Pragmatic processes through the lifespan in L2

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La convergence de la pragmatique et de la recherche en acquisition d'une langue seconde a attiré de nombreux projets de recherchent qui se sont focalisés principalement sur la notion de pragmatique interlangue, soit les phénomènes d'interférence interlangue – ou encore d'influence cross-linguistique comme elle est parfois nommée – susceptible d'influencer les processus pragmatiques. Dans cet article, nous explorons une autre dimension de la pragmatique de langue seconde en nous penchant sur des processus pragmatiques de bas niveaux qui contribuent à la saturation de la forme propositionnelle d'un énoncé. Spécifiquement, nous nous concentrons sur deux types de processus de désambiguïsation de référent qui sont a priori identiques en L1 (Allemand) et en L2 (Anglais). Nous présentons deux paradigmes expérimentaux dans lesquels les participants doivent désambiguïser les référents d'énoncés EFL. La perspective adoptée est doublement cognitive en ce sens que nous nous intéressons à l'impact cognitif de la L2 sur l'aptitude à tirer des inférences (explicatures) de bas niveau, et que nous étudions les corrélations entre les dimensions cognitives du vieillissement et la performance obtenue par nos participants dans ces explicatures référentielles tout au long de la vie. Nos résultats, conformes en cela à des études précédentes en L1, montrent que les processus pragmatiques simples de bas niveau sont hautement sensible à la charge cognitive à laquelle le sujet est soumis. En conséquence, la performance est significativement affectée en L2 aussi bien en termes d'exactitude que de coût cognitif. Par ailleurs, cette même sensibilité à la charge cognitive est reflétée dans la dégradation observée avec le vieillissement. Enfin, même si les généralisations précédentes s'appliquent aux différents types d'explicatures référentielles testées, ces types semblent néanmoins générer des profils distincts lorsqu'ils sont corrélés avec l'âge des participants.

Mots-clés: pragmatique, attribution de référent, acquisition d'une langue seconde, processus cognitifs, vieillissement

1. Introduction

The topic of language learning and age has gained much attention not only within the scientific community but also among lay people, even influencing school curricula that cater to bilingual education. This chapter deals with one aspect of language learning that is all the while often neglected, namely language learning and pragmatics. In doing so, it shall focus on disambiguation processes across the lifespan, more specifically reference assignment. How do L2 learners assign reference in ambiguous contexts? How does this compare to their behavior in L1? Does their performance in both their L1 and L2 change with age? And what implications does this change have on our understanding of language learning and language teaching? This chapter shall thus describe two experimental setups designed to help answer these questions.

2. Second language acquisition, aging and pragmatics

There have been numerous studies dealing with Second Language Acquisition (SLA) and age as well as SLA and pragmatics. The scientific discourse on both subjects allows us to explore their interface and view them in light of recent findings in the field of cognitive linguistics and of reference assignment. This chapter broadly represents an interdisciplinary approach integrating questions from SLA, linguistics and age as well as pragmatic linguistics. The following shall outline different points of view that underlie this chapter's scientific approach.

2.1 SLA and pragmatics

The significance of pragmatic phenomena for learning as well as teaching languages has been displayed in the field of interlanguage pragmatics, exemplified through the work by Schmidt (1983), Kasper & Blum-Kulka (1993), Kasper & Schmidt (1996) and more recently Kasper and Roever (2005). However, due to its historicity, as e.g. described by Hinkel (2005), much of the early work in applied linguistics, which came about as a result of increasing enrollment numbers of non-native speaking students of English in the U.S., focuses on learners' learning experience from a socio-cultural point of view. Rose (2005) e.g. synthesizes the research in the field and, on a very basic level, questions whether pragmatic is at all "teachable" (ibid. 390). While he concludes that second language pragmatics under certain circumstances is teachable, the targets of instruction in question all involved productive interaction skills, such as "discourse markers and strategies, pragmatic routines, speech acts, overall discourse characteristics, and pragmatic comprehension" (ibid. 397).

In fact, exploring one of the directions suggested by Foster-Cohen (2000) and (2004) for the development of a Pragmatics of SLA, we look at pragmatics less from a socio-cultural perspective and focus on detailed pragmatic processes. While most studies in interlanguage pragmatics investigate cross-linguistic pragmatic variation and the cross-linguistic contrast, we focus on low-level regular – potentially universal – pragmatic processes involved in deriving the propositional form of an utterance. Interestingly, we will see that this new perspective also sheds new light on interlanguage pragmatics.

Furthermore, our interest does not lie in L2 learners' productive pragmatic behavior in spoken or written discourse but rather in the pragmatic processes required for their receptive skills. Measuring receptive skills, of course, in any case requires a significant amount of interpretation, even with very precise measurement tools. The challenge for this study was, therefore, designing a means to infer receptive skills economically by benefitting from people's productive behavior.

