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Confirming Recognition

P300 as a reliable index for witness identification through the Guilty Face Test (GFT)

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Abstract

This paper provides an answer to the requests that has been made for witness confrontations to become an accurate and reliable tool in the court. This was achieved by the development and testing of the Guilty Face Test (GFT). Facial stimuli was used in a Target Present lineup were the enhanced elicitation of the Even-Related Potential component P300 confirmed recognition of the culprit. The participants were thereafter asked to respond to a task of color recognition and the paradigm does thus include both a Memory oddball (the culprit) and an Attention oddball (the target color). The results provided significant effects of both Memory and Attention and thereby confirms the hypotheses of an enhanced P300 when the culprit is present. Importantly was this effect of recognition independent from the attention that was directed to the task and with that could did this study confirm the P300 as a reliable index for witness identifications through the GFT. The study also found fascinating tendencies of a possible differentiation on the spatial distribution -dependent of Memory and Attention.

Keywords: Witness Confrontations, Lineup, Culprit, ERP, P300, CTP, GKT, Target, Probe etc.

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Introduction

Imagine a close friend of you being the witness of a crime, the mere agony and pain of the images being etched in his/her memory. Then move on to visualize how the same persons struggle to generate the correct pieces of information is rejected as insufficient and untrustworthy by the judge. Imagine the impotency of watching the culprit go free.

Individuals ability to correctly identify (or reject) a culprit in a witness identification is a subject under crossfire. There is indeed a lot of confounds that colors the underlying processes for the selection at hand .To mention two instances, one has shown how vulnerability to effects of Suggestibility and Social Desirability impacts the witness to make a false identification even when the culprit in fact is absent (Shapiro & Penrod,1982; Bainerd & Reyna, 1994). Faulty identifications like this have deeply impaired the trustworthiness of witnesses abilities (Christiansson, 1994). Bare further in mind the dependent state witnesses find themselves in when they posses both roles of being the witness and the victim of a perpetrator whom they know e.g. a member of the family. Or find themselves threaten to silence. Circumstances like this leaves the door wide open to false rejections of the lineup, even though the culprit is actually present (Jensen et al, 2005, Berliner & Conte, 1990). These facts together with the hardship of judging a correct identification from an incorrect one, based on behavioral measures such as confidence (Christiansson, 1994) and the CBCA (Pezdek et al, 2005), leaves a hole in the confrontational process.

Still, after years of discrediting is eyewitness testimony considered heavy material in the courtroom. Among others, research performed by Wells et al (1993) suggests that misidentification rates in laboratory controlled experiments vary up to as high as 90% and Rosen (1992) highlights that 1-10 out of every 1000 people are wrongfully convicted from serious crimes due to misidentification. This has lead to a more cautious handling of witnesses and their ability to recode the material correctly. Though is eyewitness testimony´s yet considered crucial because it is one of the only types of evidence that provides a direct link that the subject commit the crime (Wells & Loftus, 2002). It is in fact the most commonly used evidence in the juridical system (Wells, 1984) and therefore may disregarding it as a bit of useful information lead to impairments in the judging procedure. A light comes from Pipe et als (2004) claims of how individuals indeed are capable of handing the correct information about experiences –the misidentifications is according to them a result of difficulties in the mediation process. Meaning, your friend´s witness identification (see the ingress) may thus

not be a result of insufficient memory material per see and should perhaps therefore not be disregarded as untrustworthy.

There is too a growing attitude towards witness identification today. Consisting of a drive for (instead of dismissing eyewitness testimony as evidence) attempts should to be made towards it becoming a reliable and accurate tool in the courtroom (Lefebvre, 2007).

The Event-Related Potential Technique as a Method of Investigating Recognition Memory

This studies usage of the ERP component P300 to stand as a reliable index to the eyewitnesses recognition of the culprit, during a lineup –provides such an attempt.

To date, there has been only one study where the P300 has been implemented in a lineup identification paradigm (Lefebvre, 2007) (which I will return to later). But there has been extensive research investigating the use of P300 as confirmation of recognition in other forensic contexts. Specifically, research from the deception detection literature has shown how a P300 is elicited to the presentation of crime relevant stimuli (Probes), when the stimuli is embedded within a series of crime irrelevant ones (Irrelevants) that is frequently occurring. Thus resting on the assumption that items that are familiar will yield a different response (P300) than the unfamiliar or meaningless stimuli when presented in an oddball paradigm (Allen et al, 2008) (Being the direct opposite of the N400 component that is elicited when contextual incongruence is present, concerning both faces and other stimuli (Boaz et al 1991; Kutas & Van Petten, 1988;Mnatsakanian, 2004) .

