

A hidden language

Recovery of a 'lost' language is triggered by hypnosis

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Our case study confirms two previous studies demonstrating that a 'lost' language can be recovered by hypnosis. These results point to the existence of another type of attrition. Here a distinction is made between this type of attrition of a 'hidden language' (HL), that is, one that has not been forgotten but rather has become inaccessible to the speaker, and the traditionally studied attrition of a 'forgotten language' (FL) or one that is being forgotten. A conflict hypothesis is proposed to explain HL attrition. An attempt is made to show how these two types of attrition could be distinguished and to explain why brain imagery analyses are important for this distinction.

Keywords: hypnosis; neuroimaging; language forgetting; accessibility

Introduction

Investigations into language attrition can encounter at least three different types of language loss, and for each type, loss can be either partial or total. The first type of language loss results in a language system that can be called Type AL (abnormal language), because the speech produced is clearly abnormal. This type is pathological in origin as a direct result of physiological damage to the brain or other parts of the speech system. This type of language loss is very well documented by the extensive literature on aphasia, agnosia, agrammatism, etc. (e.g. Caplan 1992; de Bleser 2003). A second type of attrited language system, non-pathological in nature, can be designated as Type FL for a forgotten language. This type occurs when a speaker has acquired a native language¹ which, either through lack of use together with the use of another one, or through interference when two or more

1. Attrition can also affect a second or foreign language, but here we are concerned with L1 attrition.

languages are in constant use, is in a process of forgetting or restructuring. And thirdly, we argue, it is also possible that a language only appears to be forgotten. This last type will be referred to here as HL – a hidden language.

Knowledge of a language can attrite partially (e.g. Cook 2003; Lambert & Freed 1982; Schmid 2002; Schmid, Köpke, Keijzer & Weilemar 2004; Seliger & Vago 1991) or totally (Pallier, Dehaene, Poline, LeBihan, Argenti, Dupoux & Mehler 2003; Ventureyra, Pallier & Yoo 2004). An example of total language attrition, which seems to be due to forgetting, is described by Pallier et al. (2003) and Ventureyra et al. (2004) in studies on Korean adoptees (mean age 26.6) who no longer had any contact with their native Korean after their arrival in French families between the ages of 3 and 10. A functional magnetic resonance imaging (fMRI) study showed no specific brain activity when the adopted Korean participants were listening to Korean sentences as opposed to sentences in unknown languages, such as Japanese or Polish.

Pallier (this volume) suggests that there is empirical evidence that could put into question the notion (Penfield 1965) that the acquisition of an L1 will always leave long-lasting traces in the brain, since their Korean adoptees appear to have entirely lost their L1. However, Pallier allows the possibility that there may be traces of the adoptees' early exposure to Korean which their paradigm was not able to uncover. Thus, the question remains – is it possible that an L1 cannot be erased from memory, but rather only become more and more inaccessible (Sharwood Smith & van Buren 1991)?

If it could be demonstrated that in certain cases an L1 seems to be erased from memory but, in fact, is only inaccessible to the speaker, this would be a case of the third type of attrition proposed above, that which results in a hidden language (HL). Contrary to the first type of language loss, which is attrition resulting in a forgetting process, an HL exists when a language has been acquired as a native (or a second) language and, at some later date, becomes *largely* inaccessible to the speaker, rather than just being restructured or partly forgotten. It is proposed that when the inaccessible language is an HL, the memory traces are still stored in the brain but blocked from accessibility by some unknown mechanism.

Since there are two previous studies (As 1962; Fromm 1970) which report the recovery of a lost language through the use of hypnosis, this gives support to the suggestion that such a mechanism is possible. The present study represents an attempt to replicate and confirm these findings. Since hypnosis is not usually considered an acceptable tool, and since the 'loss' of the L1 can only be established on the basis of the participant's self-report, the initial intention was to obtain objective data to document the difference between the 'during hypnosis' and 'out of hypnosis' conditions. Such data were to be provided by the monitoring of brain activity before, during and after hypnosis by means of fMRI.