2.2 Reference assignment: a pragmatic task

In the classical sense, defining pragmatics, as opposed to semantics, has been understood via the involvement of context. Anything that is "context-specific inferred meaning" thus belonged to pragmatics (Carston 2009: 12). More recently, however, pragmatists have come to accept that the line between semantics and pragmatics is not drawn easily (see Carston 2002 for a discussion). The literature has thus moved from the 'what is said' vs. 'what is meant' distinction to the 'explicit' vs. 'implicit' distinction, where the determining factor is the type and quantity of inferences required. Anything that can be seen as a logical development of an utterance *U* is therefore to be seen as explicit while all other inferred communicated content should be regarded implicit

In this study, we adopt the contextualist position that reference assignment, belonging to the explicit meaning of an utterance, involves inferencing as well and thus is a pragmatic process. Wilson, e.g., assumes that reference assignment is not an automatic semantically triggered process and "involves the retrieval or construction of an appropriate conceptual representation, one that uniquely identifies the intended referent." (Wilson 1992: 177). Reference assignment is also said to involve *saturation* and *free enrichment* (Carston 2009) that allows the listener to correctly understand an utterance such as *the coffee is cold* to be explicated as *the coffee that I last brewed is too cold to be enjoyed*. The process of saturation, here, allows her to identify which coffee is meant (*the coffee that I last brewed*) whereas free enrichment provides the logical enrichment of the linguistic code to make the otherwise trivial information of the utterance relevant. While free enrichment remains essentially outside the scope of non-pragmatic theories of meaning, we rest on the fairly uncontroversial assumption that reference assignment involves saturation and as such requires a pragmatic process. It therefore qualifies as an *explicature*, i.e. a pragmatically saturated component of (propositional) meaning (see Carston 2002).

2.3 SLA and age

Age has been a hotly debated topic in the literature especially within the context of the Critical Period Hypothesis (CPH). Since our interest mostly concerns the entire lifespan and therefore goes beyond the Criticial Period, (which, according to Long, 1990, is age 12-13, if at all there is any) we will not, devote much space to the issue in this chapter. Nonetheless, the CPH debate has triggered a number of noteworthy studies that shed light on the age effect and whose findings are generally accepted. E.g., there seem to be patterns that apply to older versus younger learners in terms of learning rate as well as type of learning. Chandler (2006) cites that younger learners have been found to rely more on memory ability and incidental learning whereas older learners can be more analytical about their learning and draw on their aptitude for explicit

learning. He concludes that there might be multiple critical periods, which affect different aptitudes or skills. Such an exploration could be especially instructive for this study to find out which aptitudes or critical periods are related to specific pragmatic skills such as reference assignment.

Nonetheless, one must take into account that 'age' can be understood in many different ways other than just chronology. It is one thing to think of age as a contributing factor to the brain's plasticity and another thing to think of age as a mix of social, emotional, psychological and cultural components, individually mixed in each learner (cf. Abello-Contesse *et al.* 2006). De Guerrero (2009) proposes the Vygotskian "Sociocultural Theory", suggesting that the role of age in second language development is less biological/maturational but rather psychological. Meanwhile, rather than seeing language and aging as a single-trajectory phenomenon, authors like van Geert (2009) propose a more multimodal understanding of language development through the lifespan, providing a more comprehensive account (see also Wander et al. 2009). Age could also be seen as incidental and underlying cognitive functions such as working memory or fluid intelligence might actually present a more reliable factor of change. In Keysar (2007), e.g., working memory appears to be the deciding factor in perspective taking abilities.

2.4 Age and pragmatic processing

Recent research on reference assignment and pragmatic processing describes and compares the processing of reference among children and adults. One of the leading studies was conducted by Trueswell et al. (1999) and actually serves as a basis for this chapter. In the study, the authors show that garden-path sentences leading to ambiguous referential contexts are processed differently by children aged 5 in comparison to their adult counterparts. In a situation where the participants are instructed to *Put the frog on the napkin in the box*, in a configuration where there are two frogs (one frog sitting on a napkin and the other one with no other property), children tend to be misled more often than adults and interpret the modifying sub clause as a prepositional phrase. They claim that as a result of a less efficient pragmatic system children, unlike adults, are unable to use contextual material to revise their initial misreading due to verb argument structure biases.

In a follow-up study, Wexler (2001) attributes the children's poorer performance to a lack of a semantic understanding of the definite determiner *the*. He suggests that what the study of Trueswell *et al.* shows is that, while children's processing is very similar to that of adults, what is crucially different for children is that they do not have the "uniqueness condition of N" in e.g. *the N* (2011: 25). This means that children use and understand *the N* to mean that there is at least one *N* but not that there is *only* one. On a more general level, Wexler argues that psycholinguistic assumptions often take for granted that children already have

acquired the linguistic system presenting the grounds for any kind of linguistic theory. In other words, how can an incomplete or underdeveloped semantic system successfully cater to pragmatic processes?

The response to Trueswell (1999) by Meroni & Crain (2011) states that both children and adults combine the Theta Assignment Principle and the Principle of Referential Success to decode a sentence: while parsing, they a) "assign the theta roles associated with a verb as soon as possible, all other things being equal" (ibid. 44) and then b) "abandon structural analyses that do not refer to entities represented in its current model of the domain of discourse" (ibid. 46). This would explain why *the napkin* is initially interpreted as the destination prepositional phrase but later on corrected to be understood as a modifier in order to satisfy the principles of Referential Theory. What distinguishes children from adults, in their view, is simply the fact that these principles are not yet as automated in children as they are in adults. [1]

Musolino & Gualmini (2001) also favor the view that while sentence-processing abilities between adults and children may differ quantitatively, "they do not differ qualitatively" in some parsing phenomena. In their work on the disambiguation of quantified NPs, they propose that children's interpretation of *every* changes over time to become more like the non-isomorphic interpretation reading of adults. Sentences like *Every horse didn't jump over the fence*, in time, will no longer be understood to mean that none of the horses jumped over the fence. Looking at coreference assignment, Reinhart also assesses that the quality of processing is not different between children and adults: "children's parser, being innate, is identical to that of adults … The difference between children and adults, in this case, is only in the size of their working memory" (2011: 169). She, thus, attributes the empirical differences between the two groups to working memory capacity, which is smaller in children in comparison with their adult counterparts.