Detection of deception, i.e. to be able to identify a response of recognition even if the subject is behaviorally denying it, is possible since the P300 has proven to be detectable even in the absence of an overt response from the participant -as long as it is attended to (Mertens & Polich, 1997; von Hooff, Brunia & Allen, 1996). The results have generally demonstrated a high accuracy (80-95% in some cases but lower in others e.g. Lefebvre, 2006; 46-85%, Rosenfeld, 2002) in correctly identifying individuals as guilty or innocent based on P300 responses.

Improving the Guilty Knowledge Test

The paradigm that has enabled these results is the Guilty Knowledge Test (GKT), first developed by Lykken in 1959 and later reformed by Farwell & Donchin (1991. The GKT´s foundation pillars are made of the distinction between Targets and Probes. Where Probes, as previously discussed, refer to the knowledge only the guilty subject has about the situation,

such as the exact modus operandi or weapon used. The Targets however constitutes of task relevant items that the subject is instructed to search for, e.g. if the stimuli had a specific number on it (thereby providing control for false negative responses). Thus, the innocent subject is presented with a two-category oddball series in which the Targets elicits a P300 whereas the irrelevant stimuli does not. For the guilty, who possess the extra knowledge, will the crime relevant Probes stand out as a third, rare, category.

Nevertheless did Mertens & Allen (2008; Rosenfeld, 2004)) found that concealed info paradigms, such as the GKT, that rely on P300 analysis are sensitive to countermeasures (attempts from subjects to prevent the detection of certain information). This is achieved by making concealed responses to non meaningful items by e.g. toe wiggling and as a result does Irrelevant items become task relevant and therefore too elicit a P300 response. Rosenfeld et al (2008) suggests that the origin of the GKT´s sensitiveness towards countermeasures is due to Farwell & Donchin´s (1991) twist in the experimental design of the original GKT (the twist being composed of the addition for detection of false negative responses). The twist constituted of a mission for the participant´s to search for relevant stimuli in the sequences according to an already given template (the Targets). Farwell & Donchin (1991) reasoned that the Guilty Knowledge stimuli (the Probes) would be strong enough to elicit a P300 response even if the cognitive resource was directed elsewhere. But Rosenfeld et al (2008) disagree, according to them is the twist for avoiding false negative responses (the participants constant decision making of whether each stimuli is a Target or not, simultaneously as an implicit evaluation of the Probe is present)) creating a forced dichotomy of the attention processes which is reducing the strength of the Probe P300. It results in an increased risk of counter measures going by unnoticed (Rosenfeld et al, 2008).

Rosenfeld et al (2008) converted the three-category paradigm into the Complex Trial Protocol (CTP) to be able to provide a paradigm resistant to counted measures while at the same time providing a sensitive P300-based method for detection of concealed information (90% correctness). This was achieved through letting the Target decision be separated from the guilty knowledge decision by having the Probe arrive first. The CTP also puts a salvation in gaining a controlled, reference curve of the P300 response for each individual and thereby enhancing the predictability of the design both for future single trial´s and by controlling for confounds caused by individuals with small or non elicited P300 responses. Due to these merits the CTP constitutes the base paradigm that my design has evolved through to be

refined into matching my purpose–the GFT. The main difference on my design is the shift of just purpose where mine was to create a paradigm that is suitable for witness confrontations and therefore facial stimuli was used. The usage of facial stimuli is much more potent and gains a higher ecological validity than the stimuli of previous studies -that has mainly been focusing on objects. Objects are not as relevant nor as advanced as facial stimuli to encode (discussed under *Face processing*). This engagement in facial stimuli has lead my improvements of the CTP (where a longer period for encoding of the stimuli, among other things, were necessary) into the paradigm of the GFT.

Using the P300 Component to Investigate Recognition of Facial Stimuli

The applicability of the P300 component in the deception detection field has in rare cases been tested with face stimuli. Meijer et al (2007) found, using the Concealed Information Test paradigm, it to be competent of recognizing concealed face recognition. But implementing the results into the field of eyewitness testimony (that is in great need for a tool of this kind) has only been tried once previously, by Lefebvre et al (2007). They could confirm that the P300 provided a reliable index of recognition of the culprit. Thus a confirmation of the applicability of facial stimuli. The results, was consistent during all time conditions of the test (no delay, 1 hour delay and one week delay). Though, accuracy decreased a little for the 1 week condition, compared to the others, it still remained strong for those individuals who made correct identifications. This information is crucial because of its ecological validity since time delay between coding and recognition is most likely to be the case in naturalistic scenarios. But an ERP differentiation of the culprit from the fillers was thus not affected by the time interval. Interestingly is this something that contradicts the general belief in the field of eyewitness testimony, namely that identification accuracy decreases as the time between witnessing the crime and the completion of a lineup task increases (Memon, 2001; Penrod et al, 1982) and thereby enhances the strength of the P300´s ability as an index of recognition. Further good news comes from the findings that the P300 in Target absent lineups was attenuated or not elicited at all (in such a way that it could be separated from the Target detection P300, further supported by Mertens & Allen, 2008). This could serve as a good index for Suggestibility and Social Desirability effects which makes witnesses prone to identify a filler as the real Target -though the Target actually is not present.

