulated to account for the cognitive complexity of each of them. Thus, following this model, *en outre* conveys the easiest type of relation (additive), followed by *aussi* (forward causal connective), then *en effet* (backward causal connective), and finally *toutefois* (concessive connective). Based on this classification, if cognitive complexity is an important factor for adults' competence with connectives, we expected that participants in our experiment would have lower scores for *en effet* and *toutefois* compared to *aussi* and even more *en outre*, because the former encode relations with a higher degree of cognitive complexity.

Yet, cognitive complexity is not the only factor that could play a role for adults' competence with connectives. Another possibility that we tested is that the frequency with which connectives are used in the written mode might also play a

role. The rationale is this: as people encounter less frequent connectives less often while reading, they have less opportunity to integrate their meaning. This factor was indeed found to play a role for the ability of teenagers to master connectives (Nippold, Schwartz, and Undlin 1992; see Section 3 for an experiment with teenagers), and this effect might well continue to influence the competences of adults. From our sample, the two connectives *en effet* and *toutefois* are used significantly more frequently in written corpora (around 200 occurrences per million words) compared to *en outre* and *aussi* (around 100 occurrences per million words). Thus, if frequency plays an important role for people's ability to master connectives from the written mode, then the scores for *aussi* and *en outre* should be lower than those for *en effet* and *toutefois*. Note that this is a reverse pattern compared to the one expected on the basis of cognitive complexity, which enables us to pitch the role of these two factors against each other.

Finally, a third factor that could be important for speakers' competence – and that we also tested – is the fact that while some connectives have only one meaning, others are polyfunctional and can encode several meanings depending on context. For example, in English, the connective *since* sometimes encodes a temporal relation and in other cases a causal relation. In our sample, two connectives are monofunctional (*en outre* and *toutefois*) and two polyfunctional (*en effet* and *aussi*). In addition to its causal meaning, *en effet* can also be used to convey a relation of confirmation (similar to the English *indeed*), and in addition to its meaning of consequence, the connective *aussi* can also take an additive meaning (similar to the English *also*). However, these alternative meanings are not found in sentence initial position (the syntactic placement tested in our experiment), and could therefore not create ambiguities in our experimental items. Coming back to the role of polyfunctionality, if this factor played an important role in the ability to master connectives from the written mode, then we expected that the scores of *en effet* and *aussi* would be lower than those of the other two connectives, which are monofunctional.[1]

In order to assess the impact of these three factors, we created 64 experimental sentences: 16 per connective. Each connective was correctly used in 8 sentences and incorrectly used in 8 other sentences. In other words, in the correct version, the meaning of the connective was compatible with the content of the linguistic segments, as in (1), in which aussi coherently expresses a consequence relation between breaking one's tooth and making an appointment at the dentist. In the incorrect version however, the connective provided an indication incompatible

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1 Note that other factors could still play a role, such as the existence of close competitors (e.g., *ainsi* and *aussi*). The role of these additional factors will need to be tested in future experiments.

with the information from the linguistic segment, as in (2). In this example, *en outre* indicates that there is no causal link but only an addition of two independent facts between breaking a tooth and going to the dentist, thus creating an incoherence.

(1) *Roger s'était cassé une dent en mangeant. Aussi, il prit rendez-vous rapidement chez son dentiste.*

(2) *Roger s'était cassé une dent en mangeant. En outre, il prit rendez-vous rapidement chez son dentiste.*
‘Roger had broken his tooth while eating. CONNECTIVE he quickly made an appointment with his dentist'.

During the experiment, participants were asked to evaluate the coherence of sentences on a continuous scale ranging from "very incoherent" on the left to "very coherent" on the right, by moving a cursor along the scale. Results clearly indicated that participants had a higher ability to correctly judge sentences containing *en effet* and *toutefois* compared to *aussi* and *en outre*, thus indicating that frequency rather than cognitive complexity or polyfunctionality seems to be the most relevant factor to explain people's competence with connectives from the written mode, as these are the two less frequent connectives in corpus data.

To investigate whether there would be individual differences in these effects, and whether we could explain them in terms of exposure to print, participants completed a French version of the Author Recognition Test (ART-F), newly developed by us. Results showed that when participants were split into two groups depending on their score on the ART-F test, interesting differences emerged, confirming the idea that exposure to print is a relevant variable to explain variations among adults. While all participants had an equal ability to deal with the two more frequent connectives (*en effet* and *toutefois*), participants with a higher score on the ART-F test achieved significantly better results with the two less frequent ones (*aussi* and *en outre*). This study has therefore shown that the ability of adult native speakers to deal with connectives from the written mode is variable, and that this variability can be explained by the degree of exposure that people have with the written mode. In other words, even though all adult native speakers seem to master frequent connectives from the written mode, their degree of exposure to print makes the difference between people who know and do not know how to use the less frequent connectives.