The debate crystallizes around the question of whether the difference between children and adults lies in the process itself or in the way the process is hampered or accelerated. One could also formulate the question as having to do with either the development of the processing machine or rather with the working of the machine's elements. While Trueswell et al. believe that the process of, at least, reinterpretation differs between children and adults, their critics claim that it is a matter of either semantics or other processing resources such as automatization or working memory. Crucially, the critics argue that children act similarly to adults in the given tasks but lack the processing power to run the same calculations.

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[1]   This theory would also account for how the disambiguation of garden-path counts as pragmatic explicature: if the Principle of Referential Success essentially inhibits or blocks syntactic derivation, a pragmatic input is required to resolve the syntactic ambiguity.

2.5 Pragmatic processing and L2

In the same vein but from a slightly different perspective, one could ask whether such pragmatic processes differ not only when comparing children to adults but even when comparing native speakers to L2 learners of a language. Work on cognitive processes involved in disambiguation within SLA is gaining more attention in recent research. By means of a word-by-word self-paced reading and grammaticality judgment task of garden-path sentences with temporary subject/object ambiguities, Juffs (2004) found that speakers of L2 English seem to parse garden-path sentences as English native speakers do in that they show a similar sensitivity to ambiguities in terms of increased processing difficulty. However, it remains unclear what exactly underlies this difficulty in disambiguation for both groups. On the one hand, it is not clear what contributes to the "strength" of a garden-path effect, i.e. the degree to which the target sentence enforces initial erroneous interpretations and to what extent it makes disambiguation more effortful for either group. On the other hand, it remains to be discovered in which part of the process the difficulty arises.

There are several views about how the disambiguation in garden-path sentences differs between L2 learners and native speakers. Some claim that it has to do with a fundamental processing difference in that L2 learners rely "largely on lexical-semantic and pragmatic information" (Roberts 2012: 177). L2 learners, therefore, are said to operate in a way that differs structurally from that of native speakers. Clahsen & Felser (2006) claim that while processing differences between L1 children and adults are explained in terms of cognitive developmental factors, L2 learners' increased difficulty would lie in a 'shallower' syntactic representation system. Meanwhile, there are scholars who believe in a more quantitative rather than qualitative account and attribute the difference to L2 learners' lacking proficiency and to the (resulting) processing limitations (e.g. Juffs 2004, see above; Dekydtspotter *et al.* 2006).

From a Pragmatics of SLA perspective, reference assignment in typologically close languages like German and English should give rise to positive transfer in the sense of Selinker (1969, 1983). The integration of contextual assumptions when assigning referents to an ambiguous NP in L2, thus, should be similar to that in L1. As a result, assuming L2 proficiency is not a hindrance, a direct transfer, or cross-linguistic influence (Jarvis & Pavlenko 2008), of pragmatic abilities from L1 to L2 is expected. All other things being equal, it could legitimately be expected that low-level explicatures of the type discussed above should benefit from prior knowledge and skills developed in L1.

However, one of the central tenets in cognitively-grounded pragmatic frameworks such as Relevance Theory is that pragmatic processes, such as the derivation of explicatures, is subject to non-linguistic, cognitive influences. Therefore, all other things are not equal. An interlocutor's pragmatic abilities should reflect the impact on their cognitive abilities. To the extent that L2 and

age might constitute such cognitive obstacles, the central hypothesis of this chapter runs against transfer theory and predicts that learners' performance on pragmatic tasks are inferior to those of L1 speakers and that the gap between the two becomes bigger across the lifespan.

2.6 Pragmatic processing and perspective taking

Reference assignment relies on different kinds of information to draw the explicature. One element of the referential disambiguation process crucially hinges on what is referred to as Perspective Taking. It describes the alignment of the cognitive environment between speakers and hearers. Part of the pragmatic activity deployed during a verbal exchange deals with mutual knowledge, that is both interactants have to construct a mutual representation of each other's cognitive environment (including a representation of the other person's representation of one's cognitive environment). With regard to reference assignment, a very simple rule applies: only those referents that are mutually cognitively manifest (in the terminology developed by Sperber & Wilson 1995) can be the objects of discourse. As a result, interactants have to keep track of each other's cognitive environment to draw the right explicatures.

In a series of experiments, Keysar and colleagues (1998, 2000, 2007) investigated reference assignment in children (around age 5) and adults in an experimental paradigm where participants receive instructions to move objects from an instructor who does not have access to the same referents as the subject. The authors assume an *egocentric bias*, i.e. addressees by default first consider possible referents within their own cognitive environment. Therefore, referential disambiguation of this type, similar to the garden-path task, also requires a revision of one's initial interpretation. Subjects have to align their cognitive environment to that of the instructor in order to pick the correct objects. Keysar and colleagues showed that whereas adults typically revise their initial egocentric bias, children are less likely to do so.

Keysar's attributes the difference between children and adults to a matter of, what we shall call, cognitive *saturation*. He writes (2007: 75)

> [T]he consideration of other's beliefs is not automatic. Instead, it is an effortful process, which requires cognitive resources and is easily disrupted. If this is true, then people's interpretations should depend on the resources available to their working memory.