Face processing

What makes the usage of facial stimuli such an advanced yet potent twist? Face recognition constitutes of a within-category judgment and meeting people and encoding their faces

activates according to the TAC model (interactive activation and competition network) face recognition units (FRU´s). These contain stored information about the faces we are familiar with. (Braisby, 2002)

If there is a reasonable match between the encoded and stored info will the recognition unit be activated and allow access to the semantic information about the person´s identity (Bunton, 1990 reviewed in Braisby, 2005). This can be compared to how the elicitation of the component N400 is present when there is a discrepancy between the encoded info and the one presented as recognition material (no matter if faces or names is used as stimuli) and as such suggests that the N400 effect reflects the facilitation in accessing post perceptual or semantic codes for people (i. e. Person Identity Nodes). (Bobes et al, 2003).

Pozzulo & Balfour (2006) reason that the suggestion of individuals choosing behavior is a result of yielding to a feeling of external expectations to make an identification. But when there has been a transformation in the culprit´s appearance (and this does not match with the appearance that was encoded during the crime) is not even a lax criterion setting met (collate with reasonable match between stored and encoded info in the FRU´s). This result´s therefore in no activation of the recognition unit that leads to yielding of semantic information. But, according to the TAC model takes recognition of a facial stimuli place before the semantic classification and the recognition can therefore be present even without such (being backed up by Schweinberger & Burton et al (1996) who proclaim the perception of overt and covert recognition to be originated by two different structural systems). This is directly linked to the fact that face recognition and awareness of face recognition might be independent of one another. It has been found that individuals with prosopagnosia (who are not able to overtly or consciously recognize faces) have certain types of unconscious responses present, e.g. increased Skin Conductance responses to a picture of a familiar face (Moskowitz, 2005 ; Bauer, 1984 reviewed in Allen et al, 2008). Ergo, an unconscious recognition of faces. This covert recognition can even be detected using P300, where the amplitudes of single trial P300´s and the Skin Conductance Response are positively correlated with degree of familiarity of the person serving as stimuli (Bobes et al, 2004; Renault et al, 1989).

This gains support for Pipe et al´s (2004) declaration of how individual´s are capable of providing accurate information, yet the problematic lies in their limited capability to convey it –the semantic classification. It further correlates to Allen et al´s (2008) guidelines for one out of two instances when the addition of psycho physiological evaluation is good -which is when

individuals are unable to report information about the things they may still have memory about.

With this backup I consider ERP, and P300 through the Guilty Face Test, to be a prospective attempt in providing a tool to implement the overall attitude, according to Lefebvre (2007), towards making witness identification a reliable and accurate method in the court.

Aim of the Present Study

In the field of eyewitness testimony today is requests present for ways to enhance the competence and credibility of witness identifications.

The purpose of the present study is to provide the first step towards meeting these requests. This is achieved by the development and testing of the Guilty Face Test, where focus lies in the creation of a test that is sensitive enough to examine the P300 as a reliable index for detection of the orienting response elicited by the culprits face. It has also been of importance when developing the test that it can sustain ecological validity for resistance of countermeasures.

Hypotheses

The secondary hypothesis brings the results to expect an orienting response, which will show through an elicited, and increased, amplitude of the P300 when the culprit appears. This will stand as confirmation of recognition. I further hypothesize that there is a memory related oddball effect present (Probe) even at occasions when an attention related oddball is absent (NonTarget). Thereby providing a P300 response dependent of recognition -independent from attention.

As such the primary hypothesize is the ERP component P300 to pertain as a reliable index in witness identifications. Here facing confirmation of the recognition elicited by the culprit.

Method

Participants

The participants in the study consisted of 18 people, aged 21-26 (M= 23) years old (7 male). All subjects were undergraduate or graduate students who did not receive any payment or extra course credit for their participation. All was fluent in Swedish with normal hearing,

normal or corrected-to-normal vision. They were all right handed and gave their informed consent.

