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Inducing proactive interference by context reinstatement

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Sammanfattning

Proaktiv interferens inträffar när inlärd information interfererar med pågående inlärning. Följande studie ämnade undersöka huruvida gamla minnen kan interferera med ny information vid återkallning, bara genom att återinföra kontexten där den gamla informationen lärdes in. Försökspersonerna fick genomföra två jorden-runt-resor som visades på en tv-skärm, och testades sedan genom Brown-Petersons minnesuppgift. En resa bestod av nio destinationer (ex. Japan) och minnesuppgiften var att komma ihåg tre triader av ord från samma semantiska kategori vid varje resmål. Efter de första sex destinationerna presenterades en fjärde triad av ord från samma semantiska kategori i antingen ett nytt resmål, eller i samma resmål som förut. Hypotesen är att tidigare inlärda ord ska interferera med inlärningen av de nya orden om denna sker på samma destination som förut. Trettiotre försökspersoner (23 kvinnor, 10 män) deltog i experimentet (M = 23,93 år, 20-29 år). Resultaten visade på en försämring av minnesprestationen från försök ett till tre. Den proaktiva interferensen försvann vid försök fyra. Emellertid fanns det ingen signifikant skillnad i försök fyra mellan att återinföra den gamla kontexten, eller att inte göra det.

Nyckelord: proaktiv interferens, minne, kontext, event-modell, event-segmentering

Abstract

Proactive interference occurs when previously learned information interfere with current processing. The research presented here examined how old memories can compete with new information during recall by reinstating the context from which the material was learned. Participants were exposed to two around the world trips on a television screen and were tested on memory using the Brown-Peterson task. A trip consisted of nine locations (e.g. Japan) and the memory task was to memorize three triads of words from the same semantic category at each location. After the first six destinations a fourth triad of words from that same word category was presented at the same destination as before, or at a new destination. Previously learned words were then expected to interfere with the words currently being memorized if the participant visited the same locations. Thirty-three subjects (23 female, 10 male) voluntarily participated in the experiment (M = 23,93 years, range = 20 – 29 years). The results showed a declined memory performance from trial one to three. There was also a release from proactive interference in trial four. However, there was no significant difference between memory performance in trial four whether the old context was reinstated or not.

Key words: proactive interference, memory, context, event model, event segmentation

Introduction

Have you ever experienced that when you want to learn new material the old material limits and interfere with your learning? You are not alone! Interference is a big source of error in short-term memory (Craig, Berman, Jonides, & Lustig, 2013). Knowledge that is in centre of attention, i.e. "to-be-remembered" information, will have the highest activation in short-term memory, while other information, i.e., previously learned material, will be peripheral. This information can easily be moved in to attention and thus interfere with the information currently being processed (McElree, 2001; Radvansky, 2012).

Important studies in the field of interference were developed from the middle of the 20th century (Craik, 1971; Underwood, 1957; Watkins & Watkins, 1975; Wickens, 1970; Wickens, Dalezman, & Eggemeier, 1976a, 1976b). Wickens and his colleagues' (1976) experiment consisted of a number of tests on word triads from semantic categories, a task developed by John Brown, Lloyd Peterson and Margaret Peterson (Brown, 1958; Peterson & Peterson, 1959). Participants were told to remember one triad of words. The triads were shown for two seconds. After a distracter task, which consisted of 18 seconds of counting backwards by threes from a given number, the words were to be retrieved and verbally told. The participants' memory for words from the same semantic category decreased for each triad of words they were told to remember (build-up of proactive interference, PI). But, by merely changing the category (e.g., from fruits to flowers) after three triads of words, the memory for the words in the new category was nearly as good as the first triad of words in the old category (release from proactive interference, rPI). This was an ingenious way of showing how working memory can be overloaded with information due to category specific impairments and semantic organisation.

