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The Effect of Syntactic Complexity on Fluency in Speaking Performance of First and Second language

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Abstract

In this study we investigated how syntactic complexity affects speaking performance in first (L1) and second language (L2) in terms of three measures of fluency: (1) breakdown fluency; (2) speed fluency; and (3) repair fluency. Participants (30 Dutch native speakers with an advanced level of English) performed two speaking experiments, one in Ducth (L1) and one in English (L2). Syntactic complexity was operationalized in four conditions, active vs. passive/nested vs. juxtaposed, and was found to affect the three types of fluency in different ways, and differently for L1 and L2. In passives as compared with actives, we found longer pauses, a lower total speaking duration, and a larger number of filled pauses and corrections. With respect to the nested and juxtaposed contrast, longer pauses were found in juxtaposed sentences. However, in terms of total speaking duration, and number of filled pauses and corrections, nested sentences were found to be more disfluent. Although results from total speaking duration in active and passive conditions, and from duration of pauses at the speech onset position in nested and juxtaposed conditions, had different effect across English and Dutch, the distinction between L1 and L2 were found to be significant. The overall results showed that participants were more fluent in their L1 than in their L2.

Introduction

Most of the conversations we have in our daily language are produced spontaneously, that is, utterances are planned and executed as fast as they are spoken (Mehta & Cutler, 1988). One consequence of the speed at which speakers are required to spontaneously converse is that they are often disfluent, they contain elements that interrupt the flow of continuous speech without adding any propositional content to it. Disfluencies are present in speech produced by both native and non-native interlocutors. It has been estimated that around six percent of spoken words in L1 speech are affected by disfluencies (Fox Tree, 1995). Disfluencies include pauses, interruptions in either mid- phrase or mid-word positions, repeated words or repeated phrases, restarted sentences, words with prolonged pronunciations *thee* as the prolonged form of *the* or *ay* as the prolonged form of *a*, and fillers such as *uh* and *um*.

Disfluencies might be the result of problems during any stage of speech production, whether it be utterance planning, lexical selection, grammatical encoding, phonological formulation, or articulation (De Bot, 1992; Segalowitz, 2010). Segalowitz (2010) identifies seven particular points, which he calls "fluency vulnerability points" (p. 9), in the speech production system for L2 where disfluencies might occur. It has been further suggested in the literature that different types of disfluencies and their various positions in speech, might be related to different stages of the speech production process (Beattie and Butterworth, 1979; Collard, 2009; Segalowitz, 2010; Engelhardt et al., 2012; among others). In the present study, we want to focus on the grammatical encoding stage of speech production to see how fluency will be affected if syntactic complexity is manipulated and to investigate the differences in the number and type of disfluencies that are produced in L2 speech, as opposed to L1 speech. The reason that the L1 speech is also included in the present study is that we want to have a baseline for making a comparison between disfluencies in L2 and in L1, and furthermore, to explain the differences between disfluencies in these linguistic systems.

In Section 1, complexity will be defined and two constructions (passive-active vs. nested- juxtaposed sentences) will be exemplified. We will discuss what makes a system, or a structure, complex and why the contractions in question are appropriate to be used in our experiment for the interests of this study.

In Section 2, fluency will be defined and sources of disfluencies with specific reference to Levelt's (1989) speech production model will be discussed. Section 3 discusses the main theme of the current study and provides the research questions that we would like to answer with our study.

Section 4 and 5, respectively, outline the precise details and the results of the sentence production experiment we used in this study. This section will be followed by an in-depth discussion of the experimental findings and the interpretation of the results as well as the concluding remarks (section 6 & 7).

1. Complexity

1.1 Defining Complexity:

The definition of complexity has long been a source of debate among researchers as they have struggled to define and operationalize it (Housen et. al; 2012). Rescher (1998) defines complexity as “a matter of the quantity and variety of the constituent elements of an item and of the inter-relational elaborateness of their organizational and operational make- up” (p. 1). Following Rescher’s (1998) definition, Bulte and Housen (2012) define complexity as a property of a system that is comprised of interacting and interdependent components in terms of: (1) “the number and the nature of the discrete components that the system consists of; and (2) the number and the nature of the relationships between the system constituent components” (p. 22).

To clarify the first feature of the above-mentioned definition (i.e.: the number of elements) we can take Shannon’s (1948) idea of complexity into consideration. Shannon (1948) provides the following formula and suggests that the complexity of an item is a function of its probability of occurrence, that is, the lower the probability of occurrence of an element, the more complex it will be.

$$Ix = -log2\ p(x)$$

‘I’ stands for the amount of information in bits and ‘p’ is the probability of the occurrence of an item. When we flip a fair coin, the probability of head is ½. The amount of information exchanged when we flip such a coin is –log2 1/2, which equals to one bit of information. In the case of a die, the amount of information exchanged equals to –log2 1/6 = 3 which is more than the amount of the information of a coin. Therefore, when the informational value of a system increases (similar to die rolling with a larger number of constituent components), the probability of the occurrence of an item within that system decreases and, in parallel, the complexity increases[1].

It has been mentioned that complexity is not limited to the number of components, but rather to the relationship between them. With respect to this feature of complexity, Dahl (2004) provides an example on how zipping and compressing programs works in order to define complexity. We can consider the following two strings of digits to clarify the point:

A. 185185185185185185185185185185185

B. 185781857818578185781857818578818578

What zipping and compressing programs do in order to zip or compress a file is that if two parts of a file are identical, they get rid of the second one by making a cross reference to that file. In the case of (A) and (B), for these programs, it is not important how many times a character in these strings are iterated; instead, they keep track of the shortest possible algorithm or the shortest possible pattern, '185' and 18578' in (A) and (B)

[1] Probability, in this sense, is parallel with frequency, although these two concepts are not 100% equal. To distinguish frequency from probability, we can think of the following example: "too many cooks spoil the *soup/broth". In this sentence, 'Soup' is more frequent, but it is not contextually very probable as compared to 'broth'. However, if we consider probability and frequency interchangeable, we can interpret Shannon's (1948) idea of complexity simply as follows: low frequent items are complex as they have lower contextual probability of occurrence; while, high frequent items are not.

respectively, and then they eliminate the rest (i.e.: repetitions). Accordingly, Dahl (2004) claims that complexity is not just the length of the specification of an object as whole, rather the measure of the totality of patterns that a system contains, in other words the way components are put together, or simply the relationships between them.

1.2 Structural complexity:

Structural complexity is a linguistic phenomenon that refers to the number of discrete components of a linguistic expression (e.g.: a lexical item or a sentence) at some level of description (Dahl, 2004; Bulte & Housen, 2012). To further elaborate what is meant by the number of components at some level of description, we can consider "make" and "made". These two lexical items are equal in terms of the number of phonemes and the syllables they contain, but at the level of morphology, "made" is considered to be more complex than "make" by consisting of two independent morphemes: (1) the root, and (2) the past tense. In the present study, we want to investigate structural complexity, focusing on complexity of sentences at the syntactic level of description. We aim to operationalize syntactic complexity by taking into account constructions that are comparable only with regard to their degree of syntactic complexity.

One of the constructions that we consider to meet our criteria regarding structural complexity (i.e.: the number of elements and their relation) are passive and active sentences. Actives and passives convey roughly the same basic information except for the fact that in actives, the focus is on the agent, while in passives the focus is on the theme.

Passive sentences are deemed to be more complex than their active counterparts due to various reasons.

In the generative school of linguistics, passives are analyzed as deriving from active sentences by some moving operations. In this derivation, passive does the following three things:

I. It takes the subject noun phrase (NP) and places it at the end of the sentence, adding “by” before it.

II. It takes the NP object after the main verb (V) and places it at the beginning of the sentence, before the V.

III. It adds an appropriate auxiliary and places it before the V.

The following active and passive examples and their internal structures can further illustrate this derivation.

1: *John hit Bill.*

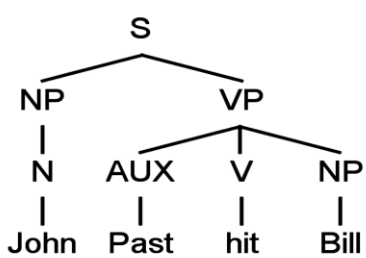

Figure 1: The structure of the active sentence "John hit Bill".

2: *Bill was hit by john*.

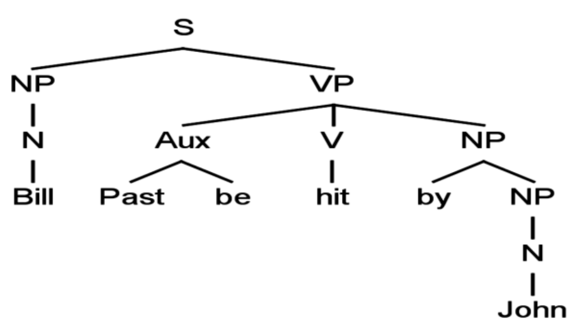

Figure 2: The structure of the passive sentence "Bill was hit by John".

Accordingly, passive sentences can be argued to be more complex than active sentences because more operations are applied in their derivation. On the basis of the British National Corpus and with regards to complexity of passives for processing and comprehension, Dąbrowska & Street (2006) show that passive sentences appear less frequently in speakers' daily language than active ones. Moreover, one can also argue that passives contain a larger number of components in their structural make up (i.e.: additional morphological markers such as the preposition 'by' and auxiliaries) which make them slightly longer sentences than actives and thus more complex.

Needless to say, passive sentences are derivations that occur within a single sentence. There are constructions, however, that involve more than one sentence in their structural make-up (e.g.: embedded or nested sentences such as relative clauses). These sentences are worth considering for the purpose of our study since they are deemed to be structurally complex. In the following sentence (3), the non-restrictive relative clause is embedded in the main clause and adds additional information to the matrix subject. Although they have roughly the same meaning and they contain almost the same number of components, the nested sentence in (3) is structurally more complex than its juxtaposed counterparts (i.e: "*the nanny was sent by the agency*." & "*the nanny was adored by the children*.").

3: *The nanny, who the agency sent, was adored by the children.* (Warren & Gibson; 2002, p. 80)

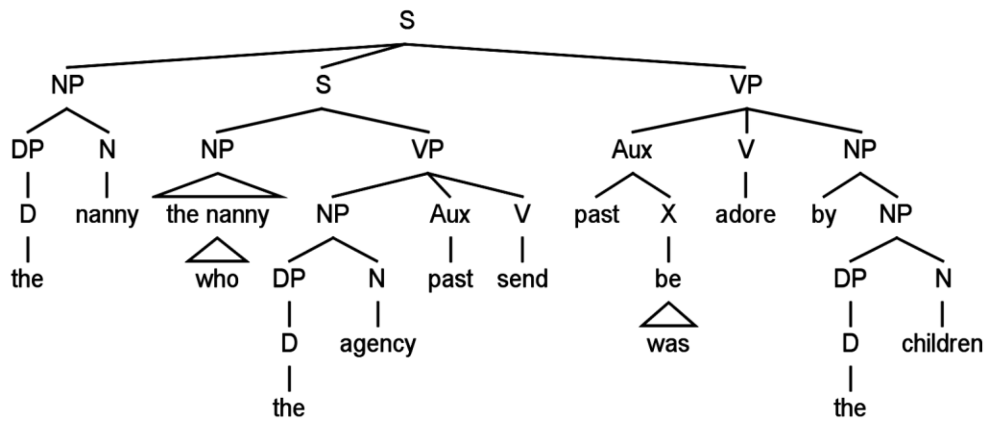

Figure 3: The structure of the nested sentence "The nanny who the agency sent was adored by children".

In an experiment on language comprehension, Warren and Gibson (2002) argued that nested sentences are difficult to process for two independent reasons. The first reason "structural integration" (p. 81), is connecting new words into the available structure. "Structural integration" means that when someone wants to process nested sentences, he needs to build or connect new elements or structures to what is already available. In (3), for example, the embedded sentence ('who the agency sent') needs to be integrated into the matrix sentence which is constructed in the first stage. The second reason, "structural storage", (p. 81) refers to keeping track of the incomplete structural dependencies in the current structure. "Structural storage" can be interpreted as keeping the incomplete structure active in working memory until the complete processing or comprehension takes place. In (3), the action (being adored by the children) which is assigned to the NP1 ('the nanny') remains uninterpreted until the end of the sentence. Thus, the NP1 and its associative structure need to remain active in working memory until the end of the sentence in order for complete processing and comprehension to take place.