Instrument

Collage:

40 collages consisting of 6-7 photographs were evolved to be used as the encoding stimuli. One of the photos was always a natural picture (transformed in the FaceGen Software into 3D stimuli) of either a woman or a man in their early twenties (20-25 years old), later to be acknowledged as the culprit. The remaining 5-6 photographs e.g. pictures of a masked man or an assaulted women, was all pieces contributing to a story told by the pictures in each collage. The culprits (also mentioned as the Probe) face was shown at a frontal view at 20 000 ms simultaneously with the rest of the collage in standard indoor lighting .Which according to Pozzulo & Balfour(2006) render possible a good look on his/hers facial attributes (Shapiro & Penrod, 1981 found a linear relation between time of exposure for the culprits face, exposure of light and amount of later correct identifications, reviewed in Memon, 2003). From the original 40 collages were 30 voted as the most emotional arousing by six voters (separated from the subjects in the study) on a scale from 1-10 (see Appendix 1) and hence used in the study. The collages were rotated across conditions to prevent any inadvertent confounding of some stimulus parameter with the experimental manipulation.

Photos:

Color photograph´s in 6x4 cm were shot of individual´s faces. Resemblance in distribution of features, hairstyle, ethnicity and skin tone are attribute´s crucial for a homogeny, nonbiased lineup (Wells et al, 2006) and were as such applied when creating the lineups. With aid from picture transformation, FaceGen were used (a software for creating 3D animated faces from real life photos) to transform the photos in to the 3D-stimuli used in the study.

From the photos were 150 chosen to constitute the 30 different lineups (15 all female and 15 all men). Further were mock witnesses used along with Luus & Wells (1991) recommendations for the constitution of a lineup. In brief, without seeing the crime, five participants (separate from the ones included in te main study) where provided with written descriptions of the culprit and asked to try to identify him/her from the belonging lineup. A lineup is considered biased if the culprit is selected more often and above chance levels – compared to the remaining lineup members. Based on binominal probability distribution I found that none of the lineup members Ire selected as the culprit, above chance levels

(p>0.05). Thus were all the lineups in the current study determined as nonbiased and with that used.

a)Target present lineups: 30 Target present lineups Ire made. Each participant were exposed to 30 lineups all and all. A lineup was constituted out of six photograph´s, i. e. five filler persons and one culprit.

Lineup design

An elimination lineup is ultimately used in a witness confrontational task, due to its positive effects on increased correct identifications and decreased Target absent identifications, i. e. false positives (Pozzulo & Lindsey, 1998). But to gain the most validity out of the ERP technique this procedure was not suitable for the present study. Though having in mind the prospective possibilities of the index and the strength´s of the CTP influenced design, GFT may prove to be strong enough to handle even a possibly less superior (for children) lineup design such as the implicit sequential one used here. This hierarchy is though being debated were Pozzulo et al (2008) place the sequential procedure at an equal footing with the elimination procedure for adults. The sequential lineup design is arranged to inhibit relative judgment´s of the photos, as such decreasing false positive as well as false rejections (Pozzulo & Lindsey, 1988).

The photos were presented alone on the computer screen for 2500 ms, arranged in counterbalanced randomization to avoid person and order related confounds, as was the case for the lineups, among each other.

Design

A 2(Probe vs. Irrelevant) x 2 (Target vs. NonTarget) within-subjects, incomplete, all possible orders, factorial design was used. The dependent variable was recognition of the previously encoded stimuli, showing through an enhanced P300 response.

Procedure

The participants were shown the stimuli´s in the laboratory in the institution of Psychology at the University of Lund. A short introduction to ERP and the project was made before the showing of the collages. The introduction of the ERP included instructions for the participant to remain calm and relaxed and to take steady deep breaths (to improve the quality of the recordings). The participant´s was also given the instructions to watch very carefully at the screen and be concentrated since each collage was short and important. I asked them to focus

on the photograph in the middle of the collage. They were further asked to commit to the task and told that the more engaged they permitted themselves to be in the collages the better the results would be.

After watching each collages were the participants instructed to, verbally, give a short narrative description of what the collage was about. They were instructed to give the leading role in each narrative to the person on the photograph in the center of the screen. If they were through with telling the story before the computer changed episode were they told to look at the photograph of the person in the center of the screen. These instructions were added to pertain a certainty that the participant would indeed gain an encoded memory of, the to be returning, culprit stimuli. The participants were further informed that they would be asked to make a rating of how emotional arousing he/she felt the collage to be (on a scale from 1-5). Thereby forcing attention to the stimulus and at the same time inducing an internal evaluation by the material. As such creating a deeper level of processing and thus providing a reference for the encoding of the material. Afterwards they received information about how to proceed with the following task.