Unfortunately, it became clear during the experiment that this second step would not be possible, due to our participant's surprising level of recovery of his lost language, Mina, after several sessions of hypnosis (Sections 3.2 and 3.3). This process, however, cannot be taken to indicate that every forgotten language is also an HL. The conditions between the participant for the present study (CK) and, for example, the Korean adoptees were different: CK had had passive exposure to his lost language for a few hours almost every week for 15 years; whereas the adoptees had had no exposure to Korean. Furthermore, the separation between the use of one language and acquisition of the other was less clear-cut in the present case, since CK continued to speak his L1 (French) during the three years in which he was acquiring his L2 (Mina), whereas the adoptees never spoke Korean after leaving Korea.

The present paper will propose a 'conflict' hypothesis as a possible explanation of the attrition process which results in an HL. Briefly, it is proposed that after acquiring the HL, the speaker had a conflict with regard to producing it, and this resulted in that language becoming inaccessible to him. This hypothesis will be described in the following terms: (1) a conflict can cause information to become inaccessible in a manner that is not 'normal' forgetting; (2) hypnosis can decrease conflict, and (3) a decrease in conflict can allow blocked information to become accessible to the speaker. Previous neuroimaging studies will be presented to support each of these three ideas.

1. Past studies of attrition resulting in an HL

1.1 As (1962)

As (1962) conducted an experiment to determine if a 'lost' language could be recovered through the use of hypnosis, specifically using age-regression. The age-regression technique is used in hypnosis to enable the participant to concentrate completely on a particular past age period *specifically* in order to enable him/her to describe images and events that happened during that period very vividly. However, the concern is not the entire age period, but the vividness of the description of specific events during that age period. Whether or not this method gives completely accurate access to childhood memories is controversial (Kihlstrom 2003).

The participant was an 18-year-old American who had immigrated to the United States from Sweden at the age of 5. At the time of the experiment he said that he could not recall his native language. He was born to Swedish parents living in Finland. They divorced and he moved to the States with his mother, who

remarried when he was almost 7, and told him that they were not to converse in Swedish, since the new stepfather only spoke English.

A distribution of scores for the participant's knowledge of Swedish before and during hypnosis was made, using 56 questions asked orally in Swedish (e.g., How old are you? Do you have a brother? Can you point to your head?). Under hypnosis with age-regression, the participant was able to answer significantly more questions correctly. The author described definite progress, according to the tests he gave, in the participant's ability to understand and speak Swedish during hypnosis after four sessions.

1.2 Fromm (1970)

Fromm (1970) came across the recovery of a 'lost' language accidentally. The author was asked to watch a hypnotic training session, in order to give a young therapist feedback. The participant was a 26-year-old Japanese-American student, who said he did not know Japanese. Fromm had just returned from Japan where she had learned a few sentences of that language. During the hypnosis, when the participant was age-regressed to 7 years old, Fromm used her limited repertoire of Japanese which the participant was unable to understand. Some months later, Fromm used the same participant to demonstrate hypnosis and age-regression. This time the participant was age-regressed to 3 years old and, without provocation, the participant spoke rapid Japanese which lasted 10 minutes. Out of hypnosis, he could not speak Japanese and he had spontaneous posthypnotic amnesia.

A taped session confirmed that the participant was able to speak Japanese fluently when age-regressed to 3 years old. When the participant listened to the recording out of hypnosis, he was only able to understand a few isolated words. A translation of the tape revealed that from 1 to 4 years old the participant had been put into a relocation camp with his family during World War II where he had spoken Japanese.²

2. Pilot study of an HL

A pilot study was conducted in collaboration with C. Pallier and N. Prieur to seek confirmation of the results of As and of Fromm. If the reactivation of an HL under hypnosis could be confirmed, it was intended to add fMRI data which would

2. Americans of Japanese descent in California had been put into these camps during the war.

show the brain activity associated with the 'lost' language before, during and after hypnosis.

The 21-year-old participant for this pilot study, CK,³ was a university student in Paris. He was born in Paris to Togolese parents who only spoke French in the home. At the age of 2½ years, he, his mother and his older brother went to live with his grandmother in Togo, where they stayed for 3 ½ years and then returned to Paris. During that time, he acquired and spoke fluent Mina (a simplified spoken local variant of Ewe) with his grandmother – whom he adored – and with his playmates. Upon his return to Paris, CK's mother was told by the head of the primary school that speaking Mina in the home would hinder CK's scholastic achievement. CK's mother related this to him and told him not to use Mina any more.