Structural complexity in these constructions depends on the number of relative clauses. This can be interpreted to mean that the larger the number of relative clauses, the more complex these sentences will be. Warren and Gibson (2002, p 80) provide examples from nested sentences that are almost impossible to process.

4) *The nanny [who the agency [which the neighbors recommended] sent] was adored by the children.*

In (4), two non-restrictive relative clauses are embedded into the matrix sentence. These clauses make the sentence structure extremely complex. Increased complexity in these constructions is due to the fact that as the number of relative clauses increases, the structural relationship of the matrix NP and its associative action is changed in the way that the matrix NP becomes less accessible in working memory. In the study at hand, we are mainly interested in language production rather than comprehension, giving our study a different focus than that of Warren and Gibson (2002) when analyzing nested constructions. Thus, we use passive/active and nested/juxtaposed sentences to operationalize syntactic complexity, and test it as our independent variable on the effect of L2 speakers' fluency.

2. Fluency

2.1 Defining fluency

One of the distinguishing features of a successful L2 speaker, in addition to accuracy and complexity, is fluency. Fluency can be defined as the ability to fill time with talk without unnatural hesitations (Fillmore, 1979). On the basis of various studies on fluency, Segalowitz (2010) divides fluency into three senses: cognitive fluency, perceived fluency, and utterance fluency. Cognitive fluency refers to the speakers' ability to use their underlying cognitive machinery necessary for producing utterances. If this machinery functions efficiently by easily integrating the various components necessary for speech production, speakers are considered to be cognitively fluent. The second sense, perceived fluency, refers to the inferences listeners make about speakers' cognitive fluency based on their perception of the speakers' utterance fluency. Listeners receive the physical aspects of the speakers' speech in order to evaluate their fluency. The final sense, utterance fluency, refers specifically to those features of an utterance that can be measured objectively (e.g.: speakers' pauses, repetitions, corrections, and speech rate).

Utterance fluency can be further divided into breakdown fluency, speed fluency, and repair fluency (Tavakoli & Skehan, 2005). Breakdown fluency refers to the flow of speech and can be measured as number of pauses, length of run, and length of pauses. A single measure that summarizes such measures is phonation time ratio, the total length of speech divided by the total utterance time, to put it differently, the percentage of time filled with speech. Another measure related to breakdown fluency is the number of times speakers use filled pauses (such as *uh* & *um*). Speed fluency refers to how many words or syllables are actually uttered per time unit. This can be measured in terms of number of syllables or number of words per time unit. Finally, repair fluency refers to the number of false starts, corrections, and repetitions. As mentioned earlier, in this study, we want to focus on the effect of syntactic complexity on the three measures of utterance fluency separately, breakdown fluency, speed fluency, and repair fluency.

2.2 Speech production mechanism

Cognitive fluency can be studied in the context of speakers' cognitive machinery; this cognitive machinery includes speakers' speech production system, their knowledge repertoire, and their lexicon. The speech production process involves a speaker planning an utterance (i.e.: what to say), it involves transferring the pre-verbal message into a verbal plan (i.e.: how to say), and lastly, it involves the actual articulation of the message (i.e.: articulation). In this study, Levelt's (1989) monolingual speech production model or the adapted bilingual version of the model proposed by De Bot (1992) will serve as our theoretical basis. In what follows, I will present Segalowitz's (2010) extended version of the model (Figure 4) as it exhibits points of potential relevance to L2, specifically (dis)fluency in this domain.

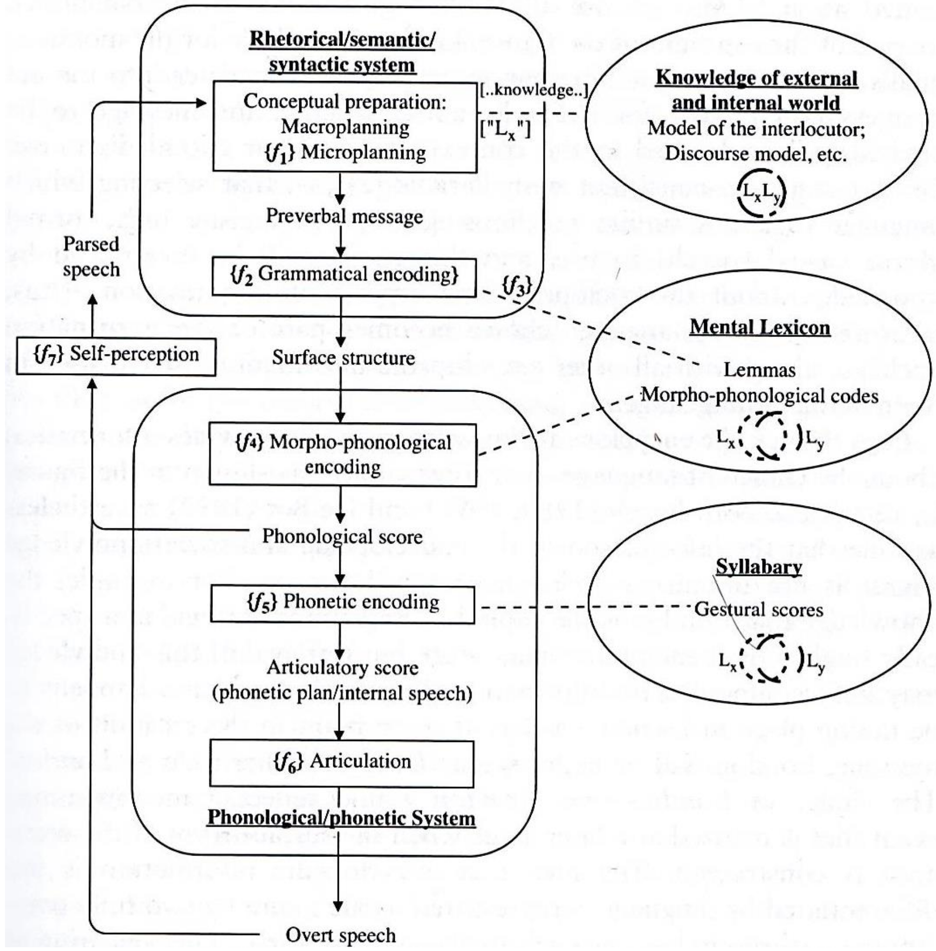

Figure 4: Segalowitz's (2010) model of the L2 speaker, taken from Levelt (1989) "blueprint" of the monolingual speaker and adapting De Bot's (1992) version of the bilingual speaker. The dotted and dashed Lx and Ly circles refer to how information relating to language X and Y are related to each other, making partial or full overlapping relation between the languages. The letter f stands for "fluency vulnerability points" (p. 9) referring to critical points where underlying processing difficulties are considered to be associated with L2 speech disfluencies.

The speech production begins with conceptualizing an intended message. This stage of Speech production is called conceptualization and it consists of two independent processes: (1) macro-planning; and (2) micro-planning. In macro-planning, speakers start with some communicative intentions or goals, which can be divided into a series of sub-goals or speech acts, based on their encyclopedic knowledge of the external world and their knowledge about the interlocutors' internal state of mind. Speakers then select relevant information to be expressed in each speech act, and finally they order the speech acts in a coherent way. The macro-planning process ends with a series of speech act intentions which will be sent to the micro-planning system. It is important to note that the macro-planning stage and its resulting speech act intentions are language independent. Hence, the fully overlapping circle of Lx and Ly displayed in Figure (1) refers to the fact that L1 and L2 are parallel, thus, no L2 fluency related issue is expected to arise in this stage.

After macro-planning, the outcome will be sent to the micro-planning stage. In micro- planning, certain processes need to be completed before the pre-verbal message can be sent to the formulator. These processes are choosing the accessibility of referents, choosing topicalized elements, assigning an appropriate propositional format (e.g.: imperative, declarative, etc), and lastly, setting any language specific requirements. This last operation refers to the fact that languages conceptualize certain relations in different ways. In Russian, for example, experiences comparable to joy, sadness, or anger (i.e.: emotion related words) are often lexicalized as verbs, rather than adjectives. Contrarily, in English, emotions are conceptualized as passive states, by means of adjectives and pseudo-participles. Therefore, depending on the language of the speaker, different information may need to be encoded in order for the concept to be ready to be sent to the formulator stage. As shown in Figure 4, the first point of vulnerability to fluency {f1} arises at the micro-planning stage because L2 speakers might have difficulty in formulating the pre- verbal message based on their L2 specific rules (De Bot, 1992).

The output of the conceptualizer stage (i.e.: a pre-verbal message) will be sent to the formulator in order for the grammatical and the phonological encoding to take place. At the grammatical encoding stage, the pre-verbal message needs to be grammatically shaped by assigning the correct lemmas and the correct syntactic structures into it. Two points of possible vulnerability to L2 fluency can appear here {f2 & f3} because L2 speakers might not be able to have a fully efficient performance at this stage, or they might find it difficult to access the grammatical resources necessary for creating the correct grammatical output. At the phonological encoding stage, which is an umbrella term for both morpho-phonological encoding and phonetic encoding, {f4 & f5}, correct articulatory plans will be selected and the output will be transmitted to the articulation stage in order to be finally articulated (i.e.: {f6}). The last point of relevance to L2 fluency {f7} is monitoring (or self-perception). Monitoring allows speakers to monitor their own output, to reformulate their speech planning, or to correct utterances that are erroneous. The central focus of the present study will be the grammatical encoding stage of speech production, as we are interested in investigating how speakers' performance at this stage or their access to grammatical resources might affect their utterance fluency.

3. Linking complexity with fluency

3.1 Theoretical grounding

As we mentioned in the previous sections, the aim of our study is to explore how difficulties at the grammatical encoding stage of speech production result in disfluencies in speech for

L2 production. For this purpose, we will manipulate syntactic complexity. Before providing a detailed description of the present study, and for the sake of building our study's theoretical grounding, we should first address how complexity, in general, or syntactic complexity in particular, is linked with (dis)fluency.

It has been argued in the literature that proficiency in a second language has three dimensions: complexity, accuracy and fluency, CAF henceforth, (Housen et. al; 2012, Myles; 2012, among others). Accuracy is defined as the degree of compatibility of L2 speakers' performance with a norm and the norm is considered to be native speech. It can be argued that if an L2 speaker deviates from this norm, his speech is viewed to be inaccurate or erroneous (Housen et al., 2012). The question now is how complexity is related to accuracy on the one hand and, more importantly, to fluency on the other. Towell (2012) distinguishes three kinds of mental representation that shape the cognitive bases of L2 speakers, namely linguistic competence, linguistic learned knowledge, and procedural knowledge. In brief, linguistic competence refers to the universal knowledge that is shared among all human beings in all languages. Learned linguistic knowledge is language specific and refers to morpho-syntactic, phonological, and discourse-pragmatic-related rules or structures of a particular language, and the procedural knowledge finally is the knowledge of language processing in real time, that is, the way L2 learners process, retrieve, and utilize their knowledge of L2.

According to Towell (2012), to answer the aforementioned question of how the elements of CAF interrelate, it is important first to understand how these types of mental representations interact. Towell (2012) claims that learners who are exposed to a particular linguistic form in a particular context of their L2 store the form and its associative meaning in their lexicon. In other words, the linguistic form, which is the linguistic learned knowledge of a particular L2, is being stored in the learners' lexicon, which is deemed to be part of their linguistic competence. When the learners use the form repeatedly in various contexts, their confidence in the accuracy of the form increases and then with more exposure and more practice, they will reach to the point where little or no further improvement is necessary. This is to claim that the learners' linguistic learned knowledge of a particular form becomes more and more proceduralized or automated.

The interaction between the elements of CAF, as dimensions of L2 proficiency, is highly related to the learning process of an L2. Although learners may focus consciously or subconsciously on one of the three dimensions at the expense of another, the interaction between CAF elements is considered to be linear. This linear interaction is such that the internalization of new and more complex L2 structures (i.e: greater complexity) is followed by the correction and the modification of those internalized structures (resulting in greater accuracy), thanks to repeated exposure and practice. After achieving complexity and accuracy, L2 performance will be completed with the development and the automatization of the internalized structures (leading to the better control and more fluent L2 performance). As Housen et al. (2012) pointed out, the cyclical linear interaction of CAF elements would then have the following sequence: "complexity > accuracy > fluency" (p. 7).