It is well known that context has a strong influence on memory. For instance participants who learned lists of words under water were better at recalling those words under water then in an alternative context. Likewise if the participants learned the lists of words on land they were better at recalling them in the same environment (Godden & Baddeley, 1975). Up until today innumerable studies have been carried out to explain the underlying mechanisms of memory retrieval. The context maintenance and retrieval model (CMR) helps us get a greater understanding of the dynamics of memory search (Polyn, Norman, & Kahana, 2009). This model explains how memory clusters information through different organization schemes, more specific via semantic-, temporal- and source factors. Memory will cluster events that happened in the same environment, and if a sudden context change occurs memory can isolate events within one context (Polyn et al., 2009).

Everyday life contains of a constant dynamic flow of observed information. People make sense of this in part by segmenting the stream of information into events. In turn, these events work as meaningful units that help us encode-, retrieve- and communicate information to ourselves, and others. Events guide us while we are making our actions and give us a clue of what is about to happen (Kurby & Zacks, 2008; Zacks, Speer, Swallow, Braver, & Reynolds, 2007).

According to Zacks & Tversky (2001) an event is a segment of time, which has to be experienced at a given location and have to have a beginning or an end. People are able to distinguish events from each other by determining when an event ends and another one begins. This inherent ability is referred to as an “event structure perception” that makes it possible for us to instinctively segment flowing activity into events. People have active representations of the present event that are updated due to changes in its features. These representations are called event models. Events consequently helps us make anticipations about future information, which is an assumption that is the basis for event segmentation theory, EST (Kurby & Zacks, 2008). When an event ends, its information becomes stored in memory, so that information in the following event does not occupy space in the past event model (DuBrow & Davachi, 2013).

Event segmentation occurs in the change of the features of the activity observed. The changes can for example be physical or conceptual; the activity of going home after a day at work could be divided into several different events due to location (being at home or at work) or conceptuality (talking to a co-worker about your family). These chunks of events give necessary and functional hints about what have been done and how different activities are related to each other (Kurby & Zacks, 2008). The point where one event ends and another one begins is called event boundary. Event boundaries are crucial as they make people update their current memory representations to an alert adjustment of what is going on in the moment and what could happen in the future. Imagine walking to the kitchen to get a cup of coffee. When the phone suddenly rings predictions of the event become invalid as a lot of errors occur. Prediction errors induce a need for updating memory and generate a new hypothesis of “what to do next” (Kurby & Zacks, 2008; Radvansky, Tamplin, & Krawietz, 2010). Thus, event boundaries make people update their memory so that new information can be encoded.

There are however different results from studies on how event boundaries affect memory; when a context shift occurs in a narrative, reading time increases (Zwaan, Langston, & Graesser, 1995); lists of words become harder to memorize due to context shifts in the surrounding architecture (Radvansky et al., 2010); when an object is presented *on* the event boundary memory for those objects increases (Swallow, Zacks, & Abrams, 2009). And it is not a simple one-way procedure for how people segment events. We comprehend situations, environments and behaviour differently partially by how we perceive event boundaries (Swallow et al., 2009). Simple instructions of how to segment events can affect how people perceive and apprehend time and activity. In a study by Newtson (1973) people were presented with different instructions before watching an actor perform everyday activities (short films). The observers were divided into two groups: one group got instructions telling them to meaningfully segment the actor's behaviour into as small units as possible, while the other group got instructions about meaningfully segmenting the behaviour into as big units as possible. The results showed that the group of people that divided actions into smaller units were more confident about the actor's intentions and thought the activity was short. At the same time the group of people who divided the activities into big units had more difficulty understanding what he was doing, and estimated the films to be longer. A similar study but with an addition of a recall-test showed that the two groups made different transcriptions of the same event (Hanson & Hirst, 1989).