The participants were in each following trial shown a photo of a lineup member, possibly being the culprit. The Probe (the encoded photograph in the collage) was unique for each lineup (8 trials), as was the case for all of the irrelevant stimuli (lineup filler´s). The Probe was followed by a second stimulus which the participants were instructed to decide whether it was a Target or a NonTarget.

Detailed Trial Structure for Lineup´s (See figure 1)

Before the onset of the first trial were instructions, showed on the screen -pushing on the need for correct answers above fast and uncertain ones, also inducing a personal commitment to the task. Each trial began with a 200 ms baseline period under which a pre stimulus electroencephalogram (EEG) was recorded and followed by the presentation of one collage persisting of 6-7 pictures (including a photograph of the culprit) for 20 000 ms. As the recording continued a 250 x 250 cm first stimulus Photograph from the Lineup was presented from 2500 ms on a computer display approximately 0.5 meter in front of the participants. This picture was either a Probe (the culprit previously seen in the lineup) or an Irrelevant stimulus (lineup fillers). The participants were instructed to signal their having seen this first stimulus (either Probe or irrelevant) and did so by pressing the left button immediately afterwards. Thus, no decision that divided attention from the task was made by the participants at this

stage –providing a more sensitive and resistant protocol for countermeasure´s (Rosenfeld et al, 2008). The response simply indicated that the participants had seen the stimulus. The Stimulus 1 was followed by a randomly varying Inter Stimuli Interwall (ISI) on originally 500-1100 ms on a dark screen to create Jitter, but a mishap instead created a Jitter based on the ISI of 50-100 ms. At the end of this darkness was the same Stimulus 1 (either a Probe or an irrelevant stimulus) presented again for 2500 ms with a big dot on the right cheek in one of six colors where the color lime was presented as the Target color. The remaining colors (blue, fuschia, gold, maroon and purple) were defined as Non Targets (see Figure 2a and 2b). The search for and decision of whether the dot was the Target color or not, enforced the participant to encode the entire stimulus material. The dots localization (at the cheek below the eye) also induced an eye focus and kept the interference with the facial features as low as possible. Thereby also avoided a search processing for the Target color only. The participants were instructed to press the left button when projected to a Target color and the right one for a NonTarget color. Both Probes and Irrelevant Stimulus 1 could return with a dot on the left cheek as Stimulus 2 (Targets or NonTargets). The selection of which photograph, in each lineup for each participant, that would make up the Probe was in counterbalanced order. A Jitter of 500- 1100 on the Inter Trial Interval was also included to correct for rhythmic expectations and force attention to Stimulus 1. The above described trial was repeated for all lineup members in all the lineups i. e. a total of 30 trials for each participant.

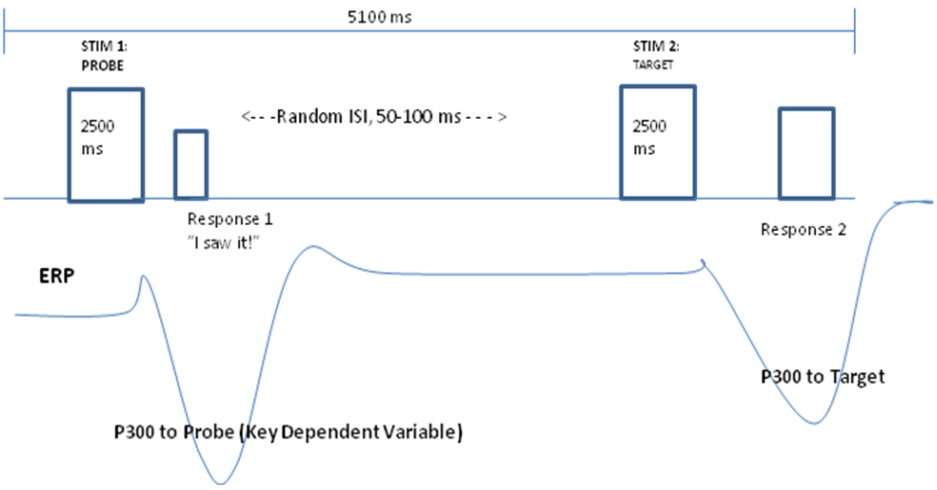

Figure 1. The structure of an example trial of the GFT used in the study is here shown in terms of stimuli, responses and ERP as a function of time (f(time))

Stimulus 1 **Stimulus 2**

2 A

Figure 2 A
A Target Probe trial (the person on the photograph is identical with the one shown in the preceding collage and the color of the dot has the Target color of lime)

2 B

Figure 2 B
A NonTarget Irrelevant trial (the person on the photograph is different from the one shown in the preceding collage and the color of the dot is one of the NonTarget colors, here purple)

