

Foreign-Language Acquisition by Watching Subtitled Television Programs

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THE CASE OF SUBTITLING

Smaller countries import a large number of television programs from abroad. The imported programs are generally either dubbed or subtitled in the local language. The debate between dubbing and subtitling has been settled by considerations of speed and cost; most countries with a smaller language community typically apply subtitling due to its lower cost and easy translation. In most countries in the world where subtitling is being applied, the same rules of thumb are used for timing the subtitles. Two lines of text, each with a maximum of 32 characters and spaces, can be used at a time. If there are two lines of 32 characters and spaces each, the subtitle is displayed for 6 s. Shorter subtitles are time-scheduled proportionally according to this 6-s rule. Nobody seems to know how this 6-rule was arrived at.

With subtitled movies, there are at least three different input channels: the visual image, the soundtrack (including the foreign voices) and the subtitles (a translation of the voices). The text lines of the subtitles should, ideally, be completely overlapping with the translated information of the soundtrack. Most imported programs in Belgium are in English, a language which is fairly well known by the adult Belgian participants; anecdotal evidence further suggests that translation errors in the subtitles are almost immediately noticed.

The visual image (not including the subtitle) and the sequence of events in the movie typically provide abundant information which makes sometimes either understanding the spoken language or reading the subtitle superfluous. Moreover, it has been claimed that people unconsciously lipread to a certain extent.

READING SUBTITLES, MANDATORY?

How is a person able to divide and shift his or her attention in such a complex situation? To answer this question, observers watched a subtitled movie and we measured their eye-movement fixation patterns between image and subtitles. d'Ydewalle, Van Rensbergen, and Pollet (1987) showed that Dutch-speaking subjects were able to switch effortlessly between the visual image and the subtitle. Moreover, the time spent in processing the subtitle did not change when reading the subtitle was made either more important for understanding the program (by switching off the soundtrack) or less compelling (when the subject knows the foreign language very well). Therefore, it was concluded that reading the subtitle at its onset presentation is more or less obligatory; it is unaffected by major contextual factors such as the availability of the soundtrack and important episodic characteristics of actions in the movie.

In order to explain the findings, two hypotheses were formulated. First, reading a subtitle is more efficient than listening to the foreign language. Second, Dutch-speaking subjects are very familiar with subtitles before they ever master the foreign language. The experience may still lead them later to reading the subtitle even when they know the foreign language very well.

The main evidence in favor of the first hypothesis came from d'Ydewalle, Praet, Verfaillie, and Van Rensbergen (1991). In Experiment 1, American subjects watched an American movie with English soundtrack and subtitles. Despite their lack of familiarity with subtitles, they spent considerable time in the subtitled area. Accordingly, subtitle reading cannot be due to habit formation from long-term experience. In Experiment 2, a movie in Dutch with Dutch subtitles was shown to Dutch-speaking subjects. They also looked extensively at the subtitles, suggesting that reading the subtitles is preferred because of efficiency in following and understanding the movie.

In d'Ydewalle and Van Rensbergen (1989), some evidence was gathered for the second hypothesis by recording eye movements of young children. Although the attention pattern of fourth- and sixth-grade children did not differ from the pattern of adults, the pattern of second-grade children depended largely on the movie shown. For example, second-grade children watched a subtitled "Garfield" (a heavily verbally loaded cartoon) exactly as adults did, but they did not read the subtitles in "Popeye" (an action-oriented cartoon). This suggests that reading subtitles is not yet completely compulsory for young children, although they are well able to read them (as evidenced by their behavior when watching "Garfield").

The preceding studies all used segments from film or a television series. As summarized in d'Ydewalle and Gielen (1992), we also used news broadcast. News broadcast differs in several

respects from film. First, one is not used to watching a news broadcast with subtitles whereas 90% of the films shown on Belgian television networks are foreign and subtitled in Dutch (or French). Second, film represents entertainment, deals with only one story with a beginning and an end, and features a number of reappearing characters. The images are often more attractive than the dialogue, and the pace is, in general, rather slow. A news broadcast, on the other hand, is meant to inform the viewers of what is going on in the world at large. The text is often far more important than are the images. A news broadcast provides a great deal of concrete information in a short period of time. Moreover, the different news items within a news broadcast do not relate to one another. The Dutch-speaking subjects were divided into four conditions: a Dutch film, a German film, a Dutch news broadcast, and a German news broadcast, all provided with Dutch subtitles. The results can be summarized as follows. With news broadcast, subjects had a greater need for subtitles as they started to look at the subtitles at a faster pace and read them for longer periods, even when the spoken news broadcast was in their own language.

Elderly people complain more about subtitles than other age groups. d'Ydewalle, Warlop, and Van Rensbergen (1989), using again eye-movement recordings, found that with longer subtitles, younger people looked longer at the subtitle than the older people. As younger people read faster than older people and therefore finish reading earlier, younger people start re-reading the subtitles and therefore, linger longer in the subtitles. The age-related difference does not occur with shorter subtitles because in that case nobody has extra time available due to their shorter presentations. Watching subtitled programs requires to integrate continuously the information from the image, subtitles, and sound, and older subjects are considerably slower to integrate; therefore, older subjects return to the image as quickly as possible after a first reading of the subtitles. A number of detailed analyses of the data as well as the screening of the video recordings confirmed the above explanation.

Verfaillie and d'Ydewalle (1987) investigated subjects who were deaf from birth. Three different sources of information were presented: subtitles, sign language, and information from lip movements. The eye movements of the subjects were measured while they were watching a spoken television story. All subjects were shown stories in four different modalities: (a) speaker, sign interpreter, and subtitles at the same time; (b) subtitles and sign interpreter; (c) subtitles and speaker; and (d) speaker and sign interpreter. The results showed overwhelmingly a preference for the subtitles. When enough time was left after reading the subtitles, the subjects looked at other parts of the screen, preferring signs to lip reading.