With respect to the main concern of this study, namely the relation of complexity (i.e.: syntactic complexity) and fluency, one can argue that if complexity of L2 elements increases, speakers' fluency might decrease. The reason is that learners might find complex elements difficult to retrieve or to process since they still might not have had enough practice or appropriate exposure to those L2 complex elements, and thus this will result in a lack of automatic cognitive machinery necessary to have a fluent performance. Skehan (1998) argues that people have a limited information-processing capacity and L2 learners must therefore prioritize where they draw their attention to when they are asked to perform a task. If they are asked to perform a complex task (e.g.: by asking L2 speakers to produce more complex constructions), learners' fluency will decrease because attention allocated to one dimension of language production will come at the expense of others.

3.2 Present study:

Research into the link between complexity and fluency, specifically syntactic complexity, which focuses on the grammatical encoding stage of speech production, is relatively sparse. To the best of our knowledge, no one has yet directly investigated this relation. Most of the studies in this area revolve around the link between task complexity, by demanding speakers to perform a simple or complex task, and speakers' speaking performance in either native or non-native speech. The overall results from these studies reveal the fact that complex tasks elicit less fluent, but more accurate and complex production than do simpler tasks (see Robinson, 1995 & 2001; Skehan, 2001; De Jong et al. 2012; Gilabert, 2007; among others).

One of the studies that links speakers' speaking performance to the grammatical stage of speech production is Engelhardt et al. (2010). This study is relevant for the interest of our study since it measured how participants' fluency was affected when they produced active and passive sentences. Engelhardt et al. (2010) compared the speech production of two groups of participants, healthy and attention deficit/hyperactivity disorder (ADHD) subjects, with the goal of investigating the role of inhibition in the production of disfluencies. In this experiment, participants were presented with one animate object, one inanimate object, and a verb, which was either an unambiguous participle (e.g.: ridden) or ambiguous between past tense and past participle (e.g.: dropped). In half of the trials, the animate pictures were presented first and the inanimate pictures were presented second (i.e.: active bias order), in the other half, the reverse order was used (inanimate pictures were presented first and animate pictures second, i.e.: passive bias order). Engelhardt et al. (2010) found that both groups of participants produced more disfluencies when the verb was a participle (passive bias) or when there was a mismatch between the order of objects and the form of the verb, that is, cases in which the animate first object order (active bias) was paired with a participle verb and cases in which the inanimate first object order (passive bias) was paired with an ambiguous verb. However, the form of disfluencies between the ADHD group and the healthy group were different; ADHD participants produced more repetitions and repair disfluencies whereas healthy participants produced more filled pauses as the task demands increased (i.e.: the mismatch conditions). The results from this study are important for our purposes because they show that speakers produced more disfluencies in passive bias conditions.

Our research question focuses on the effect of syntactic complexity on L2 speakers' utterance fluency. We want to explore to what extent L2 speakers might have difficulty in producing structurally complex sentences. Participants will be asked to complete a sentence production task by producing a grammatical sentence in which they will be presented with two names (one animate and one inanimate) and one verb in passive/active conditions and with three names (one animate and two inanimate) and two verbs in nested/juxtaposed conditions. Participants will be asked to perform the task in both L1 and L2 as we predict that their L1 performance will provide us with a baseline that we can use to make a comparison between these two linguistic systems. We predict that increased complexity will lead to disfluencies because of the more morho-syntactic resources that complex sentences demand. If we compare passive with active and nested with juxtaposed sentences, these sentences are different due exclusively to their structural make up that is, passive sentences are more complex than active sentences, and nested sentences are more complex than juxtaposed sentences. Our prediction is that L2 speakers would produce more disfluencies when they will be asked to utter passive and nested sentences than when they are asked to utter active and juxtaposed sentences due to the level of complexity of the formers. Comparing L1 and L2, we predict syntactic complexity to have a larger effect (i.e.: more disfluencies) on speakers' fluency in L2 as speakers had not yet fully acquired the use of complex language in their L2 necessary for producing syntactically complex sentences.

It has been argued in the literature that disfluencies occur for different reasons. Speakers want to buy more time to think more before they initiate any utterance (Collard, 2009) or they produce silent or filled pauses and repetitions when they want to reformulate their utterances (Collard, 2009; Engelhardt et al., 2012), or repairs occur when inadequate planning's requiring speakers to retreat and correct their utterances (Segalowitz, 2010). Accordingly, if we confirm our initial hypothesis that syntactic complexity triggers disfluencies, the secondary goal of this study will be to investigate how many, which types, and more importantly, how similar or different are the disfluencies produced by participants in their L1 and L2. Thus, we pose the following research questions:

3.3 Research questions

RQ1: What is the effect of syntactic complexity on L2 and L1 utterance fluency.

RQ2: Which disfluencies are related to formulating and articulating syntactic complex sentences in L2, as opposed to L1.

4. Sentence production experiment

In this experiment, we investigated how participants produce active/passive and nested/juxtaposed sentences in their L1 and L2. The design of our study was based on Engelhart et al. (2010) experimental design; however, we made the following modification to better suit our purposes.

Unlike Engelhart et al. (2010), in this experiment, we included the speech production of participants for both L1 and L2, not only for active/passive sentences but also for nested/juxtaposed sentences. In this study, participants were provided with the name of each object, as we wanted to prevent the risk that they might find it difficult to name the animate and inanimate objects by looking only at their pictures, and have this difficulty results in decreased fluency. Moreover, here, we do not provide participants with the past participle or any other forms of the verbs, since these forms are part of the grammatical information that speakers need to know when they produce sentences. It is important to add that as our focus will be on the grammatical encoding stage of speech production, we do not want to use the "mismatch match" condition used by Engelhart et al. (2010) since this condition would complicate the task and thus might also lead to disfluent speech.

4.1 Method

4.1.1 Participants:

A sample of 30 participants was recruited from the linguistic institute's subject pool at Utrecht University. They were paid each 5 € for participation. Participants (mean age = 22, range from 48 to 18, M = 3, F = 27) were all Dutch native speakers and had on average advanced level of English (mean score taken from an English proficiency test = 70.7, range from 43.8 to 100). We excluded early bilingual Dutch-English speakers or students of English or related fields from our subject pool. Participants all reported to have normal or corrected-to-normal eyesight with no speech disorders, such as stuttering or dyslexia.

4.1.2 Design and Materials:

Active/passive conditions: The experiment was carried out by a computer program created by ZEP experiment software (Veenker, 2013). On each trial, participants were presented with a slide containing the printed names of an animate object (e.g.: the girl), an inanimate object (e.g. the bike), a verb root (e.g. to ride) along with an arrow and a picture. In order to make each sentence as natural as possible, the printed names appeared with an article, either definite or indefinite, (e.g: for English "the", "a", or "an" and for Dutch "het" and "de" for definite and "een" for indefinite). The arrow referred to either the animate or inanimate object showing from which point participants needed to start their sentences. Fig. 5 and Fig. 6 depict an example of the experimental paradigm. If the arrow referred to the animate object (i.e.: the girl), participants were asked to produce an active sentence (e.g.: "the girl rides the bike."); while, if it pointed to the inanimate object (i.e.: the bike), they were asked to produce a passive sentence (e.g.: "the bike is ridden by the girl."). All pictures (N=40) were cartoons taken from Google image. Pictures were modified with the aid of Adobe Photoshop CS2003 in order to depict at least two actions. For example, for a picture of a girl who was on a bike, we also added a bag on her back to show that she was also carrying a bag. The reason that the pictures were modified in this manner was that we wanted to use the same pictures for all conditions in our experiment (active/passive and juxtaposed/nested conditions). In total, there were 10 slides for active and 10 slides for passive, thus each participant had to produce a total of 20 sentences for these two conditions. It is important to note that between the experiment in L1 and L2 all conditions and stimuli were equal except for the fact that in order to maximize the variations between each condition and minimize the familiarity of participants with each condition in either L1 or L2, passives and actives were counterbalanced in the two languages: the actives for Dutch were presented as passives for English, and actives for English were presented as passives for Dutch.

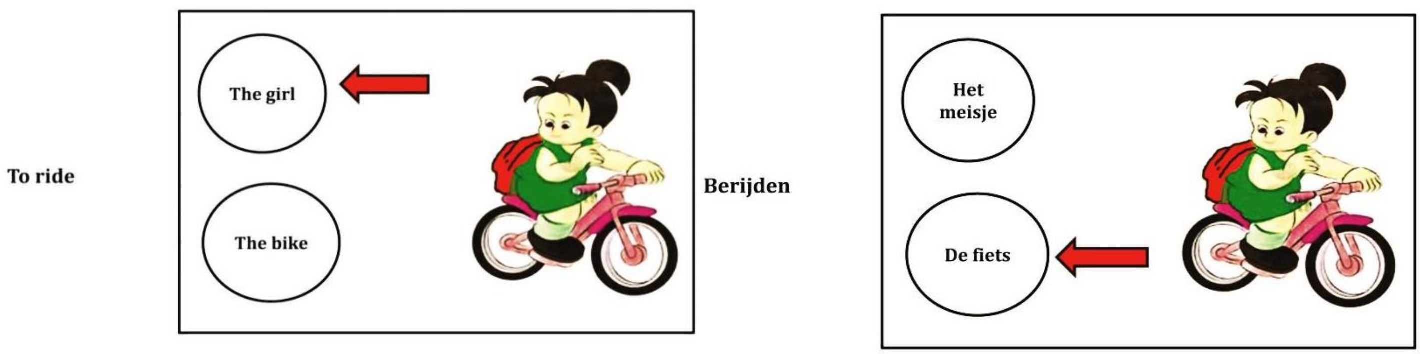

Figure 5: These two slides show the reverse order: the active conditions for English appeared as passive conditions for Dutch.

Nested/Juxtaposed conditions: The materials used in these conditions closely resembled those in the passive/active conditions, except for the following two changes. First, in these conditions participants were provided with the printed name of one animate object, but here with two inanimate objects, and two verb roots. Second, the arrow, which always pointed to the animate objects (i.e.: the starting point of each sentence), contained an “S” letter for nested condition and two “S + S” letters for juxtaposed condition. The “S” arrow instructed the participants to produce a nested sentence (i.e.: non-restrictive relative clause such as "the girl who carries a bag rides a bike."). The "S + S" was a sign to prompt participants to produce two separate sentences (e.g.: "The girl carries a bag." and "She rides the bike."). In order for the sentences to sound natural, participants were informed that they could use an appropriate subject pronoun (e.g.: "he" or "she") for the second sentence in the juxtaposed condition. In these conditions, and similar to the active and passive conditions, for each picture the counter condition between L1 and L2 was used (i.e.: nested sentences for Dutch were juxtaposed for English, and vice versa, nested sentences for English were juxtaposed for Dutch). In total 10 slides prompted nested sentences, and 10 slides prompted juxtaposed sentences, for both L1 and L2, leading each participant to produce 20 sentences in these two conditions.

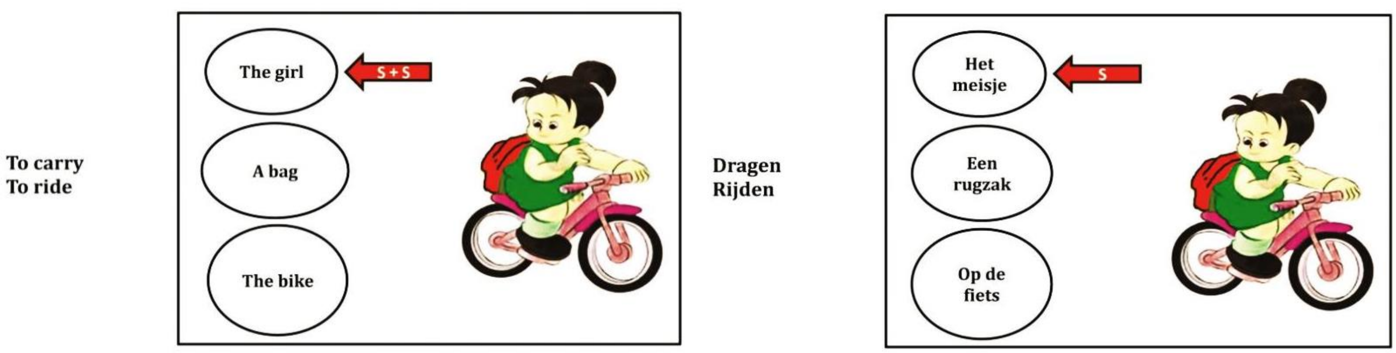

Figure 6: These two slides show the reverse order between nested and juxtaposed conditions in English and Dutch.