The variability of adults' competences was further tested in another set of experiments (Tskhovrebova, Zufferey, and Gygax 2022) involving the same connectives in two sentence completion tasks, but this time comparing two samples

that we argued would vary in their level of competence with connectives. A sample of university students actually studying French, and a sample of participants from Prolific not studying French. Participants were also administered the ART-F and showed notable differences in their exposure to print. In the first experiment, involving a context limited to two sentences that had to be linked by choosing the appropriate connective between *aussi, en effet, toutefois* and *en outre*, adults recruited on Prolific systematically reached a lower performance compared to a group of university students studying French. In the second task, involving blanks to be filled with connectives in short texts rather than two sentences only, adults recruited on Prolific again reached a lower performance compared to students, which was this time more pronounced for the two less frequent connectives than for more frequent ones. Thus, the greater context present in the second task decreased the general performance across all connectives and reduced the differences between the results of the two groups for more frequent connectives. However, the discrepancy between the two populations still remained for the two less frequent connectives, suggesting that adults recruited on Prolific mastered them less well, and that this was due to their lower exposure to print.

These experiments thus confirm that adults' limitations are not found only in judgement tasks, but are also evidenced in fill-in-the-blank tasks that simply involve choosing the appropriate word between a set of four connectives. For the portion of adults who do not fully master connectives from the written mode, the clues given by context are not enough to help them make the correct choices.

Finally, in another set of experiments (Wetzel, Zufferey, and Gygax 2020) comparing the ability of native and non-native speakers to use a broader range of connectives from the spoken and the written modes, we also found that native-speakers' score on the ART-F was a significant predictor of their ability to fill in blanks within sentences with the appropriate connective.

In a nutshell, in all three experiments, we found that native speaking adults' level of competence with connectives was quite variable, and that participants' degree of exposure to print was an important factor to explain variability among them. However, these studies did not document the onset of such a variability – especially in terms of exposure to print – a question we now turn to.

4 Individual variations among teenagers

In the literature, many studies have investigated the early productions of connectives during the first years of life in corpus data (e.g., Evers-Vermeul and Sanders 2009; Zufferey 2010). Another trend of research has focused on the ability of young

readers aged 8 to 12 to integrate the meaning conveyed by connectives (e.g., Cain and Nash 2011; Pyykkönen and Järvikivi 2012). All these studies have focused on connectives frequently used in speech, and many of them have found that cognitive complexity is an important factor explaining both the order of acquisition between connectives, and also their degree of complexity for young readers.

Few studies have addressed the issue of the later acquisition of connectives typical of the written mode. For example, Nippold et al. (1992) found that between the ages of 12 to 23 years, familiarity with the connective matters more than the cognitive complexity of the relation. The notion of familiarity was measured based on the proportion of teenagers who knew each connective in every age group. Even though this experiment included both connectives frequently used in speech and limited to the written mode, these results seem to indicate that frequency might play an important role, as it is related to the notion of familiarity. However, these studies did not directly test this factor.

In order to investigate the roles of frequency and cognitive complexity for teenagers' ability to master connectives from the written mode, we compared the ability of 40 teenagers aged 16 years to use the same four French connectives described above: *en effet, toutefois, aussi* and *en outre* (Zufferey and Gygax 2020b). The teenagers were divided into two groups based on their academic level (i.e., applied vs. theory-driven), which we used as the operationalization of exposure to print, as teenagers coming from the more applied academic level only spent part of the week doing curricular activities involving reading, with the rest being spent in practical work. In this experiment, students simply had to insert the appropriate connective in blank spaces between two sentences. Even though neither group of teenagers reached a performance comparable to that of university students, interesting differences also emerged between them. While both groups received equally low scores for the two less frequent connectives (*en outre* and *aussi*), the group of teenagers with the more theory-driven academic background outperformed the other group with the two more frequent connectives (*en effet* and *toutefois*). It seems therefore that individual differences are already apparent between teenagers. Yet, even though the differences were likely caused by the different level of academic background between them, and the varying levels of exposure to print they entailed, teenagers' individual exposure to print was not measured directly in this experiment. In addition, as only 16-year-olds were tested, this experiment gave no indications as to how teenagers progressed in their ability to use connectives from the written mode.