WHAT ABOUT THE SOUNDTRACK?

While so far it is clear that reading the subtitles does occur, and switching the attention from the visual image to reading the subtitles happens to be effortless and almost automatic, the next question is whether the soundtrack is also processed to a certain extent simultaneously. Most of the subtitled films that are shown on the Dutch-speaking television networks are spoken in English or French, two languages that most of the Dutch-speaking adults are at least familiar with. As such, it is perfectly possible that part of the soundtrack is processed as well. This is already suggested incidentally by spontaneous reports from the subjects that the translation in the subtitle did not fully agree with the spoken dialogue, in cases where such a mismatch had occurred. In Sohl (1989) with adults, a double-task technique was used. Apart from watching a television program, the subjects had to react to flashing lights (+ a sound beep) as fast as possible. The reaction time to the flashing lights was taken as a measurement for the amount of processing done with the first task, which was the viewing of a television program. The flashing lights were given at specific moments: subtitle and speaker(s) present, no subtitle, and neither subtitle nor speaker(s) present. The results showed that the presence of subtitles consumes resources, and independently, the presence of voice also slows down the reaction times. The slowest reaction times with adults were obtained whenever both a speaker and a subtitle were present, which suggests that the adult participants do make an effort to follow the speech.

Since both subtitles (in the native language) and sound track (in the foreign language) are processed almost in parallel, there may be language acquisition in such a context. Simultaneous viewing of the subtitles and listening to the soundtrack may be a factor in language acquisition. Can watching (and enjoying) subtitled television programs incidentally lead to foreign-language acquisition?

Pavakanun and d'Ydewalle (1992) and d'Ydewalle and Pavakanun (1995, 1997) investigated incidental foreign-language acquisition in the context of watching subtitled television programs. In the experiments, the language in the soundtrack and in the subtitles was manipulated: either the foreign language or the mother language in the soundtrack, or no soundtrack; likewise, either the foreign language or mother language in the subtitle, or no subtitles, leading to a 3 x 3 design. The standard condition is of course when the foreign language is in the soundtrack and the mother language in the subtitle; reversed subtitling refers to the condition where the mother language is in the soundtrack and the subtitles are in the foreign language. The adult participants were shown the subtitled cartoons for about 15 min long; immediately thereafter, foreign-language acquisition was tested. The findings established without any doubts that there is

considerable incidental language acquisition simply by watching a short subtitled movie. Surprisingly, there was not necessarily less foreign language acquisition when the foreign and mother languages were vastly different. In fact, there was not much support for distinguishing the language families as a function of their acquisition (see also d'Ydewalle & Pavakanun, 1997). In agreement with other studies (d'Ydewalle & Pavakanun, 1995; Holobow et al., 1984; Lambert et al., 1981; Lambert & Holobow, 1984; Pavakanun & d'Ydewalle, 1992), reversed subtitling enhanced language acquisition even more than the standard subtitling. However, performance in all tests on syntax and grammar acquisition remained relatively poor; acquisition was clearly limited to vocabulary.

INCIDENTAL FOREIGN VOCABULARY ACQUISITION

Several authors explicitly pointed to differences in language acquisition between adults and children (Lambert, Gardner, Olton, & Tunstall, 1970; Lambert & Klineberg, 1967; Larsen & Smalley, 1972; Macnamara, 1973), leading to the conclusion that especially children are successful in acquiring a language by being exposed to the language in an informal context, whereas the effect of such an informal contact is usually more limited in adults. In the context of first-language acquisition the notion critical period is applied (Lenneberg, 1967), suggesting that children who do not start to acquire a language by the age of 12 will never succeed in achieving normal language proficiency afterwards, even with extensive language training. For second- or foreign-language acquisition, preference is given to the more moderate notion of a sensitive period, which implies that after that period foreign-language acquisition can still take place to some degree, though not in the same way and/or not to the same extent as before the age of 12.

Although some authors favor adults in foreign-language acquisition by pointing to their higher capacity for planning, coordinating and controlling the learning in an explicit learning/teaching environment (Ervin-Tripp, 1981; McLaughlin, 1981), everyone seems to agree that children are more sensitive to foreign-language acquisition in a natural context of implicit learning.

By extending the findings of d'Ydewalle and Pavakanun (1995, 1997) and Pavakanun and d'Ydewalle (1992), d'Ydewalle and Van de Poel (1999) investigated implicit foreign-language acquisition in children. To determine not only the possibilities but also the boundaries and limits of foreign-language acquisition in a context like watching subtitled television, the tests involved vocabulary, morphology, and syntax. The first step in foreign-language acquisition is mastering new words, and this should be apparent in tests on vocabulary. Further steps involve the

acquisition of the morphology and syntax of the foreign language; we expected such an acquisition only to occur after some formal learning of the foreign language. Therefore, the study included children before and after formal learning of one foreign language (French) was started at school. By choosing French and Danish as foreign languages (whereas the first language for all participants was Dutch), the effect of first- and foreign-language similarity could be investigated at the same time (Danish being more similar to Dutch). Finally, using different age groups may give insight into the development of children's implicit language-acquisition capacities and could contribute to our understanding about the existence of a sensitive period for foreign-language acquisition.

The study showed real but limited foreign-language acquisition by children watching a subtitled movie. We did not find evidence for a sensitive language-acquisition period: There was not more acquisition by the children in the present study than by the adults in the former studies, and again, acquisition was largely restricted to the vocabulary.