4.1.3 Apparatus and procedure:

Testing took place in two different sessions for each participant. There was a minimum of one-day interval between each session. Participants were randomly selected to participate in L1 Dutch or L2 English sessions. Half of the participants were presented with L1-L2 order and the other half with L2-L1 order.

L2 English session: This session consisted of several phases starting with a familiarization phase, followed by practice trials and then the testing phase. A language proficiency test formed the final part of the session.

Participants were familiarized with the experiment in two different ways. When a session started, they were first asked to read printed instructions in which they were informed about the different phases of the experiment, the conditions, the meaning of the arrows, the relative pronoun "who" for the nested condition, and finally, the subject pronouns (i.e.: "he" & "she") that they needed to use for the second sentence in the juxtaposed condition. Participants were told that their speech would be recorded in the testing phase. At the start of the testing, participants were once again given the opportunity to become acquainted with each condition and its accompanying sentence. Each slide first appeared together with the name of its condition, and then after a few seconds, its accompanying sentence (for instance, a slide including the picture of a girl on a bike and the name of the condition, active, and the accompanying sentence, "The girl rides the bike."). Practice trials involved two slides for each condition, making a total of eight slides. As practice trails were similar to the testing phase, the accompanying sentences and the names of the conditions were no longer appeared on the screen. The slides in the practice trials appeared in a random order. Participants were asked to press the space bar on the keyboard to go to the next slide after they finished producing each sentence. When the practice trials finished, participants were asked if they had any questions. After these practice trials, participants took part in the testing phase. The testing phase was composed of 10 slides for each of the 4 conditions, making a total of 40 slides. These slides appeared in a random order for each participant. Participants' speech was recorded with a DAT recorder Tascam DA-40. After producing each sentence, participants had to press the space bar to go to the next slide until the end of testing phase. Finally, a session finished with an English proficiency test (http://www.lextale.com/, created by Lemhofer & Broersma, 2011). The English proficiency test was a test of vocabulary knowledge, and was designed for medium to highly proficient speakers of English as a second language. Participants were presented with a string of letters. Their task was to decide whether each string was an existing English word or not. If it was an existing English word, they had to click on "yes", and if it was not an existing word, they had to click on "no". Participants could spend as much time as they liked for each decision. The total testing time was approximately 5 minutes for each participant.

L1 Dutch session: The L1 Dutch session closely resembled the procedure of the L2 English session in that it consisted the familiarization phase, the practice trails, and the testing phase, but here we excluded the language proficiency test. Participants were familiarized with the experiment and after 8 practice items, they were asked to do the testing phase. The testing phase included 40 slides, 10 slides for each condition, resulting in each participant producing 40 distinct sentences.

5 Results

Out of a total of 2400 sentences, data from 202 sentences (93 sentences from English and 109 sentences from Dutch) were not included in the analysis. We excluded all ungrammatical sentences and cases in which participants did not produce the correct conditions. This left 2198 sentences remaining, composed of 1107 sentences from English and 1091 from Dutch. Disfluencies were classified with respect to their positions, in particular whether they occurred within or between Analysis of Speech (AS) units. AS-units can be described as utterances that consist of an independent clause or sub-clausal unit in the nested conditions. On the basis of this classification, we considered several positions or points where disfluencies might occur. These positions referred either to the initial or mid clause boundaries of the constructions in question. For the active and passive sentences, we considered two positions (A and B). “A” referred to the clause initial position and “B” referred to clause mid position (A [The girl rides a bike = B] for actives and A [The bike is ridden by a girl = B] for passives). For nested sentences, we considered five positions (A, B, C, D and E). “A” referred to the main clause initial position, “B” referred to the sub-clause initial position, “C” referred to the sub-clause mid position, “D” referred to the onset position of the main clause verbs where matrix subjects were linked to the main clause, and finally “E” referred to the main clause mid position (A [The girl = B [who carries a bag = C] D [rides a bike E]]). Finally, for the juxtaposed sentences, we considered four positions (A, B, C and D). “A” and “B” referred to the clause initial and mid position of the first sentences respectively, while "C" and "D" referred to the clause initial and mid position of the second sentences. A [The girl carries a bag = B] C [she rides a bike = D][2].

For breakdown fluency, we measured the duration of pauses and the number of filled pauses. As speakers were asked to produce fixed sentences in our experiment, we did not take into account the number of syllables or words produced per time unit in order to measure speed fluency, but instead we measured speakers' total speaking duration for producing each sentence. Finally, with regard to repair fluency, we counted the number of repetitions and corrections. Tables (1-3) list the means, standard deviations, and the number of occurrences of the fluency measures; break down, speed, and repair.

Table 1. Means (standard deviations in parentheses) of the duration of pauses and the number of filled pauses produced in different conditions for both English and Dutch.

Breakdown fluency	**English**				**Dutch**			
	Active	*Passive*	*Nested*	*Juxtaposed*	*Active*	*Passive*	*Nested*	*Juxtaposed*
Duration of pause A	1.27	1.61	1.73	1.82	1.29	1.38	1.47	1.48
	(0.55)	(0.95)	(1.19)	(1.03)	(1.21)	(0.61)	(0.97)	(0.9)
Duration of pause B	0.09	0.19	0.21	0.17	0.01	0.09	0.21	0.09
	(0.12)	(0.23)	(0.36)	(0.21)	(0.03)	(0.12)	(0.24)	(0.16)
Duration of pause C	----	----	0.04	0.57	----	----	0.02	0.43

[2] It is important to note that since "A" is the onset of the speech, it can be a comparable point among all conditions.

	----	----	(0.53)	(0.37)	----	----	(0.05)	(0.24)
Duration of pause D	----	----	0.39	0.01	----	----	0.04	0.02
			(0.39)	(0.03)	----	----	(0.06)	(0.05)
Duration of pause E	----	----	0	----	----	----	0	----
	----	----	(0.02)	----	----	----	0.01	----
Total duration of pause	1.37	1.8	2.39	2.6	1.31	1.48	1.77	2.03
	(0.55)	(0.96)	(1.9)	1.2	(1.21)	(0.59)	(1.01)	(0.93)

	English				**Dutch**			
	Active	*Passive*	*Nested*	*Juxtaposed*	*Active*	*Passive*	*Nested*	*Juxtaposed*
No. of filled pause A	1	1	3	4	0	3	4	1
No. of filled pause B	0	3	5	5	1	2	4	0
No. of filled pause C	----	----	1	6	----	----	1	1
No. of filled pause D	----	----	6	1	----	----	1	0
No. of filled pause E	----	----	0	----	----	----	0	----
Total	1	4	15	16	1	5	10	2

KEY: (----) indicates no value and (0) indicates nonoccurrence of disfluency in a certain position.

Table 2. Means (standard deviations in parentheses) of total speaking duration performed by speakers in different conditions for English and Dutch

Speed fluency	**English**				**Dutch**			
	Active	*Passive*	*Nested*	*Juxtaposed*	*Active*	*Passive*	*Nested*	*Juxtaposed*
Total speaking duration	1.66	2	3.2	3.14	1.47	2.09	2.99	2.88
	(0.24)	(0.27)	(0.42)	(0.45)	(0.16)	(0.24)	(0.33)	(0.33)

Table 3. Number of repetitions and corrections produced in different conditions for English and Dutch

Repair fluency	**English**				**Dutch**			
	Active	*Passive*	*Nested*	*Juxtaposed*	*Active*	*Passive*	*Nested*	*Juxtaposed*
No. of repetitions A	2	3	6	5	0	0	0	0
No. of repetitions B	2	5	2	4	0	1	4	1
No. of repetitions C	----	----	2	4	----	----	0	0
No. of repetitions D	----	----	7	0	----	----	0	3
No. of repetitions E	----	----	1	---	----	----	0	----
Total	4	8	18	13	0	1	4	1

	English				**Dutch**			
	Active	*Passive*	*Nested*	*Juxtaposed*	*Active*	*Passive*	*Nested*	*Juxtaposed*
No. of corrections A	4	7	4	6	0	0	0	0
No. of corrections B	9	14	9	7	7	19	33	16
No. of corrections C	----	----	8	2	----	----	2	0
No. of corrections D	----	----	15	2	----	----	1	6
No. of corrections E	----	----	1	----	----	----	1	----
Total	13	21	37	17	7	19	37	22

KEY: (----) indicates no value and (0) indicates nonoccurrence of disfluency in a certain position

For scale data such as the duration of pauses and total speaking duration, we conducted repeated measures ANOVA with conditions (active vs. passive & nested vs. juxtaposed) and language (English vs. Dutch) as within subjects factor. We performed a log transformation to the data and eliminated extreme outliers to maintain a normal distribution. When there was a significant interaction between conditions and language, a follow-up paired sample t-test was performed to see how the speakers' performance in different conditions varied across L1 and L2. For the ordinal data such as number of filled pauses, repetitions and corrections, we ran several Chi-square tests separately with conditions (active vs. passive & nested vs. juxtaposed) as predictor variables and measures of fluency as dependent variables. Table (4-7) list the statistics of the repeated measures ANOVA, paired sample t-test, and Chi-square tests for measures of fluency; namely, break down, speed and repair.

Table 4. Results of the repeated measures ANOVA and Chi-square test for breakdown fluency (p_value = 0.05)

Breakdown fluency	Effect	df	F_value	p_value	Partial Eta Squared
Total duration of pause	L	(1, 28)	6.54	.01	.18
(Act/Pas)	C	(1, 28)	100.61	.00	.78
	L*C	(1, 28)	.00	.96	.00
Total duration of pause	L	(1, 25)	5.29	.03	.17
(Nes/Jux)	C	(1, 25)	5.84	.02	.18
	L*C	(1, 25)	2.69	.11	.09
Duration of pause_A	L	(1, 28)	3.33	.07	.1
(Act/Pas)	C	(1, 28)	74.92	.00	.72
	L*C	(1, 28)	.04	.84	.00
Duration of pause_A	L	(1, 28)	3.2	.08	.1
(Nes/Jux)	C	(1, 28)	45.89	.00	.62
	L*C	(1, 28)	56.76	.00	.67

Duration of pause_B	L	(1, 27)	9.44	.00	.25
(Act/Pas)	C	(1, 27)	25	.00	.48
	L*C	(1, 27)	.00	.92	.00

No. of filled pauses	**Value**	**df**	**sig**	**language**
(Act/Pas)	2.02	1	.2	EN
	2.76	1	.12	NL
(Nes/Jux)	.02	1	1	EN
	6.05	1	.01	NL

KEY: L = language; C = condition; L*C = the interaction between language and condition; Value = Chi-square value; df = degree of freedom; sig = significant, EN = English; NL = Dutch

Important note: In order to maintain normal distribution, after running a log transformation, the extreme outliers obtained from some participants were eliminated from the rest of the data. Thus, as the table shows the degrees of freedom range between 25 and 28.

For the total duration of pauses in active and passive conditions, a significant effect was found between English and Dutch ($F(1, 28) = 6.54$, $p < 0.05$, $\eta^2_p = .18$) and a significant effect between actives and passives ($F(1, 28) = 100.61$, $p < 0.05$, $\eta^2_p = .78$). Speakers had more difficulty in producing passive sentences when compared with active sentences and they had more difficulty when they performed the experiment in English than in Dutch. Nested and juxtaposed sentences were statistically different in total duration of pauses ($F(1, 25) = 5.84$, $p < 0.05$, $\eta^2_p = .18$). In juxtaposed sentences, speakers had slightly longer pauses (mean = 2.6 & 2.03 for English and Dutch respectively) than nested sentences (mean = 2.39 for English and 1.77 for Dutch). With regard to the duration of pauses at A, active conditions were significantly different from passives ($F(1, 28) = 74.92$, $p < 0.05$, $\eta^2_p = .72$) and nested from juxtaposed ($F(1, 28) = 45.89$, $p < 0.05$, $\eta^2_p = .62$). There were more pauses at position "A" in passive and in juxtaposed conditions. For the duration of pauses at this position, the interaction between L1 and L2 (i.e. English and Dutch) on the one hand and conditions (i.e. nested and juxtaposed) on the other hand were significant ($F(1, 28) = 56.76$, $p < 0.05$, η2p = .67). The results from the follow-up paired sample t-test show that the significant effect was only present in nested and juxtaposed conditions produced in English (M=0.09, SD=0.46); $t(29)= 1.13$, $p < 0.05$, $r = 0.2$) but not in Dutch. Turning to the duration of pauses at "B", there was a significant difference between active and passive sentences and a significant difference between the performance in English and Dutch. Participants had more pauses in passives when compared with actives ($F(1, 27) = 25$, $p < 0.05$, $\eta^2_p = .48$) and more pauses when they performed the experiment in English than when they did it in Dutch ($F(1, 27) = 9.44$, $p < 0.05$, $\eta^2_p = .25$). The following plot for the total duration of pauses can further show how speakers performed in active and passive conditions in English and Dutch.