People seek causal connections between events in everyday life. These connections are highly related to how you store event models in the long-term memory. Stronger connections are easier to retrieve and so better remembered, while weak connections are more difficult to access. The causal structure is also important in segmenting events. When one event fails to explain a plausible cause further mental effort is needed, which results in a new event model (Radvansky, 2012). Yet further exploration on this can be seen in the event indexing model, which suggests that events in narrative are connected in memory through time, space, protagonist, causality, and intentionality (Zwaan et al., 1995). According to the aspect of time you can see that if different events share the same time index (event models), they are more connected to each other in memory and therefore easier to recall. This can be an explanation to why it is easier to retrieve information from an event model that is active in the working memory, than from an event model that has been consolidated into long-term memory. When an event boundary has occurred it is harder to retrieve the information because it is no longer active in short-term memory (Zwaan, 1996). This can also be referred to as the fading-foreground account (Glenberg, Meyer, & Lindem, 1987; Tamplin, Krawietz, Radvansky, & Copeland, 2013)

The situation model theory (which is like the event model, though it is more associated with work in language) states that people continually update their situation model to fit with the on going narrative (Zwaan & Radvansky, 1998). When the protagonist moves from one room to another the reader will update the situation model. Objects that have been strongly connected to the protagonist in one room are made less available in the working memory if the protagonist moves to another room. Thus the farther away the objects are from the protagonist the harder they are to retrieve, since they are not as available in working memory (Glenberg et al., 1987; Zwaan & Radvansky, 1998).

The more event boundaries you experience the more the memory is impaired for earlier events. The explanation for this phenomenon is theorized to be that when you learn material in different locations you update your event models. As a result each one of the locations has a certain event model. When trying to remember something the different event models become activated in working memory and interference occurs (Radvansky, 2012). Likewise when information, or attributes, is stored over more than one event model, that particular information becomes more organized and accessible. For example if one item (or multiple parts of it) is represented in several events, the different event models act together to produce as much information as possible about that specific item, due to the organization of attributes. But, multiple activated event models in memory could cause interference in memory retrieval for only one event model. In a moment where you need to remember where you parked your car, several other memories of “parking your car” can become activated, which can confuse you and slow down the process of retrieving that one much-needed event model (Radvansky, 2012).

Aim of the present study

The aim of the present study was to investigate how important context is for memory retrieval. This was done through Wickens semantic category-task. Previous studies have shown that by awakening cues from a context where subjects have learned material facilitates the memory for that material during recall. And that context shifts influence peoples’ interpretation of events and memory. In the present study we wanted to investigate how old memories can compete with new information during recall by only reinstating the context from which the material was learned.

1. Hypothesis 1. In line with previous studies this experiment will show a build-up of proactive interference in the three first triads of words.
2. Hypothesis 2. When the fourth triad of words is presented in the same context as the three first triads of words there will be a proactive interference. When the fourth triad of words is presented in a new context there will be a release of proactive interference.
3. Hypothesis 3. A final memory test for all the words that are presented in the experiment will affirm that the context were prominent, and thus the participants associate the context with the material they have learned.

Method

Subjects

Thirty-three subjects (23 female, 10 male) voluntarily participated in the experiment (*M* = 23,93 years, range = 20 – 29 years). The majority of the participants were students, and were selected through a convenience sample. All of them speak Swedish as their native language. Data from one subject was excluded due to age. Lemonade and cookies were offered, but none were given class credits or payment for participating. Informed consent was obtained in accordance with the ethical guidelines at the Department of Psychology, Lund University.

Stimuli

The experiment was programmed in E-prime. Two fictional around the world trips were constructed (trip one and two), each containing six destinations. The trips were made using Illustrator, and each consisted of three freeze frames operating as the context shift (see figure 1). Two additional frames with the texts “Let us travel further” and “Welcome to X”