Despite the assumption that providing subtitles could enhance foreign language processing, and the theory that children would be more prone to acquire a foreign language in an implicit way, our subsequent research on implicit language acquisition by watching subtitled television almost always led to the conclusion that adults performed equally well or even better than children. In order to explain why children don't show more language acquisition in such a situation, the following studies investigated the ongoing processing of subtitled television programs, and whether this processing is different in children, as compared with the processing by the adults.

In studies on the language acquisition, the best results are obtained with reversed subtitling; that is, when the soundtrack contains the spoken message in the native language, and the foreign language is presented in the subtitles (d'Ydewalle & Pavakanun, 1995, Experiment 2; d'Ydewalle & Pavakanun, 1997; d'Ydewalle & Van de Poel, 1999; Holobow, Lambert, & Sayegh, 1984; Lambert, Boehler, & Sidoti, 1981; Lambert & Holobow, 1984; Pavakanun & d'Ydewalle, 1992; for an exception, see d'Ydewalle & Pavakanun, 1995, Experiment 1). As reading subtitles is almost mandatory, the foreign language with reversed subtitles is being processed; in standard subtitling, there is no guarantee that the foreign language in the soundtrack is being attended by children. In countries where most television programs are subtitled, young children have a preference for dubbed movies (the original soundtrack being replaced by a spoken translation in the native language), instead of watching the original movie with subtitles; adult viewers, on the other hand, strongly prefer subtitling of the original movie (d'Ydewalle, Muylle, & Van Rensbergen, 1985). Accordingly, there are some doubts whether the children do indeed pay attention to the spoken

foreign language in the soundtrack.

The experiment (d'Ydewalle & Van de Poel, 2002) investigated the attention allocation over the two sources of linguistic information while watching a subtitled television program. More precisely, the question was whether children make the effort to process a foreign spoken soundtrack when the native language is available in the subtitles. Following Sohl (1989), the dual-task methodology was again applied. The basic assumption is that an individual has available at any time a fixed amount of resources to perform different tasks. The more resources are needed for one task, the less resources are available for a second task, which results in a delay of response or performance on the second task. By looking at response times on the second task, conclusions can then be drawn as to the processing demands of the primary task. The primary task of the participants was simply to watch a movie. At the same time, they had to respond as quickly as possible to a flash of light (which was accompanied by a beep), by pressing a button key in front of them. The light flashes (and beeps) were presented when either image alone, image and sound, image and subtitling or all three channels together were present. By measuring reaction times on that second task, conclusions are inferred about the amount of resources that was required to process the different information sources of the primary task.

The main interest of the experiment was to find out if people, and children in particular, show an attention pattern that could allow for incidental foreign language acquisition while watching subtitled television programs. More specifically, are they able to process a foreign spoken soundtrack as well as to read subtitles in the native language about at the same time?

The experiment gave evidence that attention is indeed paid to the subtitles: Reaction times in the conditions with subtitles were slower than in the conditions without subtitles. Furthermore, there is evidence that the soundtrack is processed as well: Again, reaction times were slower in the conditions with sound than in the conditions without. However, the effects of subtitles and soundtrack on the reaction times were not simply additive, despite their main effects, and not their interaction, being significant. When no soundtrack was available, there was an average increase of 25 ms by adding subtitles; when the soundtrack was available, the average increase by adding subtitles was only 7 ms suggesting that no more processing is being done when both subtitles and soundtrack are available than when only the soundtrack is available. Similarly, when no subtitles were available, there was an average increase of 45 ms by adding the soundtrack; when the subtitles was available, the average increase by adding the soundtrack was only 27 ms. Therefore, it is not clear what happened when both subtitles and soundtrack were available. One possibility is that different pools of resources were allocated for reading and listening; combining both processes can be then done without additional slowing down of the

reaction times. On the other hand, it could also be argued that there is a limit in the available resources. When both information sources (sound and subtitles) are available, a selection then needs to be made. From our previous studies (for an overview, see d'Ydewalle & Gielen, 1992), we do know that reading the subtitles is almost mandatory, also among children Grade 4, and that this reading is a highly automated behavior. Moreover, the subtitles here were in the native language; accordingly, this information was easier to process than the content of the soundtrack. Therefore, it seems reasonable to assume that when the subtitles and the soundtrack were given, participants' attention was primarily directed to the subtitles, possibly ignoring the soundtrack to a certain extent.

In summary, the absence of the additive effects of subtitles and soundtrack could be due either to the availability of sufficient resources for processing both sources of information independently, or to an allocation of attention only to the subtitles when both sources are available.

The observed absence of additive effects among younger children could be due to an attentional process of ignoring the soundtrack. This could eventually explain why d'Ydewalle and Van de Poel (1999) did not find more foreign-language acquisition among younger children as compared to adults, despite children's superior capacity for implicit language acquisition. Older children may have sufficient resources available to process both sources of information.

To investigate whether the verbal message of a soundtrack in a foreign language is processed, the participants of our next study (d'Ydewalle & Van de Poel, 2002) first watched a foreign spoken movie and thereafter were tested on the recognition of words and sentences from the tape: If the foreign language was being processed, there should be at least some recognition of words or sentences just presented. Previous experiments on the same issue (d'Ydewalle & Pavakanun, 1995, 1997; d'Ydewalle & Van de Poel, 1999; Pavakanun & d'Ydewalle, 1992) used recognition tests, often without great success, but they always used tapes on which speakers other than the speakers in the movie spoke the test items to be recognized: The words and sentences already had to be captured or understood at a level higher than pure auditory recognition. In the present experiment, we cut words and sentences to be recognized directly from the movie; these target items were then mixed with words and sentences from other parts of the movie, which participants did not see. To find out whether the availability of subtitles limits the processing of the soundtrack, the video was showed either with or without subtitles.