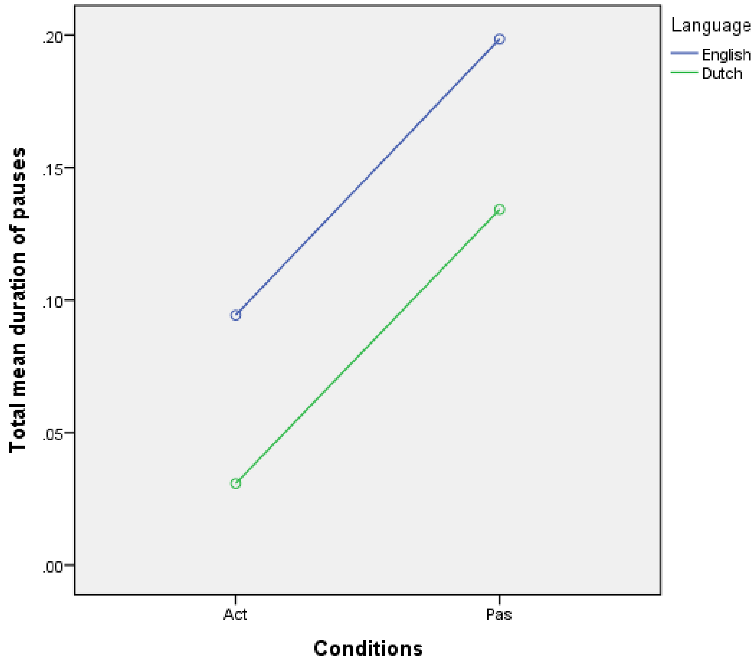

Figure 7: Total mean duration of pauses produced in active and passive sentences in L1 and L2

Regarding the number of filled pauses, there was no significant effect between active and passive conditions performed in English and Dutch. There was also no significant effect for nested and juxtaposed sentences produced in English. A significant effect was found between nested and juxtaposed sentences produced in Dutch (chi-squared = 6.05, $p < 0.05$, df = 1). Participants produced more filled pauses in nested (n = 10) than in juxtaposed (n = 2) conditions.

Table 5. Results of the repeated measures ANOVA for speed fluency (p_value = 0.05)

Speed fluency	Effect	df	F_value	p_value	Partial Eta Squared
Total speaking duration	L	(1, 29)	1.65	.2	.05
(Act/Pas)	C	(1, 29)	403.18	.00	.93
	L*C	(1, 29)	88.47	.00	.75
Total speaking duration	L	(1, 24)	9.27	.00	.27
(Nes/Jux)	C	(1, 24)	3.7	.06	.13
	L*C	(1, 24)	.38	.54	.01

KEY: df = degree of freedom, L = language; C = condition; L*C = the interaction between language and condition

Important note: In order to maintain normal distribution, after running a log transformation, the extreme outliers obtained from some participants were eliminated from the rest of the data. Thus, as the table shows the degrees of freedom range between 24 and 29.

In terms of speakers' performance in different conditions on total speaking duration, no significant effect of first and second language was found when we compared active and passive conditions. Active and passive conditions were significantly different from each other with regard to total speaking duration with a large effect size ($F(1, 29) = 403.18$, $p < 0.05$, $\eta 2p = .93$); (mean duration of total speaking duration was equal to 2 & 2.09 for English and Dutch passive sentences, and 1.66 & 1.47 for English and Dutch active sentences respectively). The interaction between languages (English vs. Dutch) and conditions (active vs. passive) was found to be significant ($F(1,29) = 88.47$, $p < 0.05$, $\eta 2p = .75$). Table (6), which is taken from the follow-up paired sample t-test, shows that the distinction between active and passive conditions had a significant effect in both L1 and L2. This effect was slightly stronger in Dutch (with an effect size of 0.98) than in English.

Table 6. Results of the paired sample t-test for speed fluency (p_value = 0.05)

Speed fluency	**Mean**	**std. D**	**t-value**	**df**	**p_value**	**r**
Act & Pas(EN)	.34	.17	-10.52	29	.00	0.89
Act & Pas(NL)	.61	.12	-27.14	29	.00	0.98

KEY: std. D = standard deviation; df = degree of freedom, r = effect size, EN = English, NL = Dutch.

Turning back to table (5), results show that nested and juxtaposed conditions were not significantly different from each other. We only found a significant difference between first and second language ($F(1, 24) = 9.27$, $p < 0.05$, $\eta^2_p = .27$) in this regard. Participants were faster in their L1 and slower in their L2 when they produced nested and juxtaposed sentences.

Table 7 . Results of the Chi-square test for repair fluency (p_value = 0.05)

Repair fluency	**Value**	**df**	**sig**	**language**
Total NO. of repetitions	1.05	1	.37	EN
(Act/Pas)	2.04	1	.24	NL
(Nes/Jux)	.16	1	.7	EN

	1.06	1	.36	NL
Total NO. of corrections	1.66	1	.2	EN
(Act/Pas)	6.81	1	.01	NL
(Nes/jux)	6.18	1	.01	EN
	10.47	1	.00	NL

KEY: Value = Chi-square value; df = degree of freedom; sig = significant; EN = English; NL = Dutch

Although the total number of repetitions was higher in passives than in actives and higher in nested than in juxtaposed sentences (4, 8, 18 and 13 repetitions in English while just 0, 1, 4 and 1 repetitions in Dutch for active, passive, nested and juxtaposed conditions respectively), the results show that repetitions did not have any significant effect, neither among conditions nor across languages. However, there was a significant effect for corrections in actives and passives produced in Dutch (chi-squared = 6.81, $p < 0.05$, df = 1); nested and juxtaposed sentences produced in English (chi-squared = 6.18, $p < 0.05$, df = 1), and nested and juxtaposed sentences produced in Dutch (chi-squared = 10.47, $p < 0.05$, df = 1). Participants produced more corrections in passives (n = 21 & n = 19) and nested sentences (n = 37 & n = 37) when compared with actives (n = 13 & n = 7) and juxtaposed sentences (n = 17 & n = 22) for English and Dutch respectively.

In sum, the results from different measures of fluency reveal that speakers are more fluent in active than in passive conditions. This result was compatible between English and Dutch. Comparing these two conditions with each other, we found several significant effects between first and second language. For example, for pauses and total speaking duration, we found that speakers performed better in their L1 than in their L2. Repetition was not significant for the distinction between actives and passives. However, for corrections, we found significant effect between these two conditions in Dutch. Speakers seemed to be more fluent in nested conditions than juxtaposed in both English and Dutch when it came to duration of pauses. There were slightly longer pauses in juxtaposed than in nested conditions. For the mean duration of pauses in nested and juxtaposed conditions, we found also a significant effect between L1 and L2. Speakers produced less pauses in their L1 than in L2. Regarding the total speaking duration, there was no significant difference between nested and juxtaposed conditions, but for the number of filled pauses and number of corrections, we found a significant effect between these two conditions. Speakers produced more filled pauses and corrections when they produced nested sentences. Furthermore, a significant effect was found between L1 and L2. Except for the filled pauses where we could not find any effect in English, speakers were significantly more fluent when they produced nested and juxtaposed sentences in their L1 than in L2. Results from the interaction between conditions (i.e.: duration of pauses at “A” in nested and juxtaposed sentences, and the total speaking duration in passive and active conditions) and language, showed different effect across L1 and L2. For the duration of pauses at “A” in nested and juxtaposed conditions, the significant effect was present in English but not in Dutch, and for the total speaking duration in passive and active conditions, the stronger effect was found in Dutch but not in English.

6 Discussion

Previous studies in the area of L2 speaking proficiency have mainly focused on the relation between task complexity and linguistic measures such as grammatical accuracy, linguistic complexity, and fluency. The results from these studies suggest that complex tasks result in less fluent, but more accurate and complex speech (Robinson, 1995 & 2001; Skehan, 2001; De Jong et. al. 2012; Gilabert, 2007). In this study, we isolated the grammatical formulation stage of speech production mechanism to examine the effect of syntactic complexity on various aspects of fluency (i.e.: break down, speed, and repair) in L1 and L2. We posed two questions. (RQ1): What is the effect of syntactic complexity on L1 and L2 utterance fluency? We speculated that speakers would produce more disfluencies not only when they formulate syntactically complex sentences such as passive and nested ones, but also when they perform the experiment in their L2. One reason behind our speculation would be the fact that producing these constructions in L2 requires the use of complex language that the speakers had not yet fully acquired. If our hypothesis proves to be true, that is, that syntactic complexity triggers disfluencies, the second question (RQ2) which we wanted to evaluate was which disfluencies are related to the formulation and articulation of syntactically complex sentences in L2 and L1.

The results from both experiments obtained from speakers' performance in L1 and L2 show that producing passive sentences, when compared with active sentences, can negatively affect speakers' fluency. Speakers made more pauses; they produced a larger number of filled pauses, and a larger number of corrections in passive conditions. The effect of passive conditions on the speakers' total speaking duration was found to be significant (i.e.: speakers produced passive sentences slower than active sentences) with a similar effect between L1 and L2. Goldman-Eisler (1968) argued that unlike pausing, articulation rate could not be affected by task complexity. According to her, articulation rate reflects a skilled part of the speaking performance that is invariable among native speakers and cannot be affected by task complexity, as native speakers have all reached a level in their speaking which allows them to converse in an automatic manner. Pausing, on the other hand, reflects an unskilled part of a speaker's performance, which can be affected by task complexity. That is, speakers make more pauses in complex tasks as opposed to simple tasks. Our results, at least as far as the distinction between active and passive sentence formulation is concerned, seem not to be in line with Goldman-Eisler's (1968) finding because not only pausing, but also the total speaking duration measured in our experiment, was affected by syntactic complexity. Although participants were on average advanced English speakers, the results between L1 and L2 with respect to active and passive conditions showed that not only was there a significant difference between the performances across these two conditions, but there was also a significant difference between L1 and L2 in this respect. Participants had a better performance in actives than passives and a better performance in their L1 than in their L2.

Our results for the distinction between the nested and the juxtaposed conditions with regard to different measures of fluency were contradictory. With regard to the total duration of pauses, speakers produced slightly longer pauses in juxtaposed than in nested sentences. This can be due to the fact that since speakers had to produce two separate sentences in juxtaposed conditions, they paused more in order to have enough time to formulate these sentences. In other words, producing one juxtaposed sentence was equal to producing two separate active sentences in terms of time; hence, this can be a good reason to argue that producing juxtaposed sentences was twice as time-consuming as producing active sentences. Another reason for the longer duration of pauses in juxtaposed conditions might be related to the experimental design we used in our study. The slides for the nested and juxtaposed conditions were similar, except for the arrow (see figure 6), making the design for the juxtaposed conditions equally as complex as the one for the nested conditions. As we have shown in the results section, after pauses at position “A”, the second longest pauses occurred at position “C”, the point where speakers had to formulate and produce the second sentence in juxtaposed conditions. Figure (8) shows how pauses distributed in these conditions across English and Dutch.