Adults thus outperform children on disambiguation explicatures because they have more resources to allocate to the pragmatic adjustment that is needed to override the initial egocentric bias. This model predicts that any kind of cognitive pressure is likely to result in a weaker performance in the given pragmatic task. It allows us to move away from the children-vs.-adults distinction and formulate a broader generalization: from a lifespan perspective, learners' processing of contextual assumptions in the course of aligning their cognitive environment

with that of the interlocutor is expected to correlate with changes affecting cognitive (i.e. not only linguistic) abilities over time.

3. Research question

The study in this chapter is based on two of the previously mentioned psycholinguistic studies, briefly summarized as follows:

3.1 Study 1: referent disambiguation in garden-path sentences

Trueswell *et al.* (1999) set out with the premise that readers usually process sentences incrementally. That is, adult readers do not need to have read the whole sentence in order to have an idea of what the end of a sentence will more or less contain. This also means that readers occasionally make incorrect commitments prematurely. Therefore, readers have the ability to 'foresee' parts of a sentence that is still ahead and, if necessary, to revise wrong commitments that were made in the process. Trueswell *et al.* investigated how this ability is represented in young children as opposed to adults, in particular in connection with reference assignment processes. To do this, they used an eye-tracking system to study the children's online sentence processing, based on the assumption that fixation data and eye-movement patterns can be used to quantify processing difficulty. Trueswell *et al.* adapt the context-sensitive pragmatic disambiguation principle known as the Referential Principle, which purports that processing commitment can be aided by the context so long as it does not run against the lexical bias (e.g. verbs that have a strong VP attachment). It was to be seen if children's understanding of a sentence was more pragmatic and contextually driven or rather more structurally driven than that of adults.

In their experiment, the authors compared children's processing of instructions that consisted of temporarily ambiguous phrases such as "Put the frog on the napkin in the box" (1999: 96) with their unambiguous counterparts "Put the frog that's on the napkin in the box." They presented each of these target sentences with two possible visual contexts: condition 1) with 2 possible referents (one frog sitting on a napkin and one that was not) supported the interpretation of "on the napkin" as a NP modifier, whereas condition 2) with only one possible referent, according to the authors, encouraged a VP-modifier reading and thus they expected the children to move the (only) frog onto the empty napkin. The same experiment was conducted with adults. Trueswell *et al.* found that adults behaved according to the Referential Principle as had been predicted. Furthermore, it was confirmed that adults were able to cancel their initial incorrect commitment and made fewer errors than children. It also showed that young children of age 5 preferred to interpret *on the napkin* as the destination of the verb of movement. In addition, they did not revise their initial commitment as willingly. As a result, they chose the correct referent in the 2-referent

condition at chance. Assuming that children also interpret utterances incrementally, one could say that they show a significantly lower tendency to revise their initially assigned referent.

3.2 Study 2: referent disambiguation in perspective-taking task

Keysar *et al.* (2000) investigated reference-assignment preferences and the follow-up study by Epley, Morewedge & Keysar (2004) in particular looked at that of children (aged between 4 and 12) in comparison to adults. However, here the disambiguation processes that govern the assignment of a referent to an ambiguous definite NP involved the correct alignment of speaker and hearer cognitive environment. The focus in this study, thus, lay on Perspective Taking and the *egocentric bias*. Keysar *et al.* started out from the macro-level assumption that communication hinges crucially for both speaker and addressee on establishing mutually known information[2] as it constitutes a prerequisite for successful comprehension, and they investigated the traces of this cognitive alignment process between two interactants from a micro-level approach by identifying how subjects assign referents in certain ambiguous contexts.

To do this, the authors had subjects participate in a referential communication game which involved moving around objects within a vertical array of slots according to the instructions of a confederate, who, acting as the director, was seated opposite the participant, across a see-through bookshelf and, therefore, had a different perspective. While all slots were visible from the participant's perspective, the experimenters occluded some of the slots from the director's view, which forced the participants to keep in mind that the director did not see all of the objects they could see. For example, in a sentence like *move the small candle one slot down*, there would be three candles of different sizes and the smallest one would be occluded. The correct referent would thus be the medium-sized candle as it was the smaller one in the director's view—assuming that he could not possibly mean one of the objects he did not see. However, if participants considered the instructions egocentrically, the authors predicted that they would initially consider all candles as referentially valid, including the occluded object. All the while during this game, the participants' eye as well as head movements were tracked to determine their gaze. Indeed, the study showed that adults' initial eye movements were fastest to the occluded object and that they fixated the occluded object longer in critical trials than in the control condition. Keysar *et al.* concluded that, even though the participants knew which slots were occluded, the egocentric bias overrode that knowledge (cf. Keysar *et al.* 2000: 35) leading to erroneous referential disambiguation.

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[2]   Where mutually known information is understood to correspond to a representation in the hearer's cognitive environment of that of the speaker and vice-versa.