In order to gather more data on these issues, we ran a new set of experiments, in which we considerably expanded the cohort of teenagers, to include 191 participants aged 12 to 22 years (Tskhovrebova, Zufferey, and Gygax 2022). These teenagers either frequented a secondary school in French-speaking Swit-

zerland (aged 12 to 15 on average) or high-school in the same geographic region (aged 16 to 18 on average). At both levels, participants were divided into groups based on the academic level of their curricula. Indeed, in these age groups, the Swiss school system separates students into different levels based on their academic achievements. In a first experiment, these participants did the same experiment conducted with the 16-year-olds and described above. In other words, they inserted one of the four connectives in a completion task limited to two sentences. Results from this task indicated that students do indeed progress in their mastery of connectives from secondary to high-school, but these improvements were apparent only for the two frequent connectives *en effet* and *toutefois*. Scores for the less frequent connectives remained low even for high-school students (less than 30% of correct choices). In addition, within each education level (secondary school and high school), teenagers from a higher academic background reached a higher score than the other students for all connectives, independently of their age. These results thus confirm that individual variations are already quite strong during teenage years, and that academic level is an important predictor of competence. In these experiments, we also included the ART-F described above. The ART-F did correlate with the mastery of connectives, but this effect was never as clear as for our adult populations. One explanation for this difference could be that the ART-F test we have compiled is not adapted to capture differences in reading experiences between teenagers, as some of the authors on the list were not recognizable enough for such a young population.

A possible explanation for teenagers' rather low scores with less frequent connectives could be that the task they had to perform did not correctly mimic normal reading situations, in which more context is provided, which could potentially give more information about the intended coherence relation. In order to assess the role of context for teenagers' competence with connectives, we conducted a second experiment with 85 teenagers aged 13 to 19, involving the same four connectives, but this time they had to be inserted into short texts (around 250 words each) rather than isolated sentence pairs. Results from this new experiment confirmed once again that teenagers master the two frequent connectives (*en effet* and *toutefois*) better than the two infrequent ones (*en outre* and *aussi*). In this version of the task, teenagers from a higher academic background again reached a higher performance compared those from a lower background, yet only for the two more frequent connectives. Finally, it is noteworthy that the scores were globally significantly lower in this task compared to the first one. For example, the ability of teenagers from a higher academic background to choose *en effet* in causal sentences dropped from 81% to 62% of correct choices. It seems therefore that having to insert connectives within a richer context also increases rather than decreases the difficulty of the task for teenagers. This also means that

the low scores evidenced in the sentence completion task were not due to the lack of relevant clues to complete the task.

To summarize, results from studies involving teenagers reported in this section provide evidence for the fact that individual differences already exist early on in the process of mastering connectives from the written mode. This ability additionally appears to be strongly dependent on academic level, which in turn is linked to the degree of exposure to print involved in the school curricula. However, current measures of exposure to print such as the ART-F test do not seem fit to capture individual differences within this population, and will need to be further adapted to the reading materials of teenagers. We will come back to this issue in Section 6. Before that, we will now turn to studies that have assessed the competence of second language learners.

5 Data on second language learners

The ability of learners to master connectives in a second language has been assessed in many studies analyzing natural productions in corpus data (e.g., Granger and Tyson 1996; Tapper 2005). Comparatively, this issue has seldom been tackled from an experimental perspective (but see Degand and Sanders 1999; Zufferey et al. 2015). In this body of literature, one of the main goals is to determine the causes of learners' difficulties with connectives, but this issue remains for the time being largely unsettled. While many studies emphasize the role of negative transfer effects (e.g., Leedham and Cai 2013; Hamed 2014; Shi 2017), others relate them to more general limitations in proficiency in the second language (e.g., Chen 2014; Tazegül 2015), and others still trace these difficulties to limitations that might also be present in learners' first language (Bolton, Nelson, and Hung 2012). This latter point of view is interesting from the perspective of individual variations, because it implies that learners' cognitive and linguistic competence might be related across languages, and therefore individual variations in the first language might be helpful to explain individual variations observed in the second language. Even though the topic of individual variations has been discussed in relation to the second language acquisition of pragmatic competences in general (Taguchi 2012), this question has not been tackled specifically in relation to the mastery of connectives.