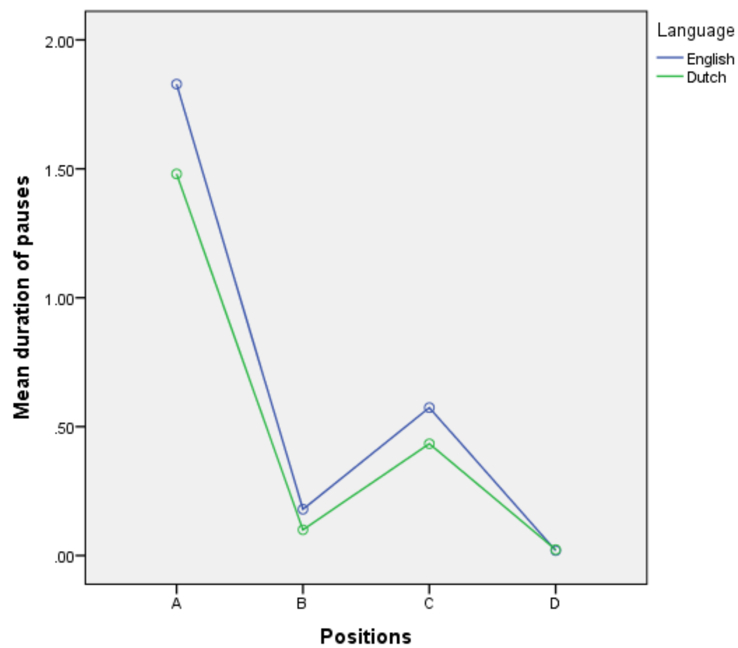

Figure 8: Mean duration of pauses produced at different positions in juxtaposed conditions

Longer pauses in the juxtaposed conditions compared to the nested conditions might also be related to the way speakers formulated these sentences. It can be argued that for each sentence, speakers needed to pause once before producing the sentence in order to bring their thought (i.e.: the concepts) together and to plan their speech. For the juxtaposed sentences, as speakers had to produce two separate sentences, pauses occurred mostly in two positions (i.e.: once before formulating the first sentences at position "A" and once before formulating the second sentences at position "C"); whereas, for the nested sentences, pauses occurred mainly at position "A" because speakers only dealt with one sentence. That is, after speakers paused at position "A", to think and plan the nested sentences, they were able to proceed to the end of these sentences without any more considerable pausing.

Finally, the results for the duration of pauses at “A” where we found a significant effect only in English might be due to the case that in L2 the difference between the juxtaposed and nested sentences is larger than L1, leading to many more disfluencies.

There was a significant difference between the nested and the juxtaposed conditions with regard to the number of filled pauses in Dutch. Nested sentences in Dutch were produced with a larger number of filled pauses. Following Collard (2009) and Engelhardt et al. (2012), one could argue that the larger number of filled pauses in nested sentences was due to the syntactic complexity of these constructions, which make them more difficult to formulate, when compared to juxtaposed sentences. Although the total duration of speaking was slightly longer in nested sentences than in juxtaposed sentences, there was no significant difference between the nested and the juxtaposed conditions with regard to this aspect of fluency. However, L1 and L2 were significantly different from each other (i.e.: speakers produced nested and juxtaposed sentences slower in L2 than in L1).

The total number of corrections was significantly different between the nested and the juxtaposed condition and between L1 and L2. Speakers produced more corrections in nested than in juxtaposed sentences, and more corrections in English than in Dutch. Gilabert (2007) argues that corrections reflect a speaker’s awareness of forms and can be interpreted as attempts at being accurate. The larger number of corrections in nested conditions, when compared to juxtaposed conditions, might be due to the structural complexity of these constructions which made participants’ speech erroneous; speakers corrected their mistakes many times in order to produce the corrected form of these sentences. Except for the total duration of pauses in which juxtaposed conditions seemed to be more disfluent, the results from the rest of the fluency measures provides evidence in support of syntactic complexity of nested constructions and its effect on a speaker‘s fluency.

Turning to the second question, we presented the number of disfluencies across conditions between L1 and L2 in the results section. Except for the duration of pauses at "A", between nested and juxtaposed conditions where the significant effect only existed in English; or the total speaking duration in active and passive conditions where the effect was stronger in Dutch, the overall results show that speakers produced a larger number of disfluencies in their L2 than in their L1. The distinction between L1 and L2 can be extended to Levelt's (1989) model. In this model, the conceptualizer delivers the pre-verbal message to the formulator, which then has to undertake the process of lemma retrieval that can subsequently derive syntactic encoding. Skehan (2009) claimed that for native speakers, the mental lexicon is extensive and well-organized, enabling the formulator stage to deal with the conceptualizer in a parallel processing fashion (i.e.: the formulator receives the pre-verbal message from the previous conceptualizer cycles, when the conceptualizer simultaneously attends to the current cycle). The result of this parallel processing is that lemmas can be retrieved from the mental lexicon smoothly and without undue difficulty. For non-native speakers, on the other hand, the pre-verbal message arrives at the formulator which is equipped with access to a smaller mental lexicon and with significantly less organization. Therefore, having access to a smaller mental lexicon with less organization, the formulator becomes more effortful and the automatic processing is disrupted, often resulting in disfluent speech. We can now interpret our results and show

how a speaker‘s performance in L2 differs from L1. When language proficiency increases, speakers are able to produce simple and complex sentences in their L1 as well as in their L2. That is, for advanced L2 speakers it is not harder to make a passive or a nested sentence in their L2 than it is in their L1. However, since the mental lexicon in a speaker‘s native language contains more information, and the information is more accessible, the condition for parallel processing between the formulator and the conceptualizer is met; thus, speakers are able to produce the simple and complex sentences in their native language with greater fluency. In non-native language and for advanced L2 speakers, the necessary information for making simple and complex sentences is available, but they are less accessible as they are stored in smaller and less organized mental lexicon, leading to many more disfluencies when compared to the fluency in similar speech production in a speaker‘s native language.

Similar types of disfluencies were identified between L1 and L2. Participants produced all types of disfluencies we predicted in English and Dutch. Davies (2003) argues that the location of disfluencies such as pauses (at clause boundaries, or within clause boundaries) is an important factor to take into account when the speaking performance of native and non-native speakers is compared. Accordingly, the main difference between L2 learners and native speakers is not in the number of pauses or the amount of silence in their performance, but it is rather more dependent on where these pauses occur. Native speakers pause less often at mid-clause, when they speak in their native language, whereas in their non-native language, this is a more frequent pause location. To test Davies’ (2003) claim against our results, we compared the mean duration of pauses at mid-clausal positions produced in different conditions across L1 and L2.

Table 8: Results of one sample t-test to compare the mean duration of pauses at mid-clausal positions across active & passive/nested & juxtaposed conditions in English and Dutch (p_value = 0.05)

Mean duration		English		Dutch	t-value	df	p_value	r
Active	(B)	0.09	>	0.01	10.86	29	.00	0.27
Passive	(B)	0.19	>	0.09	5.46	29	.02	0.15
Nested	(C)	0.04	>	0.02	2.01	29	.16	0.06
	(E)	0	=	0	----	----	----	----
Juxtaposed	(B)	0.17	>	0.09	5.97	29	.02	0.17
	(D)	0.01	<	0.02	0.11	29	.74	0.00

KEY: (>) indicates having higher, (<) indicates having lower, and (=) indicates having equal value, (----) indicates no value, df = degree of freedom, r = effect size. The green lines provide supportive evidence with significant results in favor of Davies' (2003) claim indicating that mid-clausal pauses occurred mainly in non-native language. The red line provides contradictory evidence for this claim.

As table (8) shows the distinction between mean duration of pauses produced in nested sentences (at position "C", inside the sub-clausal boundaries), and those produced in juxtaposed sentences (at position "D", inside the mid-clausal boundaries of the second sentences) is not significant across English and Dutch. However, the mean duration of pauses in active and passive sentences, as well as in juxtaposed sentences (at position "B", inside the mid-clausal boundaries of the first sentences) were significantly longer in L2 than in L1 (see the green lines provided in table 8). These results provide supportive evidence for Davies' (2003) claim that longer pauses are produced mostly within clause boundaries in a speaker‘s non-native language. It has been argued that different pausing pattern between native and non-native speakers is associated with linguistic and cognitive processes such as how speakers process information, plan their utterances, and monitor their performance (Tavakoli, 2003). Accordingly, native speakers pause at clause boundaries where they allow breathing space, and where a sequential thought processing occurs until they finish their utterances; L2 speakers, on the other hand, pause more often in mid-clause positions, to think or plan their speech, and to find a word, a structure, or even the correct pronunciation of a word.

7 CONCLUSION

To conclude, in line with Tavakoli and Skehan (2005) who proposed that fluency has a multifaceted nature, we showed that different aspects of fluency are differentially affected by syntactic complexity across L1 and L2. The more syntactically complex a sentence structure is, the more likely it is for disfluencies to occur. This is the case for both L1 and L2. The native and non-native language is affected to different degrees by this phenomenon with the non-native language being affected the most. Speakers produced syntactically complex sentences with longer pauses, a lower total speaking duration, and a larger number of repetitions, and corrections. We extended the effect of syntactic complexity on fluency to information processing and a speaker's mental lexicon. We argued that the need to retrieve more complex lemmas, or the need to encode more complex syntactic structures, seems to have a cost in terms of how smooth speech flow is maintained. This effect on the flow of speech is related to the fact that such retrieval creates processing demands on the way the formulator deals with the conceptualizer: it disrupts the parallel processing between these stages of speech production mechanism and exerts effort on the formulator, leading to disfluent speech.

There is no clear difference between the types of disfluencies produced in L1 and in L2. As far as the position of pauses is concerned, disfluencies are more likely to occur at mid-clause boundaries in a speaker's non-native language. Different positions between disfluencies in native and non-native language are related to points where speakers process necessary information to produce an utterance. In their native language, speakers pause more often at clause boundaries to allow breathing space, to organize their thoughts, and to produce one sentence after the other. On the other hand, speakers in their non-native language, pause in mid-clause positions to find a correct word, a structure, a pronunciation, or to think and plan their speech. Results such as the duration of pauses at "A" in nested and juxtaposed conditions, or the total speaking duration in active and passive conditions, show that fluency can be affected to different degrees in L1 and L2. However, one major finding between L1 and L2 is that speakers were more fluid, and thus less disfluent in their formulation of L1 sentences. The difference between L1 and L2 can be explained on the basis of Housen et al.'s (2012) argument concerning the cyclical linear interaction between CAF elements or Towel's (2012) discussion regarding the process of learning in L2 (i.e.:

achieving fluency is the last step in L2 learning). After extensive practice and massive exposure, one can achieve fluency in learning a second language. It can be argued that having a native-like fluency requires a native-like mental lexicon in which the stored information is extensive and easily accessible, thanks to high exposure and practice. Speakers equipped with such a mental lexicon have the pre-condition for the formulator to deal with the conceptualizer in a smooth parallel processing fashion, enabling them to formulate sentences fluently. The reason that in spite of high English proficiency, our speakers scored lower on almost every measure of fluency in their L2 is due to the fact that speakers' amount of exposure to their native language is incomparable with their non-native language. As the proficiency in L2 increases, L1 and L2 become more functionally parallel, and consequently, the performance in both systems becomes more and more similar.