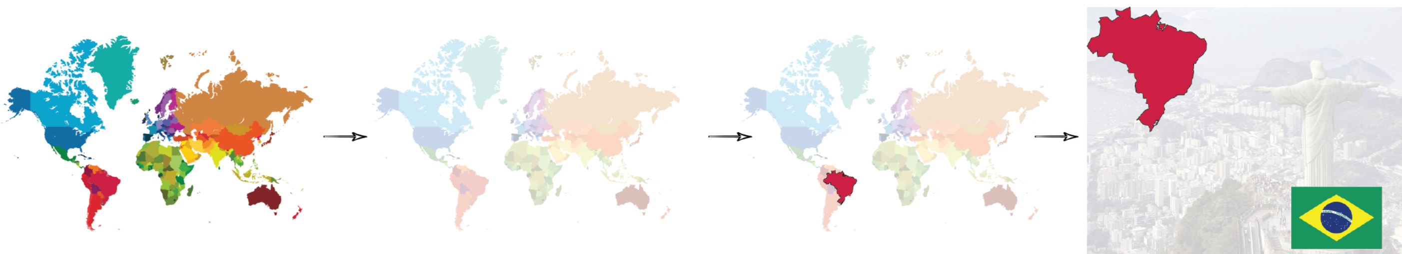

Figure 1 Experimental procedure for one destination, consisted of one picture of the world, one with the whole world blurred, one with the specific destination highlighted and one with the destination and the flag of the country.

(where X stand for the country), made the participants understand the change from one destination to another. The learning frame, a blurred photography of the destination, was created and functioned as background when the learning material (the words) was presented.

There were a total of 216 words and 18 different word categories. Six categories in each group (A, B and C), and each category contained 12 words. The words were divided into four triads (T1, T2, T3 & T4). The triads were presented in sequential order (T1 first, T2 second and so on). T1, T2 and T3 were counterbalanced so that every triad contained words of the same degree of difficulty according to syllables, word length and taxonomy. T4 contained the three words with lowest taxonomy from each category to control for ceiling effects. The categories were taken from *Swedish Category Norms* (Hellerstedt, Rasmussen & Johansson, 2012).

The categories used were: bird, body part, colour, dancing style, flower, fruit, fuel, furniture, garment, insect, sport and tool. The countries used were: Argentina, Australia, Brazil, Chile, China, Denmark, Egypt, Germany, Great Britain, India, Japan, Mexico, The Netherlands, Russia, South Africa, Thailand, Turkey and USA.

Design and Procedure

A repeated measures design was used where each participant were exposed to two around the world trips, randomly assigned on a 32-in. television screen. The trips were randomized, so that every participant visited all destinations in different order. The experiment began with instructions telling the participants to memorize words, contexts and the information presented. The procedure at the first six destinations was identical: following an information box about the destination (e.g., the language in Japan is Japanese), a 2-s presentation of one triad of words, T1 (e.g., apple pineapple papaya) was shown. A distracter task was presented. It consisted of a randomly picked 3-digit number, which the participant counted backwards from by seven for 18 s. This functioned as a rehearsal-preventing task. The memory test phase consisted of the question “Which were the words?” and was presented after the question “What number did you arrive at?”. The participant had 8 s to remember the words. The same procedure followed for T2 and T3: information about destination – 2-s presentation – distracter task – memory test phase (figure 2).

Figure 2 Experimental procedure at each destination. Information about the destination was followed by the words that were encouraged to be remembered. The distracter task lasted 18 s and the question about what number the participants had arrived at were followed by "which were the words". The same procedure was repeated for T1, T2 & T3. The procedure at T4 were practically the same, with an additionally question about whether the participant had been at the specific destination before. This was shown right after the first information box.

Different words from the same semantic category were used in T1, T2 and T3, (e.g., fruits). Scoring was done by giving the participant one point for each correct answer, and one extra point if the words were in the same order as presented in the study phase (Wickens et al., 1976a).

After completing the first six destinations, the participant went on a short trip, alternating to the same destination as before (PI-condition) or to another destination (rPI-condition). At every destination the following procedure was used: After the question "Have you been here before?" a triad of words, T4, were shown for 2 s, from the same sequential order that the categories in the six-destination trip was presented. The question was used to update the participants' mental model of the context that they had learned the triads of words in. After a distracter task the memory test phase began after the question "What number did you arrive at?" and was the same as before: "Which were the words?". The last phase encouraged the participants to write down all the words they remembered from the trip. Each destination was then shown for 30 s and was the time the participant had for remembering. This ended the first trip. A pause was given, and the new trip began as soon as the participant felt ready. The experiment lasted approximately 45 min including break.