The findings from the word recognition test were clear-cut as a function of the stated hypotheses. Among the Grade 4 children, it appeared that adding the subtitles detracted the attention of the children from the soundtrack: Their performance on the word recognition test

went down when the native language was made available in the subtitles. If adding the subtitles to the soundtrack did not increase reaction times in the prior study, this is because those children selected to process the subtitles and to ignore the spoken language in the soundtrack. On the other hand, the word recognition of the Grade 6 children improved by adding the subtitles; those children have sufficient resources available to process both sources of information; that is, the subtitles in the native language and the spoken foreign language are both processed.

So far we only discussed studies involving standard subtitling. With reversed subtitling, a native spoken soundtrack is available and subtitles are provided in the foreign language. Interesting in this context is a recent study which involved eye movement recordings under both standard and reversed subtitling conditions (De Bruycker & d'Ydewalle, in press). Results indicated that under standard subtitling conditions participants spend more time in the subtitle area than under reversed subtitling conditions. This difference is especially large among the children. Moreover, under standard subtitling conditions children spend proportionally more time in the subtitles than adults, while in the reversed subtitling condition no such difference occurs. Since children's reading skills and overall mental capacity are not yet fully developed, they probably need more time to process the subtitles. This might explain why they spend more time in the native subtitles than adults do. However, it is less obvious why the difference between adults and children disappeared when the subtitles are provided in a foreign language. In this case, children will probably notice that it is too hard for them to read and process the subtitles in the foreign language and might therefore mainly ignore them. In adults however, the difference between the standard and the reversed subtitling condition is rather surprising, since reading in adults is a highly automated process. Therefore one would expect them to give equal attention to all subtitles, independently of the language in which they are presented. Apparently however, this is not the case.

Vanachter, De Bruycker, and d'Ydewalle (2002) studied the amount of attention allocated toward image, soundtrack and subtitles, while watching subtitled television, under both standard and reversed subtitling conditions. The double task paradigm was used again. The primary task was simply to watch a subtitled television program. At the same time, participants had to respond as quickly as possible when a beep + flash occurred, by pressing a button key in front of them. These stimuli occurred when either only image, image and sound, image and subtitles or all three channels together were present. With adults, clearly adding subtitles did not produce costs: Reaction times were not slower with either Dutch subtitles (standard subtitling) or Swedish subtitles (reversed subtitling). On the other hand, the soundtrack did produce in both cases (standard and reversed subtitling) a cost, suggesting strongly that the soundtrack was being

processed in both cases. While the general pattern of findings with adults did not differ in the standard and reversed subtitling, there were major differences with children. In standard subtitling, there was basically an additive effect of the presence of Dutch subtitles and the Swedish soundtrack, suggesting again that the foreign soundtrack was being processed. However, with reversed subtitling, reaction times were unaffected by the Swedish subtitles but were considerably slowed down by the Dutch soundtrack: Clearly, children attempted to follow the movie by listening to the soundtrack in their native language but skipped reading the foreign subtitles.

In sum, evidence was found that both children and adults made an effort to read the subtitles when they were provided in the mother tongue. However, when subtitles were presented in a foreign language, children will probably ignored them and focused entirely on image and soundtrack. Even in adults evidence was found that less attention was being paid to the foreign subtitles (see De Bruycker & d'Ydewalle, in press). The question whether or not their attention toward the foreign subtitles was influenced by the availability of a native spoken soundtrack, will be addressed in our next experiment.

The next experiment (also in Vanachter, De Bruycker, & d'Ydewalle, 2002) involved a word- and sentence recognition test. The participants first watched either a foreign spoken movie (standard condition) or either a movie with subtitles in the foreign language (reversed condition). Later on, they were tested on the recognition of foreign words and sentences extracted from different parts of the movie. For the subjects in the standard condition, the same method was used as in d'Ydewalle and Van de Poel (2002, Experiment 2). That is, words and sentences to be recognized were directly cut from the soundtrack of the movie. These target items were mixed with words and sentences from other parts of the movie, which participants did not see. To find out whether the availability of native subtitles limits the processing of the foreign spoken soundtrack, the standard movie was shown either with or without subtitles. The condition with reversed subtitling was similar. In this condition words and sentences were cut from the subtitles in stead of the soundtrack, and all items were presented visually on a television screen. To investigate whether the presence of a native spoken soundtrack limits the processing of the subtitles in the foreign language, the movie was shown either with or without the native spoken soundtrack.

Most interesting was the finding that in adults the availability of a Dutch spoken soundtrack has a rather unfavorable influence on attention allocation toward the foreign subtitles. Also in children, less sentences of the foreign subtitling were recognized when a Dutch spoken soundtrack is provided. However, among the young participants the effect was not significant.

Still, it is interesting to mention that children only performed better than chance level in the reversed condition without a Dutch spoken soundtrack available. Thus, it seems that both children and adults showed a tendency to ignore the foreign subtitling when also a Dutch spoken soundtrack was available. This is in agreement with the findings of the eye-movements recording study by De Bruycker and d'Ydewalle (in press). They found that under reversed subtitling conditions less time was spent in the subtitling area than under standard conditions, that less words were fixated in the reversed condition, and that the average time before shifting to the foreign subtitles was significantly longer than the average time before shifting to the native subtitles. However, they only recorded eye movements when both subtitles and soundtrack were available. Given our own results, eye movements recording when watching a movie with only foreign subtitles available, and no native soundtrack, might yield different results.