In a follow-up study that compared the behavior of children ranging from 4 to 12 years of age to that of adults, they found that the children reached for objects more egocentrically than did their adult counterparts. Whereas adults also committed errors in the critical trials, theirs were significantly fewer than those of children. Furthermore, the number of errors was significantly related to the participants' age with fewer errors being committed the older participants got. In terms of looking at the egocentric and thus incorrect object, adults and children were equally quick. However, adults were shown to be quicker when it came to correcting the initial egocentric choice and subsequently better at picking the correct object, i.e. at pragmatically revising their initial reference assignment. The authors conclude that "[a]dults and children do not appear to differ in the automatic processing of their own perspective but do differ in the controlled adjustment required to accommodate another's differing perspective." (Epley 2004: 765) This is in line with the findings of Trueswell *et al.* where the adults pragmatically outperformed the children.

Epley *et al.* draw a direct relation between a strong egocentric bias and the participant's high attentional load as well as when the motivation to make accurate judgments is low. According to the authors, therefore, the difference in performance on the tasks between children and adults is not related to differences in the automated processes themselves but rather in the mental processes that control or affect those processes. It remains unclear, however, in what way the ability of perspective taking improves with age. Epley *et al.* make a tentative suggestion that performance could improve as the process becomes more automated: with practice and experience growing children's disambiguation processes become more "efficient and effortless" (766).

3.3 Pragmatic processes in reference assignment

In both studies described above the adults outperformed the children in the respective pragmatic tasks. Meanwhile, the children were less able to revise their initial commitment and selected the incorrect object in the critical trials. This is a strong indication that what drives hearers' pragmatic ability to disambiguate sentences correctly is either inexistent or underdeveloped in children. On the one hand, one could argue that children have not yet acquired or developed that which would have prevented the misreading of the utterance. On the other hand, one could say that the children's pragmatic system is not 'powerful' enough to revise the initial erroneous commitments. This would entail either that children's pragmatic machine is not automated enough or that their pragmatic machine does not have access to enough cognitive resources.

To investigate this matter further, the study described in this chapter applies similar experiments to second language learners. It is to be seen whether solving reference disambiguation tasks in an L2 is anything like what has been found for L1. Understanding whether the difference in pragmatic processing

between native speakers and L2 learners is qualitative or quantitative in nature could shed light on the difference between children and adults. If we assume that it is qualitative, we would find that the pragmatic process of reference assignment is something that is acquired or perfected at some point and thereafter stable across all levels of cognitive demands put on the system, including aging. The acquisition of pragmatics would have to be considered a 'developmental' matter. However, if the difference is attributed to a quantitative difference, one expects that adults and L1 speakers outperform non-native speakers like they do children due to a different access to cognitive resources and assuming that non-nativeness is a stressor. In this case, additional cognitive stress would result in more errors—even in L2 adults—and we would have to say that the acquisition of the pragmatic machine is a matter of 'cognitive saturation'. The research question pursued in this chapter, in line with the ongoing debates on whether variation in pragmatic processes is either qualitatively or quantitatively grounded, asks whether the pragmatic processes in question are affected by L2 towards the 'developmental' or rather the 'saturational' take. The following section will outline how the two original studies were adapted towards that end.

4. Research design

For the two experiments described in this chapter, over 150 native speakers of German were recruited, which provided a convenience-sample representation of the population. Eligible participants were selected according to an online survey tool, by which it was ensured that they knew, by means of their personal evaluation, some English but did not speak it as their mother tongue. The entire sample of eligible participants consisted of participants aged 10-11, 15-16, 20-29, 30-39, 40-49, 50-59, 60-69, 70-79 and 80 and above, each age group consisting of 20 people[3]. To replicate the experimental setup from the original studies and yet be able to accommodate as many subjects as we did, we reconstructed two computer-assisted tests using E-Prime. That way, the stimuli were set and reset by the program automatically and did not have to be construed manually. This allowed for conditions to be maximally similar across all participants and testing conditions.

In both experiments, the participants are walked through the task with slides explaining to them what they needed to do in German. They were allowed to repeat this part as often as they wished. Two to three trial slides, during which the computer program validated their response, ensured that they had completely understood the task before starting the test, all the while giving them the option of returning to the explanatory slides.[4]

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[3]   As some of the participants aged 80 and above dropped out, this age group was smaller.

[4]   In order to ensure that the participants of all levels of English could perform the task well, they were introduced to all of the objects that would appear in the test slides along with their names in

The experiments were conducted between fall of 2011 and summer of 2012 with a mobile computer lab set up at the University of Zurich campus. For participants who were not mobile, the assistants arranged to set up the lab in the participants' homes. Subjects were compensated with a monetary gift. The experimental battery run on the participants included the two experiments presented in this chapter as well as those conducted for two other studies presented in this volume. The experiments ran on a laptop computer and a wireless mouse to gather participants' responses. For both experiments of the present chapter, the data include the location of the subjects' first clicks to measure their accuracy in pointing to the correct referent for the target NP as well as their response time, i.e. the duration between stimulus onset and their first click. The order of the tasks was randomized so that cross-design effect could be controlled for.

4.1 Procedure experiment 1: reference assignment in garden-path sentences

In the experiment based on Trueswell (1999), the stimuli displayed 4 clickable objects. Upon hearing the instruction, e.g. *Put the frog on the napkin in the box*, they had to click first on the correct referent (the correct frog among up to two possible ones) and then the correct destination, in this case the box. As seen above, the critical instructions consisted of a garden-path sentence and contained a temporary ambiguity in that, as long as *in the box* was not heard, *on the napkin* could be mistaken for a verbal adjunct phrase rather than a nominal modifier phrase. Based on the study by Trueswell (1999), the experiment investigates the subjects' ability to correct their initial misreading of the garden-path sentence as well as the effort it takes them to do so in L2. The conditions varied in terms of how many possible frogs there were (1 or 2) and whether the sentence was syntactically ambiguous or not, i.e. introducing the modifier phrase with or without *that*.