Since this paradigm constitutes of a Probe-Target trial (i. e. an early P300 response to the Probe followed by a later one due to the Target) I emphasize that the second P300 response is of interest for two reasons. The first reason is for gaining a within subject index to the P300 and as such validating the response to the first Probe P300. Which of course is the key variable of interest with respect for detection of knowledge and thereby confirmation of the recognition made by the subject for the lineup member - as being the culprit in the given context. The second reason is for providing a protection against countermeasures by adding load on the cognitive resources and by avoiding a forced dichotomy of the attention processes for the recognition of the stimuli and thereby avoiding a reduced strength of the P300 leading to a larger amount of detected countermeasures (Rosenfeld, 2008) The ratio of Probe to

irrelevant (Stimulus one) were 1:4 for each block of trails (30 blocks) as seen in Table 1. Note that the Probe-Target and Probe-non Targets have equal probabilities, whereas irrelevant-Target and irrelevant-NonTargets (more frequent) have not. Which is an ecological necessity when dealing with lineups where there is no equal probability of culprit and fillers, and according to Rosenfeld et al (2008) do not provide a confounding problem.

Table 1. Stimulus probabilities

Stimulus type	*Number*	*Probability*
Target Probe	30 (23.4)	0.125
Nontarget Probe	30 (23.1)	0.125
Target Irrelevant	30 (23.5)	0.125
Nontarget Irrelevant	150 (119.5)	0.625
All Probes	60 (46.5)	0.250
All Irrelevants	180 (143)	0.750

Note: The original probabilities and numbers are given in bold text and the average actual numbers of presented stimuli used for the analyses (stored ERP´s after removal of trials containing artifacts) are in parentheses.

Electrophysiological Recordings

The data acquisition procedure was performed in line with Hansen´s Axiom: There is no substitute for good data" (Luck, 2005, page 100)

The electrodes were affixed to the surface of the scalp. The connectivity of the electrode to the scalp was measured by passing very low currents through the electrodes and measuring the impedance to the flow of the current. EEG was recorded through an electrode cap with Ag/AGCl electrodes attached to the scalp based on the 10-20 system, at a partial set consisting of the sites F3, Fz, F4, C3, Cz, C4, P3, Pz, P4 and O1, Oz, O2. To solve the problem of the ground circuit picking up noise were differential amplifiers used. The references to the scalp electrodes were given by placing an unlinked reference at the mastoid process (the bony protrusion behind the each ear). The left mastoid reference site was chosen due to its qualities of being a convenient and comfortable site and at the same time providing shelter against bias towards one hemisphere (Luck, 2005). Previously mentioned sites were kept unlinked to be able to detect lateralized effects. After registration were a new reference calculated from the mean of left and right mastoid. To be able to separate interference from

the eye region, Electro occulogram (EOG) was recorded from four sites around the eyes; on the left side of the face electrodes Ire placed above and under the eye (vertical, VEOG) as well as on the left side of the eye (horizontal, HEOG). On the right side of the face was the electrode attached at the right side of the eye and thereby handling both vertical and horizontal eye movements. Disinfection pads and conductive paste were used before the onset of the eye-and reference electrodes to gain improved conductivity. The scalp electrodes were treated to reduce resistance between electrodes and the scalp so that the impedance of the skin was below 5 K Ohm. This was achieved by peeling of the scalp to remove the outer layer of dead skin. To control for skin potentials as a source of high electrode impedance were the subjects asked to remain still and calm throughout the experiment and the temperature was kept at an even comfortable degree. A thorough talk where the participant was informed about the technique and questioned about internal fears and worries about ERP was made before the onset of the cap. This was included in the procedure to gain a relaxed, non nervous and comfortable participant. Since I used a cap consisting of a partial set of electrodes I could in an efficient manor decrease the amount of time spent on attaching the electrodes and as such both diminish the confound of electrodes creating electrical bridges among themselves due to too much gel used and the probability of having a bad connection going by unnoticed. It though meant that I had to be extra careful with the recordings of the electrodes I used and therefore a net was put externally on top of the cap to keep the electrodes positioned and gain enhanced contact with the skull (Tucker, 1993). The participant´s forehead was connected to the chassis of the isolated side of the amplified system, also known as “ground”.

The EEG was amplified 10, 000 times and recorded with a Bandpass of .01-100 Hz and digitally sampled at 500 Hz. ERP recordings Ire time-locked to the onset of the appearance of Stimuli 1 and Stimuli 2 and epoched for 5100 ms (including a 200 ms pre-stimulus baseline). The epoched data was filtered off-line with a Bandpass of .3-20 Hz (12 decibel/octave). Epoch´s containing eye movements were corrected according to a regression method in Neuroscan Occular Artifact Reduction. Trials with registrations artifact with an EEG < 75 mV were discarded from the analysis.