In contrast with the findings of d'Ydewalle and Van de Poel (2002, Experiment 2), we did not observe an effect of the availability of Dutch in the standard condition. In their experiment Grade 4 children performed worse on the word recognition test when the native language was made available in the subtitles. In the new experiment, children never performed better than chance level in the standard condition. This might be due to a lack of familiarity with the foreign language we used. In d'Ydewalle and Van de Poel (2002) the movie contained a German spoken soundtrack. German is obviously more similar to Dutch and also sounds more familiar to us than the Swedish language. Recognizing spoken words and sentences in such an unfamiliar language might just be too hard for children.

Adults performed significantly better than children in the standard condition. As in d'Ydewalle and Van de Poel (2002), their performance was not influenced by the presence of native subtitles. In contrast to children, who showed an overall poor performance, they seemed to possess a mental processing capacity that required them to attend both information channels, at least partly or alternatively.

INCIDENTAL FOREIGN GRAMMAR ACQUISITION

With the next two experiments we wanted to investigate under which circumstances foreign language acquisition is most likely to occur, and whether or not children are in advantage when it comes to acquiring a foreign language in such an informal way as watching a television program (Van Lommel & d'Ydewalle, 2002). The two experiments examined the acquisition of morphology in particular when no reference was made to an upcoming language test (i. e., incidental learning). Mastering a foreign language implies the acquisition of the grammar, beyond the

vocabulary. Contrary to vocabulary acquisition, our previous studies (d'Ydewalle & Pavakanun, 1997; d'Ydewalle & Van de Poel, 1999; Van Dyck, 1997) failed to detect clear grammar acquisition. The experiments typically involved a 3 x 3 design, with two independent variables. The first independent variable was the language of the subtitles: subtitles in the foreign language or in the native language, or no subtitles. Similarly, the language in the soundtrack was a foreign language or the native language, or there was no soundtrack. After showing the movie in one of the nine conditions, a language test followed. To assess grammar acquisition, performance in conditions with the foreign language either in the subtitles or in the soundtrack (or both) was compared with performance in conditions where the foreign language had not been presented. Accordingly, the control conditions also received the movie (without the foreign language), potentially inflating the performance level simply by guessing the accurate answers from the content of the movie. In order to assess the amount of incidental learning of the rules, both experiments of Van Lommel & d'Ydewalle, 2002) included a condition with no movie.

Some participants in the second experiment (intentional learning condition) were explicitly instructed to draw attention to the foreign-language soundtrack and to the endings of the words especially, in order to search in what way a movie could help in acquiring the grammar of the foreign language.

The beneficial nature of explicit language learning is a matter of dispute. Ellis and Laporte (1997) distinguished implicit learning and explicit-selective learning, the former proceeding incidentally and unconsciously, and the latter intentionally and consciously through searching for hidden rules in the data. The several versions of the ACT model (for its most recent version, see Anderson, 1993; Anderson & Lebiere, 1998) imply a strong interface between implicit and explicit knowledge: Implicit knowledge originates in explicit knowledge; therefore, explicit learning is of great importance in acquiring cognitive skills such as language. Krashen (1983) introduced a distinction between the Monitor and the monitor, leading to language learning and acquisition respectively. The Monitor and its language learning are being evoked by the formal setting of explicit instruction, resulting in explicit knowledge of the language rules. True language competence, on the other hand, is obtained through language acquisition by the monitor, activated by naturalistic and informal exposure, and producing implicit knowledge. The learned and the acquired systems coexist strictly independently (non-interface), without the implicit knowledge emerging from explicit knowledge. Explicit learning thus has a rather small impact on competence. Even if explicit knowledge does not transform into implicit knowledge, it can be of great help in language acquisition by providing opportunities for implicit learning. Pienemann (1989, 1998a, 1998b, 1998c) acknowledged the importance of explicit learning, provided that the

grammatical and computational complexities to be learned don't exceed the limited capacity of the human mind.

Advance knowledge of the rules may also contribute to subsequent acquisition of similar but not-given rules. This would be consistent with the ACT's assumption of implicit and explicit knowledge to be interwoven. The process of skill acquisition as transforming explicit knowledge into optimized implicit knowledge may enhance ensuing acquisition of related skills. The facilitation could however be limited by a variety of factors such as the complexity of the to-be-acquired structures (Hulstijn & de Graaff, 1994; Pienemann, 1998a, 1998b, 1998c). However, the more extreme non-interface viewpoint (Krashen, 1983) dismisses any interface between implicit and explicit knowledge and excludes explicit advance knowledge to influence subsequent implicit learning. To evaluate empirically the two theoretical positions, half of the participants in both experiments of the present study will receive the foreign-language rules in advance, and the foreign-language test items will include items on the rules as presented in advance as well as items on not-given rules but to be discovered in the language as presented in the movie.

As to age differences in second-language acquisition, Lenneberg (1967) and Krashen (1975), for example, referred to a critical period for second-language acquisition, analogous to the original notion of a critical period for first-language acquisition: Given an informal context, children are outperforming adults in acquiring a foreign language. Although extensive evidence in favor of a critical period for second language acquisition has been reported (for an overview, see Harley & Wang, 1997; Skehan, 1998), the evidence remains yet disputed and inconclusive (Bialystok & Hakuta, 1999; Bialystok & Miller, 1999). Furthermore, a variety of theories bypasses any reference to a critical period by explaining critical age differences through cognitive factors (e.g., McLaughlin, 1981), affective and attitudinal factors (e.g., Lambert, Gardner, Olton, & Tunstall, 1972), or both (Krashen, 1983).

A critical period advantage is predicted to occur only in an informal context. All our former studies of foreign-language acquisition through subtitled television programs involved the informal language presentation (the movie). Whereas our previous studies (d'Ydewalle & Pavakanun, 1995; d'Ydewalle & Van de Poel, 1999) failed to detect children outperforming adults in incidental vocabulary learning, the critical period advantage may emerge when the test is focused on the grammar.