At the time that the author interviewed CK, he said that he was unable to understand or speak Mina which he had not spoken since he was 6 years old. CK could only understand and produce about 30 isolated words all of which concerned food, school or childhood games, such as, 'grandmother', 'brother', 'milk', 'to play', etc. This loss of Mina had taken place in spite of the fact that CK was present at family gatherings where Mina was spoken almost every Sunday. He said he was never able to participate in any of those conversations.

The therapist Nicole Prieur (NP), who uses hypnosis for therapeutic reasons, decided to use the age-regression technique during hypnosis with CK, since he had habitually used Mina between 3 and 6 years of age. A preliminary session established that CK was a highly hypnotizable participant. In that session, CK was tested to see what he could understand and produce in Mina out of hypnosis. The participant served as his own control, since his ability to understand and speak Mina out of hypnosis was compared to when he was under hypnosis. A translator (AW) was present to ask CK questions in Mina. AW communicated with the therapist in written French for guidance for the questions. During each session, CK was put under hypnosis for one hour and all sessions were taped. The number of sessions was to be guided by CK's ability to understand and to produce Mina during hypnosis. About one month elapsed between the sessions for translation and analysis of data. There were six sessions.

3. The participant gave written informed consent. Our participant was not an adoptee. For ethical reasons, it is complicated to do the type of experiment that we were setting up with an adoptee.

Due to the work on priming⁴ and hypnosis,⁵ NP gave CK an exact posthypnotic suggestion⁶ just before ending each session – “Forget everything that has taken place during hypnosis, nothing, not a single word, will remain in your mind”. This was to avoid priming effects, since it was undesirable that CK should recover his Mina out of hypnosis before the planned fMRI part of the experiment, which could only take place when it was clear that he could recover Mina under hypnosis. It was agreed with CK that he would not know anything about the sessions until the experimenters chose to give that information.

2.1 Experiment and results

The sessions, with CK under hypnosis and age-regressed to 4 or 5 years old, consisted of a free conversation and sometimes included a questionnaire. These parts were designed to observe CK’s ability: (1) to participate in free spontaneous conversation in Mina with the translator during hypnosis and (2) to answer a series of prearranged questions asked by the translator in Mina before, during and after hypnosis. During hypnosis, the beginning of the free conversation always took place with the therapist in French. CK, age-regressed, was asked to describe a scene of his life in Togo that he could remember from that age period. CK would recall these scenes in French and say what he thought the people in the scenes were saying. Then, while continuing to describe these scenes, CK was asked to talk with the translator in Mina about them.

For Session 1, twenty prearranged questions (appropriate for a 5-year-old) were read out by the translator in Mina three times: once before, once during and

4. Priming is an increase in the ability to identify or produce an item (e.g., a word, a number, etc.) as a result of previous exposure to that item. There are two main types of priming, one type occurs when the participant is not conscious of the effect (subliminal exposure) and the other occurs with the participant conscious of the previous exposure (Posner 1978).

5. Kihlstrom’s original study (1980) showed that a posthypnotic suggestion given to participants – to forget everything that took place under hypnosis – resulted in priming in a test for implicit memory and no priming in a test for explicit memory. In the declarative (explicit and conscious) memory system is knowledge of facts (semantic knowledge) and events (episodic knowledge). In the procedural (implicit and non-conscious) memory system is knowledge which is expressed through performance in habits and skills, and simple forms of conditioning. Bike riding and native language are considered to be examples of implicit memory (Squire 1987 & Tulving 1972).

6. A posthypnotic suggestion is an idea given to the hypnotized person which is to be carried out after the person is no longer under hypnosis. Sometimes the therapist gives a cue for carrying out the suggestion after hypnosis and another cue for ending the suggestion.

once after hypnosis (Can you point to your arms? What games do you like to play? Do you have a brother? What kind of food do you like?).

Example out of hypnosis in Session 1:

- (1) Translator in Mina: “Do you have a brother?”

CK: “Je comprends ‘frère’ mais je ne comprends pas le sens de la phrase. Si je dois répondre par ‘oui’ ou ‘non’, j’imagine que je dirais ‘oui’ à une question concernant mon frère.” (‘I understand ‘brother’ but not the meaning of the sentence, if I had to answer ‘yes’ or ‘no’, I guess I would say ‘yes’ to a question concerning my brother.’)

Example under hypnosis in Session 1 with CK age-regressed to 4 years old:

- (2) Translator in Mina: “Do you have a brother?”