Statistical Analyses

Statistical analysis was performed using the SPSS software (version 20 for Windows, SPSS Inc, Chicago, IL, USA). To detect significant differences data were analysed using paired-samples t-test, one-way repeated measures ANOVA and a mixed-model ANOVA. Results are presented as means ± standard deviation and $p < .05$ was considered significant.

Results

A one-way repeated measures ANOVA was conducted to compare the three different trials: T1, first triad of words, T2, second triad of words and T3, third triad of words. There was a significant effect for build-up of proactive interference in trial T1, T2 and T3, F (4, 64) = 83.34, $p < .001$, partial eta squared = .82 (Figure 3). A paired-samples t-test was conducted to see if there was a release from proactive interference. The results indicated that there was a significant effect for release from proactive interference from T3 ($M = 51.58$, $SD = 15.66$) to T4, ($M = 66.22$, $SD = 19.15$), t (32), $p < .001$ (Figure 3). A paired-samples t-test was conducted to detect differences between T4-stay and T4-switch. The results showed no significance between words remembered if the participant stayed in the same context, T4-stay, (M=15.67, $SD = 4.88$) or if the participant changed context, T4-switch, ($M = 16.12$, $SD = 4.72$), t (32), $p = .36$.

The participants were divided through a median split into two groups regarding memory performance on the final memory test for all destinations; one group with high memory performance (M= 63.19, SD= 13.33) and one group with low memory performance (M= 22.44, SD= 10.59). A mixed-model ANOVA was conducted to see if there was a difference between the groups in performance on T4-stay and T4-switch (T4-stay and T4-switch was within-subject factors, and high performance group and low performance group in

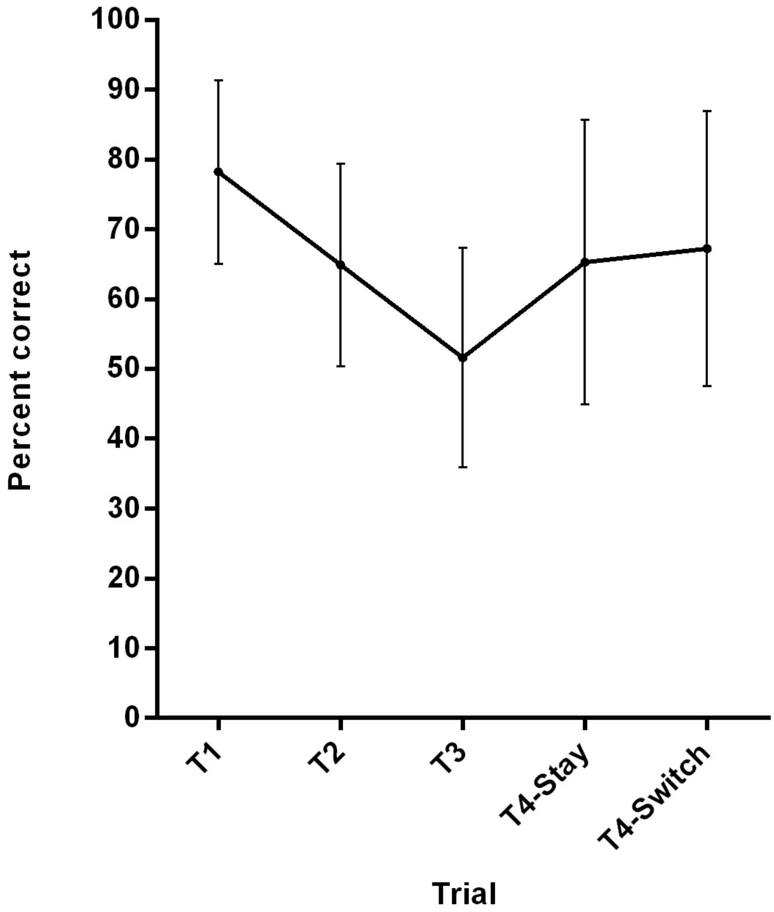

Figure 3 Significant build-up of proactive interference in T1-T3. Also a significant release from proactive interference in trial 4, however no significant difference between T4-stay and T4-switch.

between-subjects factor). The main effect for T4 was not significant, F (1, 30) = 0.88, *p* = .37. There was no significant interaction between high- and low performance on the final memory test and T4-stay and T4-switch, F (2, 30) = 0.59, *p* = .56.