The greater cognitive development of adults calls for the opposite expectation. Most theories expect adults to take more advantage of explicit instruction, as compared to children. According to Krashen (1983), the better developed Monitor would make adults better language learners, whereas children are better equipped for the informal context's language. Several critical period

theorists restricted the children's head start on adults to a naturalistic context, causing adults to excel children in explicit instruction (Lamendella, 1977; Patkowski, 1980; Singleton, 1995). Cognitive approaches also lead to the same considerations (McLaughlin, 1981; Skehan, 1998). Anderson (1987), however, generalized the explicit-to-implicit learning theory to child development without expressing a disadvantage of children.

Accordingly, we expected a better performance of the younger children in the incidental condition; however, older children beyond the critical period (i.e., beyond about 12 years) will show superior language learning when the rules were presented in advance and particularly when intentional instructions to learn were provided.

Experiment 1 investigated whether grammar rules of a foreign language were acquired through watching a subtitled movie. To increase the likelihood of obtaining evidence on grammar acquisition, reversed subtitling (native language in soundtrack; foreign language in subtitles) was used: Preceding studies showed more vocabulary acquisition with reversed than with standard subtitling. The artificial language Esperanto, known for its simplicity and small number of rules and irregularities, served as foreign language. To test for true rule acquisition instead of simply remembering the sentences from the movie, the grammar test comprised old items that appeared in the movie as well as new items that did not appear in the movie but were examples of the same rule. More acquisition was expected with younger than with older children. For half of the participants, the rules were explicitly given the day before watching the movie.

Experiment 1 hardly showed any direct rule/grammar acquisition following the presentation of a movie. The better performance on old items after watching the movie could simply due to a literal recollection of the sentences as presented in the movie. Moreover, the rule/grammar acquisition due to movie presentation was only marginally significant among the children that had previously received the rules; the same effect could not be observed among the older children, perhaps due to a ceiling of their performance level.

Experiment 2 sought to further clarify the reliability of the age difference. While Experiment 1 demonstrated a strong beneficial effect of the advance presentation of the rules in a incidental learning context, Experiment 2 manipulated the instructions at the onset of the movie presentation: The instructions for half of the participants told to look for rules as applied in the movie while no reference to the rules was made for the other participants. Also, test items included items that applied the rules as presented in advance to half of the participants as well as items that represent rules which had not yet been introduced. Finally, we abandoned the reversed subtitling presentation and used standard subtitling (Esperanto in the soundtrack and the native language in the subtitle), in order to approach more a real-life situation.

While there was reversed subtitling (foreign language in the subtitle) in Experiment 1 and standard subtitling (foreign language in soundtrack) in Experiment 2, the same basic findings were obtained in the two experiments: no rule acquisition through the movie only, and a strong effect of advance rule presentation, particularly among the older children.

Our preceding studies did not reveal incidental grammar acquisition after watching a foreign subtitled movie. However, those studies could be criticized by a number of shortcomings in the design of the experiments. The two present experiments contained a number of design improvements, as for example including control conditions without a movie as well as inserting in the acquisition assessment old and new items (old items literally were given in the movie while the new items implied applying the rules in examples which were not presented in the movie). Notwithstanding the improvements, simply watching the movie did not lead to an incidental acquisition of the rules in the two experiments.

In Experiment 1, two findings could be interpreted as some evidence in favor of rule acquisition by watching a movie. First, performance of the primary school children improved slightly more after having watched the movie than without movie when the rules were presented in advance. However, the effect was only marginally significant, and did not show up in the comparable conditions of Experiment 2. Second, the young and older children were clearly better on the old items (items which were included in the movie) after receiving the movie. However, a similar effect did not emerge in the new items, suggesting that the participants did acquire vocabulary by watching the movie, causing a better performance on the old items of which the correct answer had literally appeared in the movie: The better performance on the old items was simply due to remembering literally what was presented in the subtitles of the movie and was not based on applying the rules. The correct answers on the new items had not appeared in the movie and thus required the use of induced grammar rules but no increase in performance on the new items was detected.

Experiment 2 displayed more clear-cut results about rule acquisition with a movie. All performance averages in conditions without advance rule presentation were at, or close to chance level, either with or without movie presentation. When the rules were presented in advance (explicit rules), performance on items where the explicit rules were to be applied was best when no movie had been watched.

In both experiments, performance improved considerably when the rules were presented in advance. The improvement was equally strong with the old and new items (there was no significant interaction between the nature of the items and advance rule presentation; in both experiments, $F < 1$). This means that presenting explicitly the rules in advance affected not only

correct choices on items which appeared in the movie (old items) but also allowed applying those rules on new items; clearly, the explicit rules were acquired at a level allowing also their application on new cases.

According to a strong interface view (e.g., Anderson, 1993; Anderson & Lebiere, 1998), explicit learning is of great importance in further acquiring new, implicit rules. In Experiment 2, there was no such evidence: Performance on items where implicit rules were to be applied was at chance level without advance (explicit) rule presentation; with advance (explicit) rule presentation, performance on the same “implicit” items remained at chance level.

We predicted a superior performance of the younger children in the incidental condition; however, older children beyond the critical period (i.e., beyond about 12 years) were to show better language learning when the rules were presented in advance and particularly when intentional instructions to learn were provided. Only one part of the predictions was confirmed in both experiments: Advance rule presentation was clearly more beneficial among the older children than among the younger children. Separate analyses of variance on the incidental conditions in both experiments failed to show the predicted better performance of the younger children; similarly, an analysis of variance on the data of the intentional condition of Experiment 2 showed no better performance of the older children.