CK: “Oui” (‘Yes’)

CK could understand several isolated words but not complete sentences. Several of the words in Mina that CK knew were deliberately used in the questionnaire to help him to begin to speak Mina, but it became evident that CK could sometimes guess the global meaning of the sentence from knowing 1 or 2 words. In addition, the fact that it was possible to answer ‘yes’ or ‘no’ to several of the questions made the results unclear as Example (2) above shows.

CK’s answers were divided into three categories: Category 1 refers to responses which indicate that he did not understand the question, or which consist of *oui* (‘yes’) or *non* (‘no’). Category 2 contains those responses which indicate that a few words of the question, or the question’s global meaning were understood. Category 3 responses show that CK understood the question completely. Table 1 shows that there is no difference before, during and after hypnosis with respect to the distributions of responses between the three conditions in the first session (numbers are given in percentage of total number of responses).

In Session 2, for the first 28 minutes after the beginning of hypnosis, the therapist and translator were trying to coax CK, age-regressed to four years old, into answering questions in Mina concerning the scene he was describing about his life in Togo. CK produced a word here and there in Mina during this time. Then, for the first time, CK said a few complete simple sentences in Mina and without any accent or errors in grammar.

Table 1. Percentage of CK’s responses for each category in Session 1

	Category 1	Category 2	Category 3	Total %
Before hypnosis (n = 20)	30	60	10	100
During hypnosis (n = 20)	25	65	10	100
After hypnosis (n = 20)	25	65	10	100

Table 2. Percentage of responses for each category in Sessions 2, 3, 4 and 5 during hypnosis⁷

	Category 1	Category 2	Category 3		Total %
			CK answers in French	CK answers in Mina	
Session 2 (n=64)	57.8	6.2	4.7	31.2	99.9
Session 3 (n=81)	80.2	0	3.7	8.6	92.6*
Session 4 (n=58)	8.6	0	77.6	13.8	99.9
Session 5 (n=79)	27.8	0	0	72.1	99.9

*In this session, 7.4% of CK's responses were sounds that were incomprehensible and when he was asked to be more precise, he would just make another sound. Thus these responses could not fit into any category and were not counted in the results.

An example during hypnosis of an interaction totally in Mina in Session 2:

- (3) Translator: "What is your grandmother doing?"
 CK: "She is preparing a sauce."
 Translator: "What dish is she preparing?"
 CK: "Smoked chicken and gombo"
 Translator: "What else is she putting into the sauce?"
 CK: "She's putting in some salt."

Table 2 shows that in Session 3 during hypnosis, CK understood less than in Session 2. Example (4) below appears to indicate that CK was blocking or refusing to answer the translator in Mina, because it became clear that he was capable of answering. This interaction occurred when CK was describing a scene (under hypnosis and age-regressed) that he said he had seen happening in Togo. There were three interactions of this type in Session 3.

- (4) Translator in Mina: "Can you tell me what is happening in the street in Mina?"
 CK in French: "Non." ('No')
 Translator: "Qu'est que les adultes dans la rue sont en train de dire en mina?" ('What are the adults in the street saying in Mina?')
 CK in French: "Rien" ('Nothing')
 Therapist (in a tone of voice which is gently pushing CK to respond): "Qu'est que les adultes disent en mina?" ('What are the adults saying in Mina?')
 CK in Mina: "Don't play ball in the street."

7. Before and after hypnosis CK was unable to understand any complete sentence or to produce a complete sentence in Mina in all sessions.

In Session 4 two new elements were introduced. This was done because there had been a decrease in CK's responses in Session 3 compared to Session 2. First, NP put CK into a deeper hypnosis, and second, she suggested to CK, when under hypnosis and age-regressed, that *he* was not speaking Mina himself, but rather just mouthing what the other people in the scene he was describing were saying.

An example of this with CK under hypnosis in Session 4:

- (5) Therapist: "Qu'est-ce qu'elles disent, simplement répète ce qu'elles sont en train de dire." ('What are the girls saying, just repeat what they say.')
- CK: "Il a pris l'argent avec lui." ('He took the money with him.')
- Therapist: "Mais maintenant je veux l'entendre des bouches des filles, ce n'est pas vous qui me le racontez, laissez votre bouche dire leurs mots." ('But now I want to hear it from the girls, you are not telling me, let your mouth say their words.')
- CK: "J'essaye, mais je n'y arrive pas." ('I am trying to, but I can't seem to.')
- Therapist: "Ce n'est pas *vous* qui dites quelque chose, ce sont les filles qui sont en train de parler ensemble." ('You are not saying anything, it is the girls who are talking to each other.')
- CK in Mina: "He took the money with him."