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Appendix: (experimental stimuli used in the speaking experiment)

English Slides

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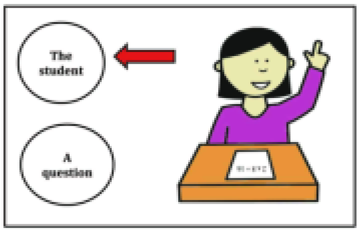

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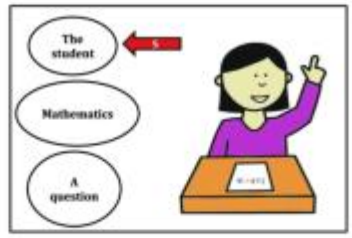
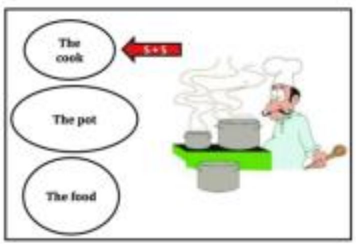
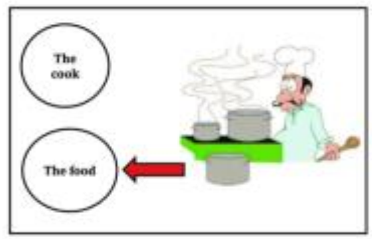
To ask



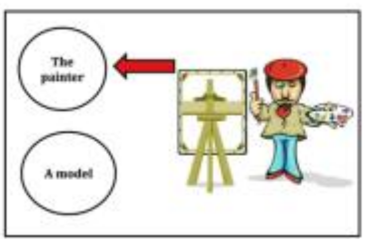
To look at
To ruin



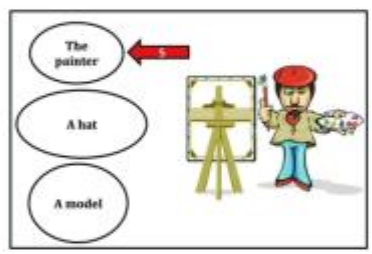
To ruin



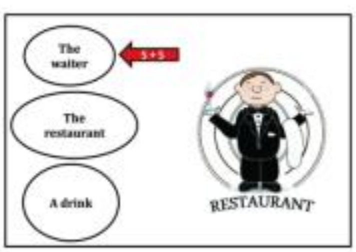
To paint



To wear
To paint



To work in
To serve



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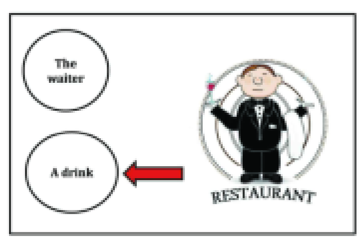
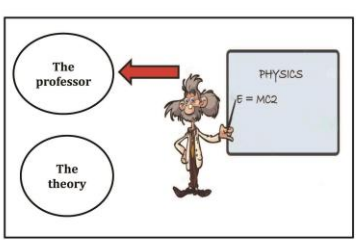
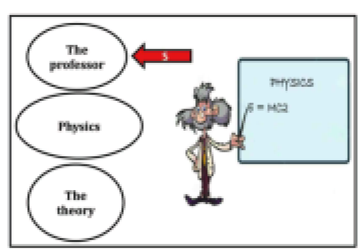


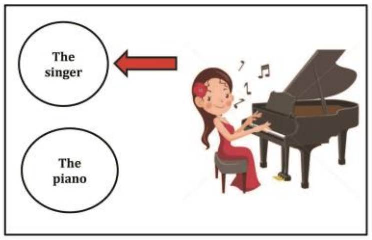
To explain



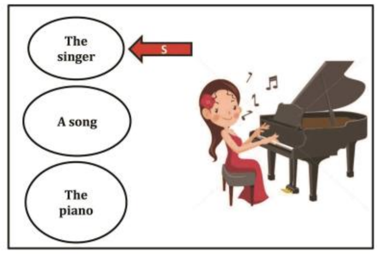
To teach
To explain



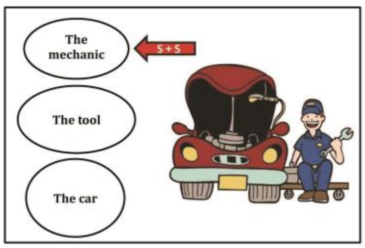
To play



To sing
To play



To hold
To repair



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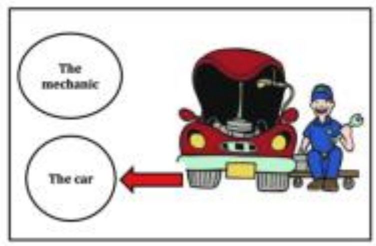

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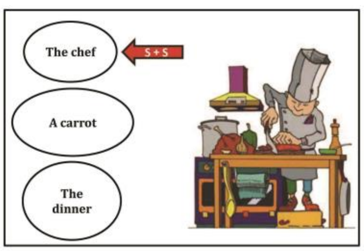
To prepare



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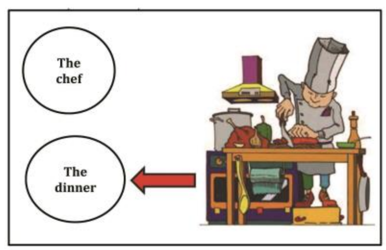

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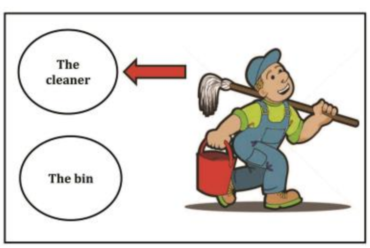

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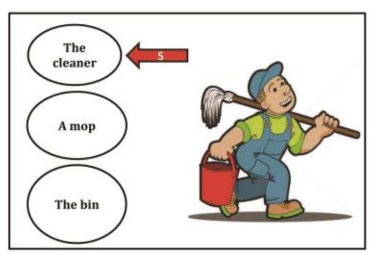
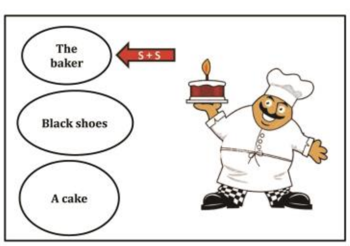
To empty



To wear
To bake



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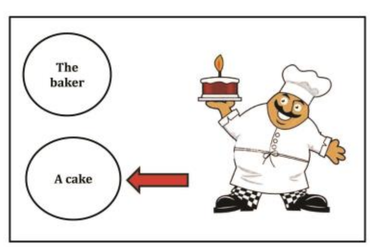

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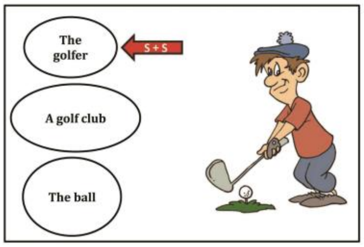

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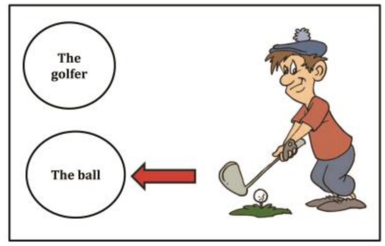

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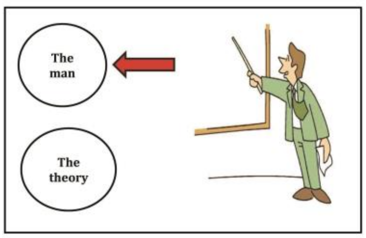

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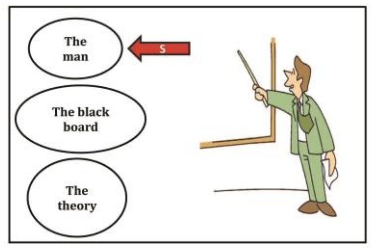

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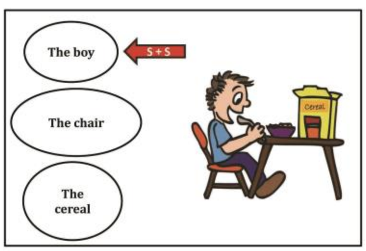

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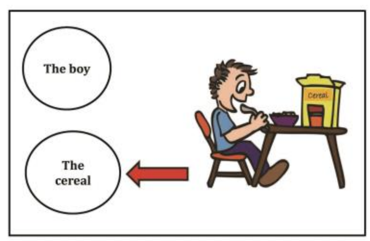

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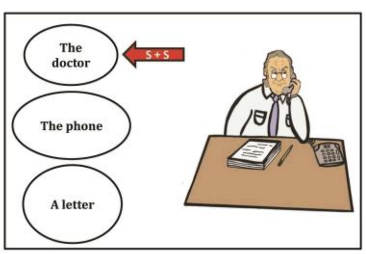

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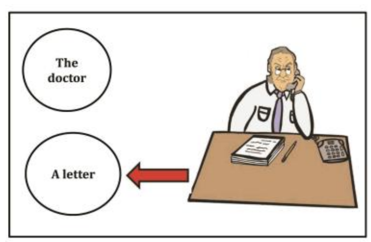

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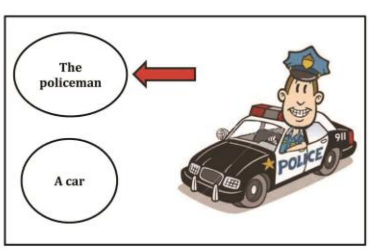

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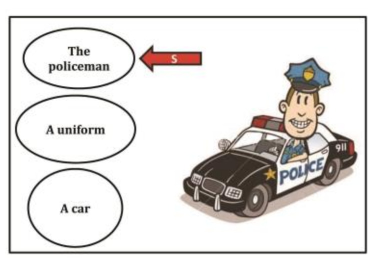

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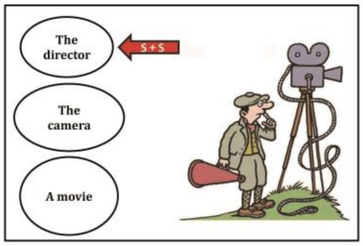

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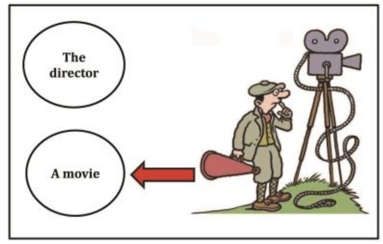

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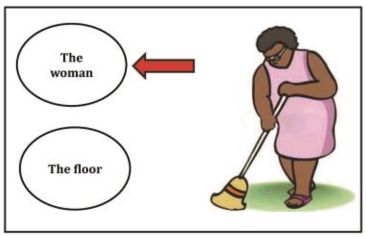

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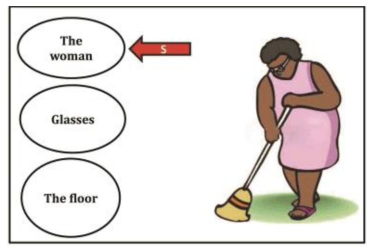

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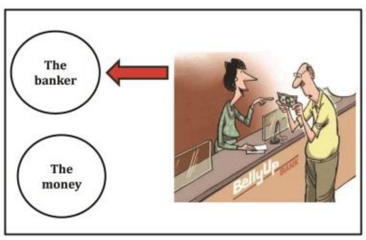

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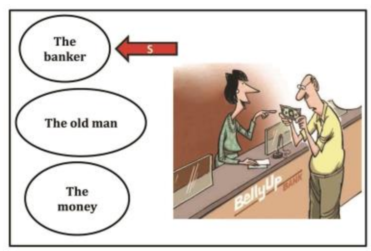
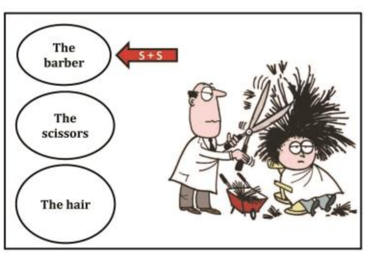
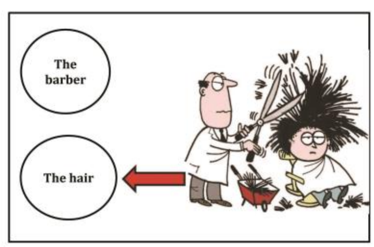


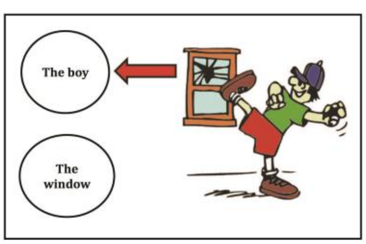
To hold
To cut



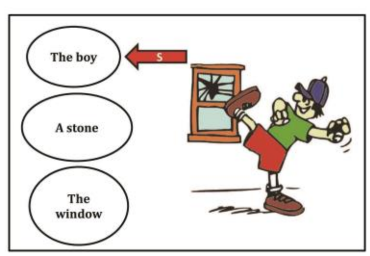
To cut



To break

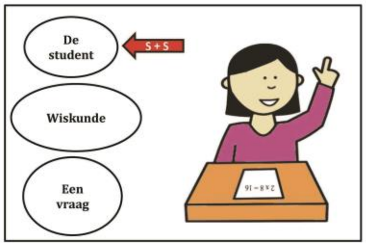


To throw
To break



Dutch Slides

Studeren
Stellen



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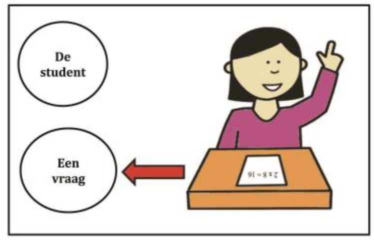
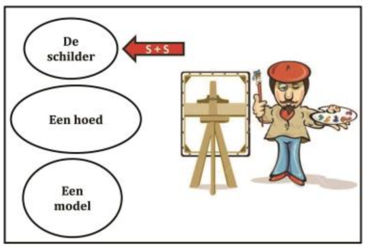