The final memory test was established to affirm the effect of context as a cue to generate the memory for the words the participants learned in the different countries, i.e. inducing proactive interference. In whole, the participants remembered 25.8 % of the words (162 words in total). In the first trip the participants remembered 19.49 % of the words and in the second trip they remembered 32.14 %.

Discussion

To our best knowledge, the present study is the first that tries to examine the context's impact on memory by using the Brown-Peterson paradigm. The results for build-up of proactive interference in trial one, two and three were in line with the hypothesis and previous studies. There was a release from proactive interference in both T4-stay and T4-switch, which was in opposite of the hypothesis. The results for the context reinstatement and awakening the old memories, the differences between T4-stay and T4-switch, were not in line with the hypothesis. Neither were there a significant difference between high memory performers and low memory performers on T4-stay and T4-switch.

The experiment did, however, differentiate in some important aspects from the original experiments using the Brown-Peterson paradigm. Firstly, only three triads of words were used at each destination to confirm a build-up of proactive interference. Secondly, there was no trial to examine the release from proactive interference immediately after the third triad of words. Thirdly, the experiment controlled for time between the third triad of words (T3) and the fourth triad of words (T4) to guarantee that the context would be the only manipulation. Fourthly, to ensure that ceiling effects would not occur, words with lowest taxonomy in T4 were used. And last, and maybe the most important, there were no change in semantic category from the third to the fourth trial, as the manipulation was a context shift.

The experiment consisted of a complete new design, and yet it showed a build-up of proactive interference and a release from proactive interference. Where older experiments (see for example Wickens, 1970; Wickens, Dalezman, & Eggemeier, 1976; Underwood, 1957; Watkins & Watkins, 1975 & Craik, 1971) have used the Brown-Peterson paradigm in the original way, the present experiment consisted of two around-the-world trips, where the participants learned words from specific semantic categories at different destinations.

The differences between T4-stay and T4-switch indicate that the context in the experiment did not work as a sufficient cue for awakening memories. Radvansky, Krawietz and Tamplin (2011) constructed an experiment where they let the participants pick up objects in one room and then move to another room and put it down. Either they picked up an object in one room and put it down in another, or picked up and put it down in the same room after visiting other rooms. The participant was to remember the objects. If the memory for objects were better when the participants went back to the same room as they had picked it up, then a the result would give support to the encoding specificity theory (Thomson, 1970), otherwise it would support the location updating effect (Radvansky & Copeland, 2006). The location updating effect states that it is the shift in locations that is the most essential for memory. The results did not indicate that a return to the same context improved performance, which gives support to the location updating effect. It is the number of updates that impairs memory.

There is of course a possibility that there were too many shifts in the experiment. The encoding specificity holds that the material learned in one context is better remembered in that specific context (Godden & Baddeley, 1975; Tulving & Thomson, 1973). The participants visited six different destinations. Before the T4 session they would have learned 54 words from six different semantic categories at six different locations over a time period of approximately 25 minutes. There is a lot of information that would have to be consolidated in order to get an effective proactive interference on the last trials. The proportion of previously learned information could possibly have made the impact of the proactive interference too small. Radvansky (2012) states that when a person experience a lot of event boundaries memory gets impaired. The context changes can have impaired memory so that the participant did not manage to reinstate the context and remember the words that were learned there, and thus induce proactive interference. Although our final memory test indicated that the memory were quite good for where the words had been studied. When reinstating the context on the television screen participants remembered about 25 percent of the words. Maybe the time between the first three triads of words and the fourth triad of words were too long, instead of the number of context changes. When the participants were to awaken the words previously studied in one context the words were forgotten due to too long time since the study phase. One way to test this hypothesis would be to shorten the trips to three-four destinations, and thereby making the memory traces more accessible in long-term memory.