The results in Table 2 show that in Session 4 CK answered *the therapist* in French when asked questions in Mina by the translator, instead of answering the translator in Mina. However, CK did produce 12 complete sentences in Mina, all grammatically correct.

In Session 5, since it was now clear that CK could understand and speak some Mina, two new elements were added. A forced-choice questionnaire was given during and then again after hypnosis. The second element was that the therapist told CK after he was under hypnosis and age-regressed that he *was able* speak Mina. After 6 minutes into the hypnotic state and after the therapist had told CK that he could speak Mina; he then conversed with the translator in Mina for 38 minutes. Then, suddenly, CK stopped, said in Mina that he was tired and his grandmother was putting him to bed.

The difference should be noted between Sessions 4 and 5: in Session 4, CK answered the therapist (77% of the total number of possible responses) in French when she asked him to answer the translator's questions which were said in Mina, but in Session 5, he answered the translator (72% of the total number of possible responses) directly in Mina.

The results of the forced-choice questionnaire (40 items appropriate for a 4-year-old) with three possible answers were not significantly different during and after hypnosis. It was concluded that it was too easy to guess at the correct answer (global meaning) from knowledge of one word in the sentence. The problem in

creating forced-choice questions for a 4-year-old is that negativity (other than just the word 'No') and active/passive voice have not yet been mastered in L1 acquisition by this age. Thus all the questions had to be stated in the affirmative with active voice. These simple questions allowed for too much guessing. It was impossible to ask questions such as 'Don't you go to school on Sunday?' 'Was the lion eaten by the mouse?' It is also possible that there was in fact a priming effect.

At the end of Session 5, CK, out of hypnosis, heard the recording of the 12 complete sentences that he had produced in Mina during Session 4. CK was unaware until this time that he was able to understand and speak Mina. CK's comments while listening to himself on tape speaking Mina with the translator were recorded. His comments made it clear that he was astounded to hear himself speaking in Mina in full sentences. He was asked to translate these 12 sentences into French. However, he was only able to understand isolated words but not the meaning of any sentence, as illustrated by examples (6) and (7) below. This result was identical to that of the participant in the Fromm (1970) study who heard himself on tape speaking Japanese that he had produced under hypnosis (Section 2.2).

Examples from when the tape was played back to CK in Session 5:

- (6) CK in Mina on the tape: "He took the money with him."
 CK's comment in French after hearing his sentence: "Je ne peux pas traduire la phrase, je ne comprends que le mot 'argent' mais je ne comprends pas le sens de la phrase." ('I can't translate the sentence, I only understand the word 'money' but not the meaning of the sentence.')
- (7) CK in Mina on the tape: "That man was terribly afraid."
 CK's comment in French after hearing his sentence: "Je comprends 'peur' mais je ne comprends pas le sens de la phrase." ('I understand 'afraid', but not the meaning of the sentence.')

The results from Session 5 (see Table 2) indicated that CK could understand and speak more Mina under hypnosis than he was capable of out of hypnosis. In Session 6, CK was tested to see what amount of Mina he could now produce without hypnosis. The translator had a typescript of Session 5 and asked CK appropriate questions in Mina to try to reproduce the conversation that had taken place in Session 5. This was done twice in order to separate listening comprehension from oral production abilities: the first time, CK was asked to answer only in Mina, and the second time, he was asked to translate what AW said into French. Lastly, the same forced choice questionnaire given in Session 5 was repeated.

In Session 5 during hypnosis, the translator asked CK questions in Mina concerning a scene he had described in French and he was asked to respond only in Mina. In Session 6 out of hypnosis, the same questions were repeated twice, the

Table 3. Percentage of responses per category in Session 5 compared to Session 6

	Category 1	Category 2	Category 3	Total %
Session 5 (n = 79)				
During Hypnosis	27.8	0	72.1	99.9
CK answers in Mina				
Session 6 (n = 79)				
Out of Hypnosis	55.7	11.4	32.9	100
CK answers in Mina				
Session 6 (n = 79)				
Out of Hypnosis	21.5	35.4	43.0	99.9
CK answers in French				

first time CK was asked to respond only in Mina, the second CK was asked to translate the questions into French (see Table 3).