In order to address this issue, we designed an experiment meant to assess the ability of German-speaking learners of French to use 12 French connectives (Wetzel, Zufferey, and Gygax 2020). These connectives conveyed six different coherence relations: *addition*, *consequence*, *contrast*, *concession*, *cause* and *condition*. For each relation, two connectives from the written mode were included: one of them

with a high frequency in corpus data and another with a low frequency. For the high frequency group, these connectives were: *par ailleurs, ainsi, cependant, par contre, dans le cas où* and *car*. In the low frequency group, the connectives were: *en outre, c'est pourquoi, néanmoins, en revanche, pourvu que* and *puisque*. The task was a simple sentence completion task in which participants were asked to fill in blanks between two sentences presented in isolation with one of six connectives (the two groups of connectives were presented separately). In addition, learners' level of competence in French was assessed using two tests. In the first, participants evaluated the grammatical correctness of 40 given sentences, among which 20 contained typical grammatical errors of written language (Zufferey and Gygax 2020). The second language proficiency test used was the vocabulary test Lextale in French, targeting the ability to discriminate existing from invented words. This test was chosen because it has been shown to correlate strongly with other measures of language proficiency (Brysbaert 2013). Participants were finally also administered the Author Recognition Test in two versions: French authors (the ART-F mentioned above) and German authors (Grolig, Tin-Richards, and Schroeder 2020). The rationale for using two different versions of the test was that performance on the ART test in people's mother tongue was shown to correlate with various aspects of second language proficiency in previous studies, as discussed in Section 3.

Contrary to native speaking teenagers and adults, results from this experiment indicated that frequency is not always the most relevant factor to explain learners' difficulties with connectives from the written mode. While some high frequency connectives from the written mode were indeed better mastered than their less frequent counterpart (*car* was mastered better than *puisque* and *par contre* was mastered better than *en revanche*), there were no significant differences for other pairs (*en outre* and *par ailleurs*, *dans le cas où* and *pourvu que*, *cependant* and *néanmoins*). For one pair, the frequent connective even triggered a significantly lower score than its less frequent counterpart (*ainsi* and *c'est pourquoi*). These findings also indicate that learners' difficulties with connectives might not come from the cognitive complexity of the discourse relation they encode, as no significant differences were found between the relations.

Thus, it seems that in the case of learners, other explanations than those put forward for native-speaking teenagers and adults must be called for to get a full picture of their strengths and difficulties with connectives from the written mode. For example, as hinted by our results, learners may at times rely on what Hasselgren (1994) called "comfort words", that is, words that they know and feel comfortable using, independently of their frequency. In the case of connectives, Crewe (1990) already observed that learners tend to rely first on a small subset of connectives that they tend to overuse in corpus data compared to native speakers, before progressively expanding their repertoire. This factor could explain why in

some cases, learners do not struggle with some less frequent connectives. These connectives may be part of their curricula and hence already integrated into the learners' lexicon. The results from the Grammar task and the Lextale proficiency measures indicate that the group of learners tested is not yet at an advanced proficiency level. They might therefore still be in a phase of overreliance to a reduced "comfort" vocabulary.

However, the pair made of *par contre* and *en revanche* provides some indications that frequency may still be at play, at least for some connective pairs. The strong preference for *par contre* may reflect the fact that learners prefer words that have a high frequency in spoken language. Indeed, *par contre* is very frequently used in colloquial speech, with a variety of functions extending from a contrastive connective to discourse marker uses (i.e., topic change), whereas the overall less frequent connective *en revanche* is associated with a higher language register and more frequently used in literary works. Leedham and Cai (2013) also observed that learners use more informal connectives than natives. Other studies have found that even native speakers are better at using connectives used in speech than in writing, even in the same sentences (Zufferey and Gygax 2020a).

In the case of the pair made of *c'est pourquoi* and *ainsi*, for which results seem to counterintuitively indicate that learners master the less frequent word better, the discrepancy might be due to the fact that *c'est pourquoi* is still partially transparent semantically (the meaning is literally "it is why", and this might have helped learners to guess its meaning, even though it was probably less familiar). The role of transparency will need to be further assessed in future experiments.

Coming now to the question of individual variations, scores on the French version of the ART test did not seem to predict the mastery of connectives. However, this lack of effect is hardly surprising given that learners reached very low scores, probably reflecting the fact that they did not read much in French. However, quite interestingly, their performance on the connective task was linked with their score on the German version of the ART test. Thus, results from this experiment confirmed that being exposed to print in one's native language has advantages extending beyond the mastery of that particular language (similar to what suggested Bolton et al. 2012), which is also the case for the mastery of connectives. The relationship between L1 and L2 competences will need to be further assessed in more detail in future work.