In the following EOG artifact rejection a limit of a minimum of 16 passed trials was put and created a mean where 78% of the data was retained for the analyses in the TargetProbe condition, 78% for the TargetIrrelevant condition, 77% for the NonTargetProbe condition and 79% for the NonTargetIrrelevant condition. In the first analysis of Irrelevant vs. Probe did all

18 participants pass the numsweep limit of a minimum of 16 passed trials and thus were included in the analysis (see Table 1). Artifact contaminated single channels due to poor contact with the scalp or some malfunction of an amplifier was deleted and thus not a part of the analysis. They did not exceed 5% of the total.

P300 was measured by the Peak to Peak (p-p) method due to its repeatedly shown sensitiveness in P300 based studies (e.g. Rosenfeld, 2008; Soskins, Rosenfeld &Niedam, 2001). The algorithm searched for Stimulus 1 through a window of 200-500 ms, and for Stimulus 2 through a window of 1800-2200 ms for the maximally positive average segment of 100 ms. The midpoint of the maximum positivity segment defined the P300 latency. After the algorithm found this maximum positivity it searched from its latency for the maximum negativity and the difference between them defines the Peak to Peak measure.

Grand Average Waveforms

For each of the electrode sites were the ERP from the EOG-artifact free data from each participant averaged according to Stimulus 1 and Stimulus 2 over the four conditions; TargetProbe, TargetIrrelevant, NonTargetProbe and NonTargetIrrelevant. Grand average waveforms were created for each condition by averaging the individual averages (depicted in Figure 2).

Four scalp areas were chosen, frontal (F3, FZ, F4), central (C3, CZ, C4), parietal (P3, PZ, P4) and occipital (O1, OZ, O2). These were combined with laterality in three levels, right hemispheric dominance, middle and left hemispheric dominance.

Statistical Analysis

A series of repeated measures analysis of variance (ANOVA) were conducted to investigate group effects for the impact of (1) Memory and (2) Attention. They were made to be able to answer the hypotheses of whether an enhanced P300 is elicited in the presence of the culprit. And to entangle if the P300 response to the memory oddball (Probe) is present even in the absence of the attention oddball (Target).

In the case of evaluating whether an enhanced P300 was elicited in the presence of the culprit was considerations taken to the fact that Targets is possible to modulate by both memory and attention processes (while NonTargets is only influenced by memory processes) and therefore ought the comparisons between Related and Unrelated stimuli be significant if a memory for the exposed photograph has been established. I therefore chose to merge the four categories of

TargetProbe, TargetIrrelevant, NonTargetProbe and NonTargetIrrelevant into two grand average (Related vs. Unrelated) for the initial part of the analysis process. This was constituted through a three-way repeated measures ANOVA with Status of Stimuli 2(Related ,Unrelated), Scalp location 4(frontal, central, parietal and occipital) and Lateralization 3(left, central, right) as factors.

Though to evaluate these effects in a more thorough manor was the analysis then dismantled from the two category paradigm Status of Stimuli (Related vs. Unrelated) into a four category paradigm of TargetProbe, TargetIrrelevant, NonTargetProbe, NonTargetIrrelevant. This to be able to learn from the separation of Target vs. NonTarget whether the P300 elicited at Stimuli 2 was causal from the decision process from responding to the attention oddball or was a function of true recognition of the Probe and as such a memory dependent automatic response. Above was conducted through a Memory 2(Probe vs. Irrelevant), Attention 2(Target vs. NonTarget), Scalp location 4(frontal, central, parietal and occipital) and Lateralization 3(left, central, right) four-way repeated measures ANOVA. Which was conducted from the individual average P300 values. Interaction effects was further analyzed with planned contrasts to investigate whether the spatial distribution related to the attention oddball was deviant from the one related to the memory oddball, possibly reflecting a differentiation of the underlying neural correlates.

The dependent variable was amplitude of the P300 component. When deviations from sphericity was present were the degrees of freedom corrected and reported according to Greenhouse-Geisser(GG) value of probability p(GG) and the associated epsilon (e) value. The alpha level was rectified to sustain $p<.05$ for each test. Only significant main and interaction effects considered germane to the experimental hypothesizes were explored and further analyzed.

Results

Impact of Recognition in the Two-Category Paradigm of Related vs. Unrelated stimuli

There was no significant effect of Stimuli 1, $F<1$, and following analysis´s was therefore conducted on Stimulus 2 only (see Table 2).