Table 3 indicates that CK was more capable of answering in Mina during hypnosis in Session 5 than out of hypnosis in Session 6, but that by Session 6, CK had recovered some ability to understand and to produce Mina out of hypnosis.

In Session 6 out of hypnosis, CK seems not to be able to understand many questions (55% of the questions asked) when he was asked to respond only in Mina. However, that number decreased to 21% when he was asked to translate the questions into French. Thus, it was considered, given that CK could respond to 32% of the questions in Mina out of hypnosis and could understand more Mina than he could produce, that the difference in his ability to understand Mina under hypnosis and out of hypnosis was no longer great enough to be able to obtain data for a neuroimaging study.

This decision was based on three observations. Firstly, although there was a difference between CK's answers in Mina under hypnosis in Session 5 and his answers in Mina out of hypnosis in Session 6, it was clear from his ability to translate the questions into French that he had *understood* much more than he could *say* in Mina out of hypnosis. Secondly, during Session 6 out of hypnosis, CK was able to answer the forced choice questions as well as he did when he was under hypnosis in Session 5, showing that he had increased comprehension in Mina. Thirdly, given that Session 5 could have had priming effects on Session 6, a last test was given before finishing Session 6. The translator was asked to talk with CK in Mina about CK's life today (a totally different style of speech and vocabulary than the scenes in Togo). Although there was a lack of vocabulary, CK was nonetheless able to converse on this subject for six minutes in Mina.

The only factor that might have influenced CK's recovery of Mina out of hypnosis was that at the end of Session 5 CK heard the tape of himself speaking Mina during Session 4. Even though he could not understand himself, he was clearly

visibly surprised and pleased to hear himself speaking Mina. Perhaps knowing that he *could* understand and speak Mina decreased his conflict which *allowed* him access to the HL when he was not under hypnosis.

2.2 Conclusions of the pilot study

There were three conclusions from this experiment.

1. This case study confirmed the two previous ones in that a 'lost' language can be recovered under hypnosis, which shows that there is attrition resulting in an HL.
2. In spite of precautions taken with a posthypnotic suggestion to forget everything that happened under hypnosis, an unexpected recovery of Mina out of hypnosis did take place.
3. Due to CK's recovery of the comprehension of Mina out of hypnosis, it was considered likely that no significant differences with CK listening to Mina before, during and after hypnosis would be perceivable in neuroimaging data.

The results of this study indicate that it is possible for memory traces of a lost language to remain in the brain although that language can be inaccessible to the speaker. Perhaps for the neural connections to still remain in the brain, a necessary condition is that there is some passive exposure to the HL during the time when that language is not spoken, which was the case for our participant.

3. Preliminary directions for HL research

If the neural traces for the language no longer functionally existed, which presumably happens when a language is completely forgotten, then the results of the three studies (our pilot study; As 1962; Fromm 1970) on HL recovery would not have been possible. Because this type of recovery is global, as opposed to partial, and the recovered language is grammatically correct, it might be preferable for HL research not to attempt to *describe* the attrited language as is done for an FL, but rather to *explain* the mechanisms that might produce an HL. What type of process might cause the loss of the language resulting in an HL and what mechanism could allow this global type of recovery? How can an HL be distinguished from an FL?

A preliminary hypothesis to answer these questions will be proposed based on the assumption that some sort of conflict has caused the HL to become in-

accessible. This 'conflict' hypothesis shall be put forth linking ideas concerning conflict, brain activity and hypnosis.

3.1 Explaining an HL

All three studies on HL attrition could be interpreted in the following way: the participants had had an involuntary conflictual situation associated with speaking the HL when they were young after they had acquired the language. This conflict might have resulted in the language becoming inaccessible. In the As (1962) study, speaking Swedish linked the participant to his mother but would have excluded his stepfather, thus his mother made the request for them not to speak Swedish. For the Fromm (1970) study, speaking Japanese in the family would have been natural for a Japanese but would have reminded the participant and his parents of the painful time during the war in the relocation camp, and thus it was not spoken. In our pilot study, after the participant returned to Paris, he was told by his mother not to speak Mina, since that could cause him not to do well in school.