Unlike previous studies within the Brown-Peterson paradigm, the present study did not investigate proactive interference per se, but used the phenomenon to look at memory and context. Wickens and his colleagues used a semantic shift in word category between the third- and the fourth trial to investigate how old knowledge can impair memory performance (Wickens et al., 1976a), while this study only made a contextual shift at T4. And even though our context reinstatement was an exact overlap (the same picture of the destination were shown when the participant revisited the destination), maybe our context could have been more prominent. Our television screen may have been too small to create an immersion that was necessary for the participants to experience it. We did not make any further investigations to how screen size affects the experience of the context. However Radvansky and his colleagues (2011) tested the influence of screen size on perception of events and event boundaries in their second inquiry of “walk-through doorways”-experiment. By repeating the experiment in three different ways, with a bigger screen, a smaller screen and in a real-life environment, they saw no significant difference in the effect of the context shift. This suggests that the screen size did not make that much of a difference to the results (Radvansky, Krawietz, & Tamplin, 2011).

When participants travel between destinations they will create an event model for each location, and when features in an event model changes physically or conceptually, a new one emerges. The experiment was constructed so that the physical changes (travelling between locations) generated event models, rather than conceptual (Kurby & Zacks, 2008). The specific event model contains information about what they have learned at that location. When the participant returns that particular event model will re-emerge and thus interfere with present learning. There could however be a problem as for the background-pictures in the experiment. Environmental similarities could bring forth several event models at the same time, which in turn can lead to a loss of competing memories (Radvansky, 2012). Possibly the conceptual features could have a stronger impact on the phenomenon proactive interference then contextual changes.

After the trials in the first and second trip the participants were asked to write down the words they remembered in a last memory test. As the participants revisited the destinations they were asked to remember both memorized words and in what semantic category the words were placed. The results showed that the performance was extensively better at the second final memory test. This could be due to a practice effect, a recollection of the initial instructions after the first final memory test or an alteration in memorization strategy after the first final memory test. To investigate if the improved memory in the second trip made an impact on differences between T4-stay and T4-switch we performed a mixed-model ANOVA. No significant differences were found. This can, of course, be due to several different confounds: no context reinstatement, ambiguous instructions, memory overload etc. This can affect the internal validity of the experiment. Logically persons with better memory would have a stronger proactive interference in the T4 as more memories (memories that to a greater extent are consolidated) compete during memorization and memory retrieval. Simultaneously participants with lower memory function would perform of inferior quantity.

The interjudge reliability was high, even though there were two different experiment leaders. The words were verbally told by the participants and the experiment leaders had direct guidelines for how to collect answers. There was an ambiguity in the final memory test, which affected the reliability of that test. The extent to which the results can be generalized to a larger population is limited due to the use of a convenience sample.

In summary, the present study examined how old memories can compete with new information during recall only by reinstating the context from which the material was learned. The results showed no significant effect for that context reinstatement induced proactive interference. It could be interesting for future research to extend the context reinstatement by including more than just the visual stimuli (e.g. sounds, virtual reality etc.), and they will also have to increase the sensitivity in the experiment procedure.

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Appendix A

Department of Psychology
Mikael Johansson, PhD
Projektansvarig

LUND
UNIVERSITY

Informerat samtycke

INFORMATION TILL FORSKNINGSPERSON

Tillfrågande om deltagande
Du tillfrågas härmed om Du vill deltaga i denna studie som inkluderar datoriserade beteendetest.

Bakgrund och syfte
Det generella syftet med undersökningen är att öka förståelsen för grundläggande minnesfunktioner. Avsikten är att kartlägga hur vi lagrar och plockar fram information ur minnet, att förklara varför vi ibland glömmer information, samt att belysa samspelet mellan olika minnessystem och hjärnregioner.