To summarize, the analysis of learners' competence with connectives from the written mode has provided a more nuanced picture compared to native speaking adults and teenagers. While frequency also seems to play a role, this factor is also mediated by other factors such as the overuse of a restricted number of "comfort words" already acquired and the reliance on semantic clues for partially transparent items, in order to guess the meaning of some connectives.

6 Taking stock and looking ahead

The goal of this chapter was to provide new evidence that individual differences exist in the mastery of discourse connectives, even in samples of adult native speakers, especially for the numerous ones that are bound to the written mode. Another aim was to illustrate the fact that individual differences also affect teenagers and second language learners. Finally, a third aim was to specifically link these differences to the degree of exposure to print that each person has. Overall, we found ample evidence in all three groups that exposure to print greatly matters for the ability to handle connectives from the written mode. As was found in other domains of language competence, the role of exposure to print starts early and becomes even greater for adults, as the gap between frequent and infrequent readers increases as years go by.

Coming back to the case of connectives from the written mode, the main lesson from the studies presented in this chapter is that their mastery is not perfect and not homogenous between readers. Their competences should therefore not be taken for granted. In addition to this, given that even the less frequent connectives included in our experiments still have a very high frequency compared to most other content words, the problems that may be caused by a lack of understanding of these connectives should not be underestimated. The experiments conducted so far focused on this ability to use these connectives appropriately. Future work will need to determine the consequence of these observed difficulties for reading and text comprehension.

One of the main challenges emerging from our experiments concerns the methods that can be used to measure exposure to print in populations that are not adult native speakers. In the case of learners, we have seen that using an ART test in learners' first language is a good way to track individual differences. The situation is more complex, however, in the case of teenagers, for whom the test also needs to be adapted. However, identifying the type of print exposure that may help to separate frequent from infrequent readers in this age group remains a challenge. In some studies (e.g., Cunningham and Stanovich 1990; Deportes et al. 1996), researchers opt for a Title Recognition Test (TRT) rather than the Author Recognition Test for children up to 13. Using the titles of the specific books may be cognitively easier for young children and, thus, allow their exposure to non-school print to be captured better. Yet, there is evidence that author names can also be well processed by children already from the age of 10. This means that ART can be an efficient predictor of the exposure to print for younger populations too if the latter are well targeted (Allen, Cipielewski, and Stanovich 1992; Stainthorp 1997; Spear-Swerling, Brucker, and Alfano 2010). There are several strategies that can be used to better target the recognition test for the tested population. One

of them is to ask school instructors and other educational professionals for the lists of books or authors that they expect to be popular among the children of the tested age bracket in the tested cultural context. Another possibility is to base the test on the best-seller lists for children and teenagers from big web platforms selling books in the tested geographical area. Finally, it is also possible to ask a relatively large number of children from the region of interest to name book titles or authors with which they are familiar, and to build the task based on a sample from the generated list. Thus, to increase the chances of capturing individual variations in exposure to print among children and teenagers, future studies should probably combine the proposed strategies to select the items for a form of the Author Recognition Test.

Another avenue of enquiry that will need to be explored in future work concerns the granularity of frequency effects. In our experiments, we simply compared a group of frequent to a group of less frequent connectives. One of the questions arising from our results is to determine from which frequency rank a connective becomes too infrequent to be mastered by most speakers. In order to address this issue, future studies will need to take a scalar rather than a categorical measure of frequencies.

Finally, all the experiments presented in this chapter were conducted with a limited range of French connectives. In order to assess the generalizability of our findings, future work is still needed, with a broader range of connectives, across different languages. A particularly fruitful avenue of enquiry seems to be the comparison between languages with a bigger and smaller repertoire of connectives. It can be expected that languages with fewer connectives may trigger less challenges, as all of them are likely used with a greater frequency and might therefore be mastered better by a majority of speakers.

To conclude, the study of individual variations represents a stepping stone for the study of connectives. It will provide important insights into the mastery of connectives across various populations, with a potentially great impact for language teaching. It would also have a strong resonance for initiatives advocating plain language writing, which aims at the production of texts that are understandable for a wider audience. In this respect, controlling the type of connectives used might be an important step ahead.

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