Grammar, contrary to vocabulary, may be too complicated to acquire from a rather short movie presentation. Pienemann (1989, 1998a, 1998b, 1998c) pointed out that large mental or grammatical complexity could prevent rules from being learned through simple presentation of the language. Upheld attention and sufficient motivation are necessary and basic ingredients for foreign-language grammar learning to occur, even in real-life situations (Harding & Riley, 1986). According to Reber (1976, 1989; Reber, Kassin, Lewis, & Cantor, 1980), the most appropriate instructions for more complex and non-salient rules would be incidental, but intentional for less complex and salient rules. Moreover, acquiring less salient rules incidentally could require exercise instead of merely observation (Berry, 1991). Possibly, a sequence of several movies, spread over a longer period of time, could solve both problems and provide conclusive evidence that vocabulary acquisition due to subtitled television programs is supplemented with grammar acquisition.

REFERENCES

- Anderson, J. R. (1987). Skill acquisition: Compilation of weak-method problem solving solutions. *Psychological Review*, 94, 192–210.
- Anderson, J. R. (1993). *Rules of the mind*. Mahwah, NJ: Erlbaum.

- Anderson, J. R., & Lebiere, C. (Eds.). (1998). *The atomic components of thought*. Mahwah, NJ: Erlbaum.
- Berry, D. C. (1991). The role of action in implicit learning. *Quarterly Journal of Experimental Psychology*, *43A*, 881-906.
- Bialystok, E., & Hakuta, K. (1999). Confounded age: Linguistic and cognitive factors in age differences for second language acquisition. In D. Birdsong (Ed.), *Second language acquisition and the Critical Period Hypothesis: Second language acquisition research* (pp. 161-181). Mahwah, NJ: Erlbaum.
- Bialystok, E., & Miller, B. (1999). The problem of age in second language acquisition: Influences from language, structure, and task. *Bilingualism*, *2*, 127-145.
- De Bruycker, W., & d'Ydewalle, G. (in press). Reading native and foreign language television subtitles in children and adults. In J. Hyona, R. Radach, & H. Deubel (Eds.), *The mind's eyes: Cognitive and applied aspects of eye movements*. Oxford, UK: Elsevier Science.
- d'Ydewalle, G., & Gielen, I. (1992). Attention allocation with overlapping sound, image, and text. In K. Rayner (Ed.), *Eye movements and visual cognition: Scene perception and reading* (pp. 415-427). New York: Springer-Verlag.
- d'Ydewalle, G., Muylle, P., & Van Rensbergen, J. (1985). Attention shifts in partially redundant information situations. In R. Groner, G. W. McConkie & C. Menz (Eds.), *Eye movements and human information processing* (pp. 375-384). Amsterdam: Elsevier Science Publishers B.V. (North-Holland).
- d'Ydewalle, G., & Pavakanun, U. (1995). Acquisition of a second/foreign language by viewing a television program. In P. Winterhoff-Spurk (Ed.), *Psychology of media in Europe: The state of the art - perspectives for the future* (pp. 51-64). Opladen, Germany: Westdeutscher Verlag GmbH.
- d'Ydewalle, G., & Pavakanun, U. (1997). Could enjoying a movie lead to language acquisition? In P. Winterhoff-Spurk & T. Van der Voort (Eds.), *New horizons in media psychology* (pp. 145-155). Opladen, Germany: Westdeutscher Verlag GmbH.
- d'Ydewalle, G., Praet, C., Verfaillie, K., & Van Rensbergen, J. (1991). Watching subtitled television: Automatic reading behavior. *Communication Research*, *18*, 650-666.
- d'Ydewalle, G., & Van de Poel, M. (1999). Incidental foreign-language acquisition by children watching subtitled television programs. *Journal of Psycholinguistic Research*, *28*, 227-244.
- d'Ydewalle, G., & Van de Poel, M. (2001). *Do children listen to the spoken foreign language while watching subtitled television programs?* Manuscript in preparation.
- d'Ydewalle, G., & Van Rensbergen, J. (1989). Developmental studies of text-picture interactions in the perception of animated cartoons with text. In H. Mandl & J. R. Levin (Eds.), *Knowledge acquisition from text and pictures* (pp. 233-248). Amsterdam: Elsevier Science Publishers B.V. (North-Holland).
- d'Ydewalle, G., Van Rensbergen, J., & Pollet, J. (1987). Reading a message when the same message is available auditorily in another language: The case of subtitling. In J. K. O'Regan & A. Lévy-Schoen (Eds.), *Eye movements: From physiology to cognition* (pp. 313-321). Amsterdam: Elsevier Science Publishers B.V. (North-Holland).
- d'Ydewalle, G., Warlop, L., & Van Rensbergen, J. (1989). Television and attention: Differences between young and older adults in the division of attention over different sources of TV information. *Medienpsychologie: Zeitschrift für Individual- und Massenkommunikation*, *1*, 42-57.