If an individual has blocked a language and it has thus become inaccessible, then during hypnosis there could be increased or decreased conflict with respect to that language depending on the hypnotic suggestions being given. For example, in Session 4, when the therapist repeatedly asks CK to try to answer in Mina during the hypnosis, this seems to create 'conscious' conflict. CK answers (5) "I am trying to [speak in Mina], but I can't seem to." However, in Session 5 when NP tells CK during hypnosis that he *is able* to understand and to speak Mina, this seems to have 'allowed' him to do so without the conflict, as he then conversed non-stop in Mina for 38 minutes.

Assuming there was conflict involved in the use of the HL when CK returned from Togo, then the suggestion here is that when the conflict arose there was 'active' forgetting. Neuroimaging studies have shown that a conflict can cause information to become inaccessible in a manner that is not 'normal' forgetting. Experiments were done on the neural underpinnings which control unwanted memories using a retrieval practice paradigm (Anderson & Green 2001; Levy & Anderson 2002). In this paradigm, a habitual response (one that has been previously learned and practiced) has to be overridden (or inhibited) to a target word, the stimulus. To override a response means to actively stop the memory retrieval process for that response. These authors showed that by actively blocking a memory, which is called 'active' forgetting, it became more difficult at a later time to recover it.

In another experiment (Anderson, Ochsner, Kuhl, Cooper, Robertson, Gabrieli, Glover & Gabrieli 2004), participants formed an association between a

target word and a response word before fMRI scanning. During scanning their task was to actively prevent the associated response from coming into memory when the target word was presented. During the suppression of the memory, the dorsolateral and ventrolateral prefrontal cortex, anterior cingulate cortex (ACC) and motor areas increased activation. However, the suppression reduced activation in the hippocampus which is known to be important for successful memory formation relative to recollection (Squire 1987; Squire & Zola 1993). This would indicate that the memory will be more difficult to retrieve later.

Anderson et al. (2004) compared this activation against simple (normal) forgetting and found the patterns of activation to be different. It is well documented that the ACC plays a role in conflict monitoring and attention (Botvinick, Braver, Barch, Carter & Cohen 2001; Botvinick, Cohen & Carter 2004; Botvinick, Nystrom, Fissell, Carter & Cohen 1999; Bush, Luu & Posner 2000; Posner & DiGirolama 1998; Posner, Petersen, Fox & Raichle 1988), thus the authors postulate that the ACC activation signals a conflict, which was that the associated response is summoned by the target word and needs to have an override response, in order for the associated response to be inhibited. The prefrontal cortex is activated by the signals of the ACC and is known to be involved in stopping prepotent motor responses, that is, inhibiting a motor response (for example, linked to speech) that is about to happen. Thus, the associated response (the response word which has been associated with the stimulus word) is consciously being blocked and this leads to active forgetting which makes the associated response much more difficult to retrieve.

If there is conflict and active forgetting of the HL, then how could conflict be reduced so as to eliminate the override response which makes the HL inaccessible? There is some research on conflict and ACC activation, as well as on the reduction of conflict hypnosis. The Stroop task is classically used to study conflict (Stroop 1935). The participants, who have to be experienced readers, are asked to name the ink colour of a word, the meaning of which is a colour, e.g., the word *green* displayed in red ink. Reading the word and incorporating its meaning is automatic and leads to the behavioural Stroop Interference Effect (SIE), that is, an involuntary conflict when the meaning of the word and the colour of the ink of the word are incongruent. When the ink colour and the meaning of the word are congruent, the participant responds faster and with fewer errors.

Several neuroimaging studies have shown that ACC activation covaries with the levels of response (reaction time and errors) due to conflict, such as that found in the Stroop task (Botvinick et al. 1999, 2001, 2004; Carter, MacDonald, Botvinick, Ross, Stenger & Noll 2000; Casey, Thomas, Welsh, Badgaiyan, Eccard, Jennings & Crone 2000; MacDonald, Cohen, Stenger & Carter 2000; Ullsperger & von Cramon 2001). The levels of the behavioural interference effects, indicating conflict

for the participants, have been shown to increase or decrease in correlation with the increase or decrease of ACC activity (Botvinick et al. 1999; Carter et al. 2000; Casey et al. 2000; Kerns, Cohen, MacDonald, Cho, Strenger & Carter 2004).