Dragen
Schilderen



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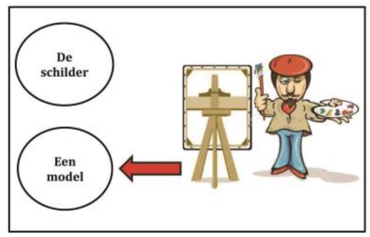
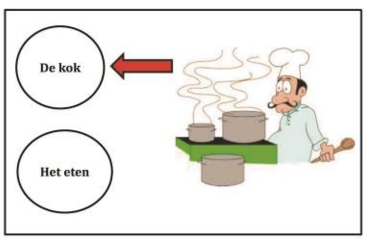
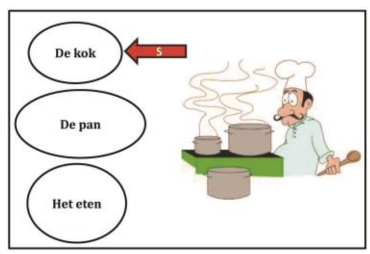


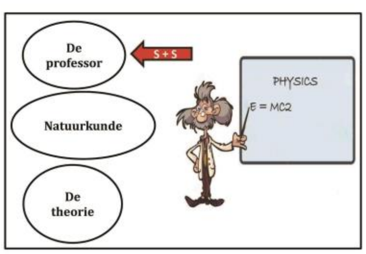
Verpesten



Kijken naar
Verpesten



Geven
Uitleggen



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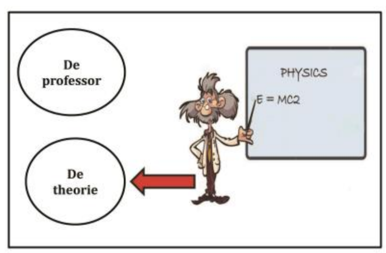
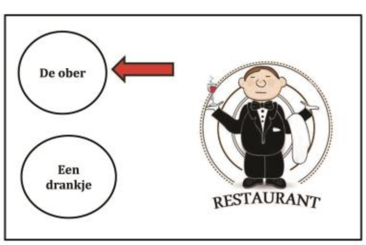
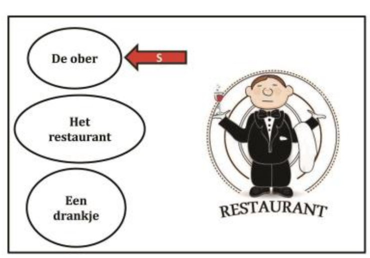


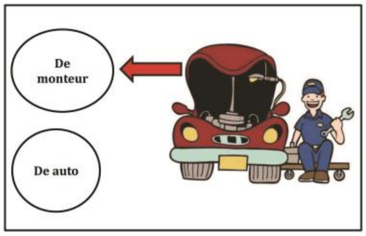
Serveren



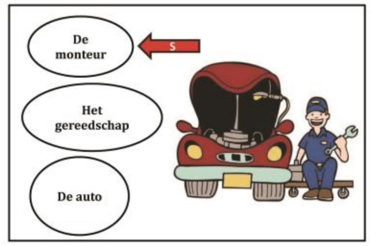
Werken in
Serveren



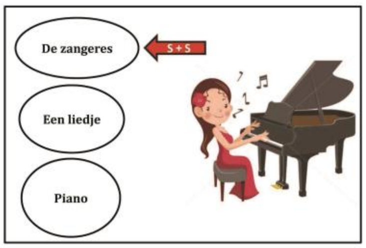
Repareren



Vasthouden
Repareren



Zingen
Spelen



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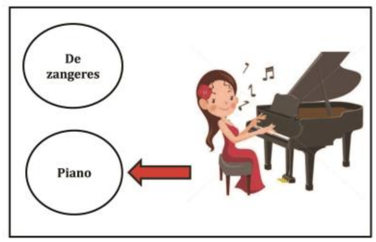

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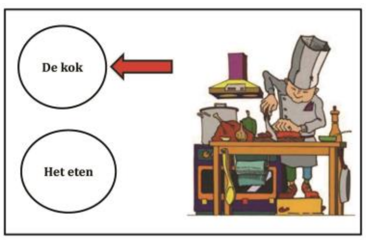

Snijden
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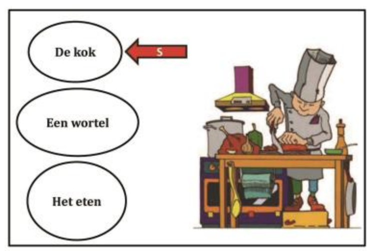
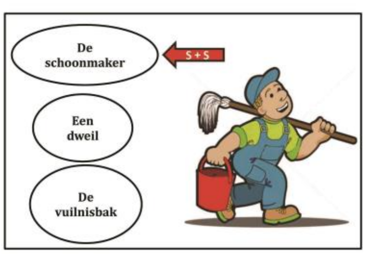


Dragen
Legen



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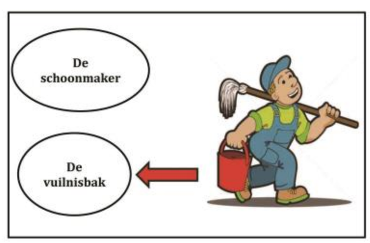
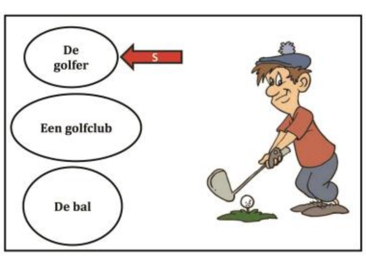
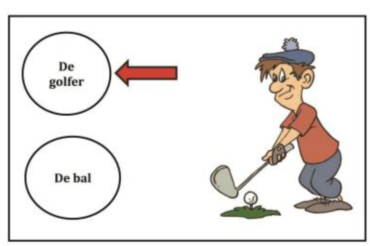


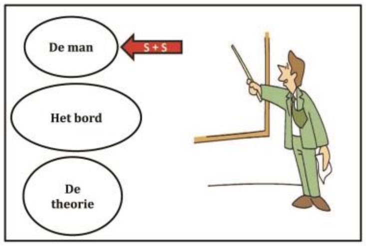
Vasthouden
Slaan



Slaan



Wijzen op
Presenteren



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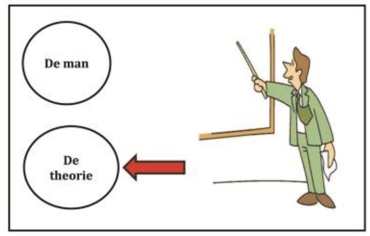
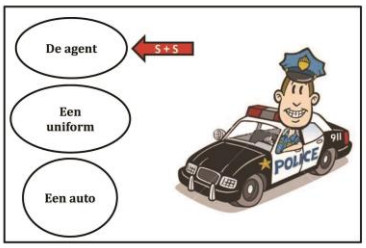
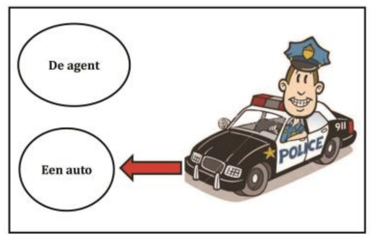


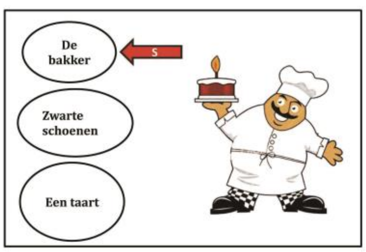
Dragen
Besturen



Besturen



Dragen
Bakken



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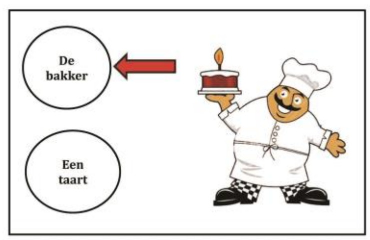

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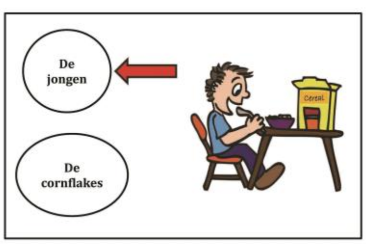
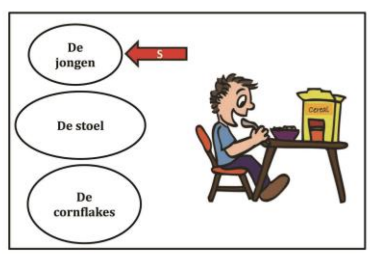


Zitten op
Eten



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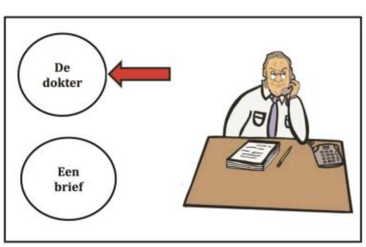
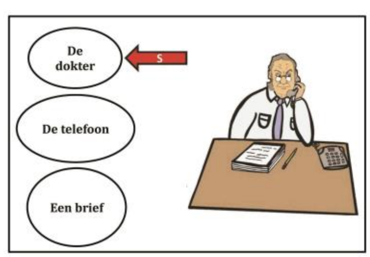


Opnemen
Schrijven



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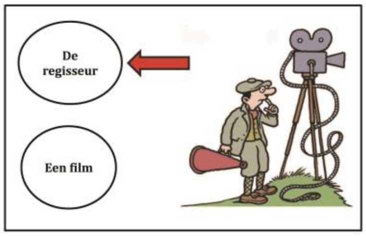
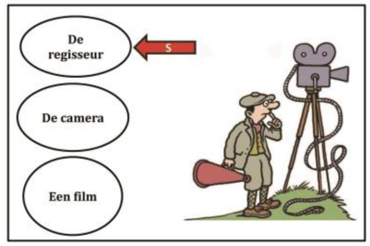


Naast staan
Maken



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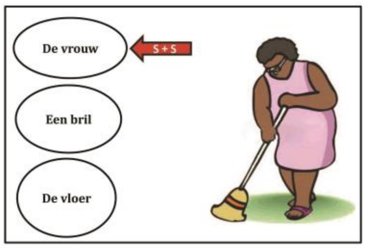

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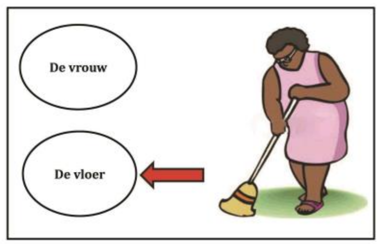

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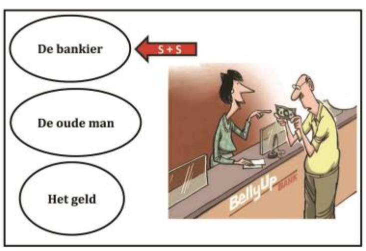
Geven



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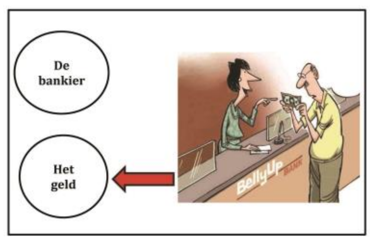
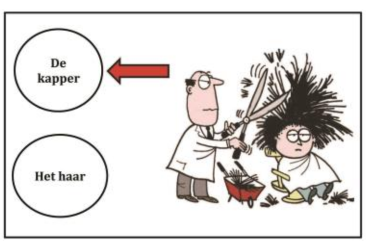
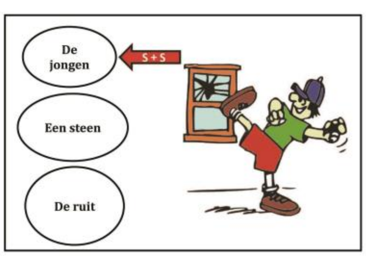


Knippen



Vasthouden
Knippen

Gooien
Breken



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