- Ellis, N. C., & Laporte, N. (1997). Contexts of acquisition: Effects of formal instruction and naturalistic exposure on second language acquisition. In A. M. B. de Groot & J. F. Kroll (Eds.), *Tutorials in bilingualism: Psycholinguistic perspectives* (pp. 19-51). Mahwah, NJ: Erlbaum.
- Ervin-Tripp, S. M. (1981). Social process in first- and second-language learning. In H. Winitz (Ed.), *Native language and foreign language acquisition* (Vol.379, pp.33-47). New York: The New York Academy of Sciences.
- Harding, E., & Riley, P. (1986). *The bilingual family: A handbook for parents*. Cambridge, MA: Cambridge University Press.
- Harley, B., & Wang, W. (1997). The critical period hypothesis: Where are we now? In A. M. B. de Groot & J. F. Kroll (Eds.), *Tutorials in bilingualism. Psycholinguistic perspectives* (pp. 19-51). Mahwah, NJ: Erlbaum.
- Holobow, N. E., Lambert, W. E., Sayegh, L. (1984). Pairing script and dialogue combinations that show promise for second or foreign language learning. *Language Learning*, 34, 59-76.
- Hulstijn, J. H., & de Graaff, R. (1994). Under what conditions does explicit knowledge of a second language facilitate the acquisition of implicit knowledge: A research proposal. In J. H. Hulstijn & R. Schmidt (Eds.), *Consciousness in second language learning* (pp. 11-26). Aila Review 11. Amsterdam: Aila Amsterdam.
- Krashen, S. D. (1975). The development of cerebral dominance and language learning: More new evidence. In D. P. Dato (Ed.), *Developmental psycholinguistics: Theory and applications* (pp. 179-192). Washington, DC: Georgetown University Press.
- Krashen, S. D. (1983). *Second language acquisition and second language learning*. Oxford: Pergamon.
- Lambert, W. E., Boehler, I., & Sidoti, N. (1981). Choosing the languages of subtitles and spoken dialogues for media presentations: Implications for second language education. *Applied Psycholinguistics*, 2, 133-148.
- Lambert, W. E., Gardner, R. C., Olton, R., & Tunstall, K. (1970). A study of the roles of attitudes and motivation in second-language learning. In J. A. Fishman (Ed.), *Readings in the sociology of language* (pp. 473-491). The Hague: Mouton.
- Lambert, W. E., & Holobow, N. E. (1984). Combinations of printed script and spoken dialogue that show promise for students of a foreign language. *Canadian Journal of Behavioral Science/Revue Canadienne des Sciences du Comportement*, 16, 1-11.
- Lambert, W. E., & Klineberg, O. (1967). *Children's views of foreign peoples: A cross national study*. New York: Appleton.
- Lamendella, J. T. (1977). General principles of neurofunctional organization and their manifestation in primary and nonprimary language acquisition. *Language Learning*, 27, 155-196.
- Larsen, D. N., & Smalley, W. A. (1972). *Becoming bilingual: A guide to language learning*. New Canadian, CT: Practical Anthropology.
- Lenneberg, E. H. (1967). *Biological foundations of language*. New York: Wiley.
- McLaughlin, B. (1981). Differences and similarities between first- and second-language learning. In H. Winitz (Ed.), *Native language and foreign language acquisition* (Vol. 379, pp.23-32). New York: The New York Academy of sciences.

- Macnamara, J. (1973). Nurseries, streets, and classrooms: Some comparisons and deductions. *Modern Language Journal*, 57, 250-254.
- Patkowski, M. S. (1980). The sensitive period for the acquisition of syntax in a second language. *Language Learning*, 30, 449-472.
- Pavakanun, U., & d'Ydewalle, G. (1992). Watching foreign television programs and language learning. In F. L. Engel, D. G. Bouwhuis, T. B o sser & G. d'Ydewalle (Eds.), *Cognitive modelling and interactive environments in language learning* (pp. 193-198). Berlin: Springer.
- Pienemann, M. (1989). Is language teachable? *Applied Linguistics*, 10, 52-79.
- Pienemann, M. (1998a). Developmental dynamics in L1 and L2 acquisition: Processability Theory and generative entrenchment. *Bilingualism*, 1, 1-20.
- Pienemann, M. (1998b). A focus on processing. *Bilingualism*, 1, 36-38.
- Pienemann, M. (1998c). *Language processing and second language development: Processability Theory*. Amsterdam/Philadelphia: John Benjamins.
- Reber, A. S. (1976). Implicit learning of synthetic languages: The role of instructional set. *Journal of Experimental Psychology: Human Learning and Memory*, 2, 88-94.
- Reber, A. S. (1989). Implicit learning and tacit knowledge. *Journal of Experimental Psychology: General*, 118, 219-235.
- Reber, A. S., Kassin, S. M., Lewis, S., & Cantor, G. (1980). On the relationship between implicit and explicit modes in the learning of a complex rule structure. *Journal of Experimental Psychology: Human Learning and Memory*, 6, 492-502.
- Singleton, D. (1995). Introduction: A critical look at the Critical Period Hypothesis in second language acquisition research. In D. Singleton & Z. Lengyel (Eds.), *The age factor in second language acquisition* (pp. 1-29). Clevedon, UK: Multilingual Matters Ltd.
- Skehan, P. (1998). *A cognitive approach to language learning*. Oxford: Oxford University Press.
- Sohl, G. (1989). *Het verwerken van de vreemdtalige gesproken tekst in een ondertiteld TV-programma [Processing foreign spoken text in a subtitled television program]*. Unpublished licence thesis, University of Leuven, Belgium.
- Vanachter, I., De Bruycker, W., & d'Ydewalle, G. (2002). *Attention allocation while watching subtitled television programs*. Manuscript in preparation.
- Van Dyck G. (1997). *Televisie als medium voor taalverwerving: Invloed van taal instructie versus taalcontact via vreemdtalige ondertitelde televisieprogramma's [Television as language acquisition tool: Influence of language instruction vs. language contact through foreign subtitled television programs]*. Unpublished licence thesis, University of Leuven, Belgium.
- Van Lommel, S., & d'Ydewalle, G. (2002). *Foreign-grammar acquisition while watching subtitled television programs*. Submitted for publication.
- Verfaillie, K., & d'Ydewalle, G. (1987). *Modality preference and message comprehension in deaf youngsters watching TV* (Psych. Rep. No. 70). Leuven: Katholieke Universiteit Leuven, Laboratory of Experimental Psychology.