4.2 Procedure experiment 2: reference assignment and perspective taking

By the same token, in the experiment based on Keysar's study (1997), the subjects were presented with a virtual bookshelf on the computer screen and were asked to imagine a speaking pig standing behind it. For each stimulus, there were several objects placed in some the bookshelf's slots. A number of these, however, were covered on the pig's side and the subjects had to factor in that the pig neither saw nor knew what objects were placed in the covered slots. The task, thus, consisted in subjects hearing an instruction such as *Put the bear above the duck* and picking the correct referent among the possible

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both written as well as in spoken form. E.g. they would see a bear along with the word "bear" on the screen and simultaneously hear somebody say "this is a bear".

bears. While the sentence in itself was syntactically unambiguous and there was always only one correct referent (all other objects were either not bears or covered on the pig's side), the instruction remained ambiguous to the subjects to the extent that they did not consider the pig's perspective.

The test was run on three different conditions. In the first one, the subjects heard an instruction that was unambiguous and where there was only one possible object to be moved. The second condition, hereafter ambiguous condition, consisted of an instruction where there were at least two of the kind of objects that the subjects were asked to move on the screen, however, only one was not occluded from the pig's perspective and thus there was only one possible correct response. In the third condition, hereafter biased condition, the participants heard instructions that included an attribute to distinguish between three possibly correct objects, such as "the *small bear*". Thus, in the biased condition, subjects heard commands such as *put the small bear above the duck* when there were three bears of different sizes on the screen but the smallest one was occluded. The difference between the ambiguous condition and the biased one is that the latter biases the subjects towards one of the objects on the screen (in this case the smallest bear) whereas the former does not. Therefore, the corrective measure required of the subjects' pragmatics is higher in the biased condition, which is why we also expect them to make more mistakes. All of the three conditions in Experiment 2 were tested in both the subjects' L1 and L2.

5. Results and discussion

In accordance with the view by which reference assignment is a pragmatic process, which should have been acquired within the first five years or so, L2 reference assignment should prove to be a fairly basic, automated task and should not pose a great challenge for the participants. While our participants performed well on the two reference assignment tasks and made very few mistakes, our data still allow us to tease out some interesting and distinctive L2 patterns.[5]

5.1 Experiment 1

Since the participants' overall mean error rate is very low, we can say that assigning reference in L2 remains a fairly straightforward task, even in a second language. Comparing the different conditions, however, we see that the subjects' error rates in response to temporarily ambiguous instructions is three times as high as for unambiguous ones. The difference in means was .801 and

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[5]   In this section, the description of the data gathered from the experiments will primarily be interpreted by testing the equality of means. However, it should be noted that since there was a ceiling effect, it is difficult to determine the central tendency and therefore the results from the statistical analysis should be accepted with due reserve at this stage.

highly significant by a paired-sample t-test (t=6.117, df=155, p<.001). If we hark back to the original study, this is reminiscent of the behavior of the 5-year olds, who in the same condition performed at chance level.[6] This shows not only that the ambiguously phrased instructions were actually perceived as ambiguous by some (if not all) subjects but not all could overcome this temporary ambiguity correctly. This is in line with our hypothesis that pragmatic disambiguation processes – in this case overcoming temporary ambiguity – in a second language, even as adults, is more prone to erroneous performance.

In terms of context, participants committed about twice as many errors in ambiguous sentences when there were two referents as when there was only one referent. The difference in means was 1.288 and highly significant by a paired-sample t-test (t=7.022, df=155, p<.001). Comparing this to the data in the original study, we again see that our subjects reflect the tendency of children to be confused about picking the correct referent in 2-Referent stimuli. This would also support our hypothesis. The difference in response accuracy between conditions is illustrated in Figure 1 below. It shows a stark contrast between the only condition that requires pragmatic disambiguation of referent (*2Ref Amb*, which stands for 2 referents with syntactic ambiguity) and all other conditions (1 referent with or without syntactic ambiguity or 2 referents without syntactic ambiguity).
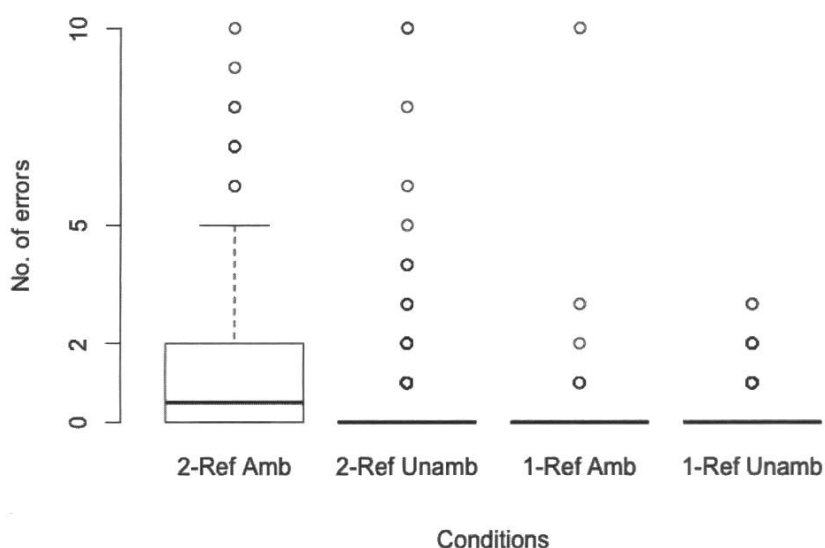

Figure 1: Boxplot of error rate per condition in Experiment 1.