Hypnosis is often not considered to be a real phenomenon. However, its use has been established for example with respect to the control of pain and the decrease of conflict. It has been well documented that hypnosis can decrease both the sensation of pain itself and the unpleasantness of the noxious stimuli (the subjective experience of physical pain), both of which are correlated with a decrease in ACC activity (e.g. Crawford, Gur, Skolnick & Benson 1993; Faymonville, Laureys, Degueldre, DeFliore, Luxen, Franck, Lamy & Maquet 2000; Raji, Numminen, Navanen, Hiltunen & Hari 2005; Rainville, Duncan, Price, Carrier & Bushnell 1997). Thus in many hospitals, patients are conscious when they undergo surgery with local anaesthetics combined with light sedation and hypnosis, instead of general anaesthetics.⁸

Recent neuroimaging research has shown that in highly hypnotizable participants a specific posthypnotic suggestion, to perceive written words as nonsense strings during the Stroop colour task, was able to reduce the involuntary conflict (Raz, Shapiro, Fan & Posner 2002) and that with the same posthypnotic suggestion the decrease in the involuntary conflict was associated with decreased ACC activation, as well as decreased activity in visual areas as compared to controls (Raz, Fan & Posner 2005). Since hypnosis can reduce conflict, with the reduction corresponding with ACC activity, it is possible that in the three case studies, hypnosis reduced the conflict associated with the HL which allowed its recovery.

To recapitulate: if the idea of a conflict provoking an HL is assumed, then an explanation of the mechanism provoking an HL and its recovery is possible by linking the above ideas on conflict, hypnosis and brain activity to an HL. First, it is hypothesized that the conflict causes the HL to be continuously associated with 'active' forgetting and this results in inaccessibility of the HL. Second, since reduced conflict (and reduced pain) has been shown to be correlated with reduced ACC activation, and hypnosis has been shown to reduce conflict (and reduce pain) which is correlated with reduced ACC activation, it is hypothesized that through hypnosis the conflict linked to the HL is reduced allowing the speaker to access the HL. This proposition could be tested by means of neuroimaging studies which could link HL recovery, conflict and ACC activation.

8. For example, in France, Belgium, Germany, Finland and the USA (Büchel, Bornhövd, Quante, Glauche, Bromm & Weiller 2002; Crawford et al. 1993; Faymonville et al. 2000; Petrovic, Petersson, Ghatan, Stone-Elander & Ingvar 2000; Ploghaus, Bécerra, Borras & Borsook 2003).

3.2 Possible studies

Such neuroimaging studies could be set up to monitor brain activity while the participants are being scanned as they hear the HL before, during and after hypnosis. The prediction is that this type of study would show an increase in ACC activity before and after hypnosis and a decrease in ACC during hypnosis which would be correlated with the recovery of the HL. Presumably, there would also be a difference in activity in the language area correlated with the recovery of the HL; whereas there would be no activity in that area before and after hypnosis when the HL was inaccessible to the speaker.

These types of studies would also allow the differentiation between an FL and an HL. If the lost language is an FL, then during hypnosis there will be no global recovery of the language and no decrease in the ACC activity. A partially attrited FL will be correlated with activity in the language area unless the FL has been completely forgotten in which case there will be no activity in the language area. Thus, what appears to be a completely attrited FL from linguistic as well as neuroimaging data could be an HL. This could only be revealed by inducing hypnosis while scanning the person who has lost the language. Would the Korean adoptees show no brain activity specific to hearing Korean as opposed to other unknown languages before hypnosis and then show a specific activity in the language area during hypnosis if Korean were to be recovered? If during hypnosis there were to be no recovery, it might show that passive exposure to a lost language is a necessary condition for it to have long-lasting neural traces, although it remains inaccessible to the speaker.

It is proposed that losing an FL is a slow process with parts of the language disappearing individually in a systematic way over a long time due to a normal forgetting process, while the loss of an HL is a rapid process in which the entire language, except for a few isolated words, disappears over a short time, due to psychological events involving conflict concerning the use of the HL. This conflict causes the speaker to block access to the language through active forgetting. The HL is inaccessible to the speaker, but the language still exists in the brain. If it is recovered, there is no grammatical loss of that language, it is fluent and spoken without any accent. An FL is either partly inaccessible due to a gradual grammatical and lexical loss or it is totally forgotten with no neural trace of the language in the brain. Here the attempt has been to show (1) how language memory traces could be blocked from consciousness and (2) how this 'lost' language could be retrieved back into consciousness. Clearly the 'conflict' hypothesis is based on only three studies and needs to be verified.

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