Studiens genomförande och risker
Experimentet består av två huvuddelar. I en del kommer ett antal stimuli (t ex ord, bilder) att presenteras och Din uppgift är att försöka lägga dessa på minnet och i en andra del kommer Din minnesprestation för det inlärda materialet att mätas.

Experimentet är helt datoriserat, vilket innebär att Du kommer att presenteras för olika typer av stimuli på en datorskärm och att alla Dina bedömningar samlas in för lagring via knapptryckningar.

Undersökningstiden är c:a 45 minuter.

Hantering av data
Persondata från studien kommer att lagras i ett register och databehandlas. Dina uppgifter är sekretesskyddade och ingen obehörig har tillgång till registret. Då data från studien publiceras kommer enskilda individer inte att kunna identifieras. Hanteringen av Dina uppgifter regleras av Personuppgiftslagen (SFS1998:204). Se bifogad bilaga med allmän information om behandling av personuppgifter i forskningssyfte vid Lunds universitet.

Sekretess
Vi behandlar resultaten av studien konfidentiellt.

Frivillighet
Du deltar helt frivilligt och kan när som helst avbryta Din medverkan i studien utan att behöva ange någon anledning.

Ytterligare information
Förutom denna skriftliga information kommer Du att bli muntligen informerad före undersökningen. Då får Du också möjlighet att ställa frågor. Du är också välkommen att ringa någon av följande personer för att få ytterligare information.

Mikael Johansson, projektansvarig
Professor
Neuropsykologiska avdelningen
Institutionen för psykologi
Tel: 046 – 222 36 39

Förnamn Efternamn, experimentledare
Kandidat
Tel:

Jag har muntligen informerats om studien och tagit del av den skriftliga informationen. Jag är medveten om att mitt deltagande i studien är fullt frivilligt och att jag när som helst och utan närmare förklaring kan avbryta mitt deltagande.

______________________	______________________
Datum	Datum
______________________	______________________
Deltagarens signatur	Experimentledarens signatur
______________________	______________________
Deltagarens namnförtydligande	Experimentledarens namnförtydligande

Appendix B

Categories and words

Frukt	Kroppsdel	Färg	Klädesplagg	Fågel	Verktyg	Blomma	Bränsle	Insekt	Möbel	Dansstil	Sport
Äpple	Arm	Röd	Byxa	Örn	Hammare	Ros	Bensin	Fluga	Stol	Vals	Fotboll
Ananas	Bröst	Svart	Jacka	Svan	Fil	Vitsippa	Kol	Humla	Hylla	Salsa	Bandy
Papaya	Höft	Orange	Shorts	Anka	Yxa	Vallmo	Uran	Larv	Säng	Street	Pingis
Citron	Hals	Vit	Kavaj	Svala	Kofot	Nejlika	Trä	Knott	Bänk	Disco	Löpning
Kiwi	Öra	Grön	Skjorta	Skata	Borr	Solros	Etanol	Geting	Pall	Jazz	Golf
Päron	Finger	Gul	Strumpor	Blåmes	Tång	Maskros	Diesel	Spindel	Soffa	Bugg	Tennis
Mango	Knä	Lila	Kjol	Rödhake	Hyvel	Blåsippa	Ved	Myra	Byrå	Balett	Basket
Banan	Ben	Blå	Tröja	Kråka	Såg	Tulpan	Olja	Mygga	Bord	Tango	Hockey
Melon	Rygg	Rosa	Kofta	Duva	Slägga	Lilja	Gas	Fjäril	Lampa	Samba	Rugby
Lime	Häl	Grå	Väst	Gam	Rasp	Syren	Raps	Broms	Matta	Jive	Spjut
Litchi	Kind	Brun	Rock	Häger	Spade	Pion	Papper	Mask	Skåp	Stepp	Dans
Aprikos	Hår	Turkos	Top	Höna	Mejsel	Orkidé	Torv	Slända	Divan	Modern	Skytte