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[6]   Adults in the original study only experienced the instructions as garden-path sentences in the 1-Referent ambiguous condition and only committed errors in their reading of on the napkin, interpreting it as a PP instead of an MP, but not when assigning reference (Trueswell 1999: 116-117).

A comparison of reaction-time means for ambiguous versus unambiguous stimuli with 2 referents shows only a minimal difference with a 28 millisecond increase for the ambiguous stimuli. A paired-sample *t*-test, however, shows that the difference is not significant (t=0.624, df=155, p=0.533). The difference between 1- and 2-referent contexts with ambiguous instructions provides a starker contrast in that the latter condition caused the subjects to take 242 milliseconds longer to solve the task. This difference by a paired-sample *t*-test proved to be significant (t=6.419, df=155, p<.001). If response times are any indication at all of cognitive processing, the data from the response times supports the claim that reference disambiguation explicatures are a costly cognitive process and slows our participants down. However, while there is a slight indication that it does appear in L2 English, the garden-path effect remains quite weak.

Looking at the accuracy data in relation to age, the participants show a sharp increase in accuracy with increased age up to the age of around 20, which is probably due to the proficiency level of younger participants. After that the pattern is less clear. While response times get better as participants get older, the participants' speed at solving the task decreases with age starting from age 30. Table 1 summarizes the exact figures of the means for each age group. Using a one-way ANOVA to test for variance of means between the participant groups aged 10 to 79, a significant difference can be found, both for accuracy, $F(7, 144) = 3.894$, p<.001, and response times, $F(7, 147) = 7.862$, p<.001.

Age in years	10-12	15-16	20-20	30-39	40-49	50-59	60-69	70-79	80-89
Error rate in %	1.641	0.802	0.254	0.219	0.578	0.212	0.212	0.809	0.083
Response Times in ms	1846	1601	1376	1709	2135	. 1917	2087	2576	2282

Table 1: Error rate and RT for each age group in Experiment 1.

The data shows that the subjects' behavior, even though they are all notably older than five years, echoes that of the children from the original study, as expected by our hypothesis. It also confirms that L2 pragmatic processes are affected through the lifespan both in terms of accuracy and speed, as there seems to be a positive correlation between age and pragmatic processing effort and accuracy. Moreover, the more difficult a task is, the more likely it is to elicit an erroneous response: despite an increase in processing time, performance is still poorer.

5.2 Experiment 2

Comparing the results from the original studies by Keysar (2004) and Trueswell (1999), we see that the cognitive environment alignment task elicited many more errors from the adult subjects than did the disambiguation of garden-path

sentences. In Keysar (2000), the subjects actually reached for the occluded object in 23% of the critical conditions. Our data reflects this increase in difficulty, showing an error rate on the first click, i.e. reference assignment of the target NP, that is more than six times higher than that of Experiment 1. Nonetheless, we see that reference assignment here, too, remains a fairly easy task for the participants and that they perform well overall. In fact, our participants' performance-level is better than that of the subjects originally tested by Keysar[7].

This difference between our results and the original study's might be explained by the design of the task: due to the virtual interaction displayed on screen, the participants might have developed a strategy that merely filtered out those objects in the stimuli that appeared in front of a gray background (and thus were to be considered occluded). Yet, since the aim of this section is to measure the subjects' contextual disambiguation from a linguistic point of view, even filtering out the gray slots can be considered a stressor and helps evaluating the subjects' referential pragmatic skills.

Considering the different conditions, we see that all participants had a perfect score when assigning reference in the unambiguous control condition in L2, as was expected. The data is more informative when we look at the two other conditions: it shows that participants committed more errors in the ambiguous condition and even more errors in the biased condition. The difference of mean error rates was 0.061 (with 0.112 for the biased condition) and highly significant by a paired-sample t-test (t=7.075, df=155, p<.001).[8] We see that the biased condition has elicited more than twice as many errors as did the simple ambiguous condition. Assuming that the biased condition posed a greater cognitive load, the data shows that reference assignment under these circumstances is more difficult. This is in line with Keysar's finding (2007: 75) that "with a high external [cognitive] load subjects were much more egocentric than with low external load, and behaved like subjects who have a low working memory capacity."[9] To what extent solving the task in L2 involves an 'external' rather than 'internal' load remains to be determined. However, one argument would be to treat L2 cognitive interference as interference that is generated by the language processing system itself and would therefore qualify as a form of internal load. The following graphs illustrate the subjects' response accuracy and places side by side their performance in their L1 vs. their L2. As we see, performance contrasts strikingly between L2 and L1, specifically on the most

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[7]   Children in Epley, Keysar et al. (2004) reached for the hidden referent 2.08 (mean) times out of 4.

[8]   The same testing procedure revealed a significant difference between the simple ambiguous and the unambiguous conditions in both languages as participants consistently achieved a perfect score in the latter.

[9]   In the 2007 study, Keysar manipulated the subject's "external load" by e.g. having them keep in mind several sets of numbers while following instructions.

demanding condition, where participants not only need to reconstruct the speaker's cognitive environment through reference assignment but they also have to deal with an additional layer of ambiguity due to the presence of a modifier in the target NP.

Errors in L1

Figure 2: Boxplot of error rate per condition in Experiment 2, L1.

Errors in L2

Figure 3: Boxplot of error rate per condition in Experiment 2, L2.

When examining the participants' response times in the two ambiguous conditions, subjects appear to take longer when dealing with the instructions in the biased condition by nearly 350 milliseconds. The difference in means, here

too, is highly significant by a paired sample *t*-test (*t*=5.201, *df*=155, *p*<.001), showing that the response times for the biased condition are significantly longer than in the simple ambiguous condition. This, again, supports the assumption that the biased condition requires more processing effort and underlines the findings from the accuracy data. These results seem to indicate that as the demand on pragmatic processing increases, the pressure exerted by L2 impedes the processes more heavily. This is in line with our observations in Experiment 1 where a clear contrast in accuracy between the 2 referentially ambiguous conditions is obtained as the condition involving a syntactic ambiguity suffers more.

Looking at the variation in relation to age, we notice interestingly that, contrary to what we observed above in Experiment 1, there is no significant difference among the groups in terms of accuracy by a one-way ANOVA, $F(7, 143) = 1.514$, $p=0.166$. Table 2 summarizes the exact figures of the means for each age group. When it comes to response times, however, one can see that while young participants up to age 29 increase in processing speed, this gradually declines with age: the youngest as well as the older groups take longer to respond than the subjects in their teens and late 30s. A one-way ANOVA has proven the group differences to be significant, $F(7, 142) = 4.927$, $p < .001$).

Age in years	10-12	15-16	20-29	30-39	40-49	50-59	60-69	70-79	80-89
Error rate in %	0.636	0.450	1.122	0.350	0.461	0.851	1.470	1.634	0.933
Response Times in ms	3249	2607	2058	2557	4129	3279	3990	4141	4082

Table 2: Error rate and RT for each age group in Experiment 2.

These results contrast with those observed in Experiment 1: one can detect two different types of reference assignment processes in L2. Although a preliminary analysis appears to be compatible with the general assumption that reference assignment is highly sensitive to cognitive load, it calls for a differentiated account of successful reference assignment processes across the lifespan in L2 (and possibly in L1), depending on the type of contextual information available.

From a language learning perspective, our results point in an interesting direction as they indicate that the cognitive nature of pragmatic disambiguation processes makes them prone to fail on purely cognitive ground. In other words, the errors noted above do not seem to be explained by the cross-linguistic variation of reference explicatures, as we argue there is none in this case, but by the sheer cognitive overload experienced in L2 which affects the subjects' performance. While it would be interesting to apply the same test in the subject's L1 for control or to test their reference assignment skills by using reference markers other than determiners, the conclusion that solving pragmatic tasks

depends on the subjects' cognitive capacity gathers further support through the deterioration observed across age groups.

In that sense, these findings offer a new take on interlanguage pragmatics. They indicate that the often noted under-performance in interlanguage pragmatics can at least in part be attributed to a shortage of cognitive resources and is not necessarily due to typological mismatches or other types of cross-linguistic influences.

6. Conclusion

To understand the implications of these results for applied linguistics, and language learning and language teaching in particular, one might wish to hark back to the question of the teachability of pragmatics as raised by Rose (2005). Answering how much should be taught will depend on how much is already there to begin with. Our results give us a glimpse of the complexity of the answer as we come to realize that there seems to be a clear gap between the competence that learners might have in EFL and their ability to *use* it. This echoes the critique voiced by Wexler (2001) that a clearer definition of the assumed linguistic systems must be provided, on the basis of which evidence of psycholinguistic and pragmatic behavior can be evaluated. In particular, our results indicate that despite their having access to a linguistic system which includes the appropriate rules of reference assignment, learners' pragmatics fails them. To put it in different words, there is nothing that could be taught regarding reference assignment to our participants which they do not already know.

On the other side of the coin, our results also call into question more traditional views about pragmatic disambiguation where reference assignment would regarded as a unified process. Thus, a general statement such as the following: "pragmatic interpretations are not arbitrary. They are well motivated, 'common-sensical' and predictable. They therefore need not be learnt when we acquire a new language" (Ariel 2010: 44) will need to be rethought as reference disambiguation appears to involve different types of pragmatic processes, which is not surprising, but that these processes appear to have distinct cognitive profiles. In turn, those differences are affected differently by the cognitive pressure exerted by L2. Also, our study shows that even if some pragmatic processes such as reference assignment need not be learnt (or taught, for that matter), they are nonetheless affected when employed under certain cognitive constraints, such as in L2 or with increased age.

The results gathered from this study have so far shown to be ambivalent in that reference assignment in ambiguous contexts in L2 English by native speakers of German is fairly accurate across the lifespan. Yet, a closer investigation of the specific processes shows that their pragmatic behavior echoes that of children in L1 English studies. Furthermore, different types of ambiguity seem

to call for different ways of disambiguating referents. The line of inquiry we wish to pursue from here, therefore, is one where the difference between perspective-based ambiguity and syntax-based ambiguity indicates that the two tasks activate different pragmatic processes, which are differently affected a) by the cognitive demands set by L2 and b) by the cognitive factors associated with aging.

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