A three-way repeated measures ANOVA with Status of Stimuli, Scalp location and Lateralization as factors, was conducted. There was a significant main effect of Status of Stimuli, F (1, 17) = *16.24*, MSE= 16.42 $p<.001$, *partial eta squared* = 0.49. The main effect was further confirmed with a paired samples t-test (M=2.33, SD=1.89), t (17) = 5,21, $p<.001$. This reveals how the elicited P300´s amplitude was enhanced in a significantly higher manor when the stimuli was Related (M=12.41) than Unrelated (M=10.08) and as such describes how a recognitions process of the facial stimuli and the targets underlies this effect.

A significant two-way interaction was detected on Status of Stimuli, Laterality, F (1.4, 24) = 1.53, MSE=10.26, $p<.001$, *partial eta squared* = .083 but not on Status of Stimuli, Scalp locations, F<1. Further detected was an, quadratic, three-way interaction between Status of Stimuli, Scalp Location and Laterality, F(1,17) =7.12, MSE= .07, $p<.05$, *partial eta squared* = .29. This significant three-way interaction indicates that the P300 component elicited dependent on Status of Stimuli was largest on the parietal scalp area in the central level of Laterality compared to each of the other sites -which is the typical elicitation area for the P300 component (Luck, 2005).

Impact of Memory vs. Attention on the P300 (in the four-category paradigm)

In support of above mentioned results, where the exploration of the GFT´s qualities proceeded with a four-way repeated measures ANOVA. The factors where Memory, Attention, Scalp location and Lateralization. Data was derived from the individual average P300 values.

Significant main effects were found on both Memory (Probe vs. Irrelevant), F(1, 13) = 6.52, MSE = 18.08, $p<.05$, *partial eta squared* =.33 and Attention (Target vs. NonTarget), F(1, 13) = 9.03, MSE = 95.50, $p<.05$, *partial eta squared* = .41 (see Table 2).

The results are ergo pointing in the direction of a significantly higher elicited amplitude of the P300 component due to the Memory oddball task (Probe vs. Irrelevant) and also a higher elicited amplitude of the P300 component due to the Attention oddball task (Target vs. NonTarget). I. e. the neural correlates of Memory seem to act independently of Attention.

This was further confirmed by a paired samples t-test for the groups of NonTargetProbe vs. NonTargetIrrelevant, *(M*=1.7, *SD*=1.83), *t(*13)=3.48, *p*<.005. The analyses thereby provided confirming results that the recognition related response was elicited independent of the decision task i.e. evidence of a Memory oddball (Probe) being present at times when the Attention oddball (Target) was not. As such it strengthened the competencies of the GFT.

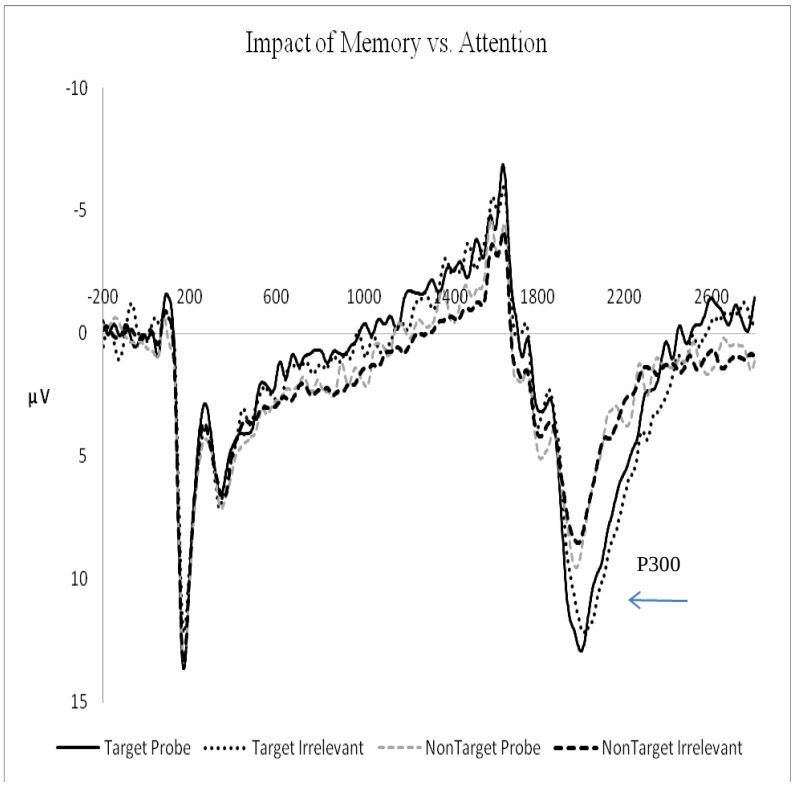

Figure 2. Grand Average Waveforms for the four conditions of Target Probe, Target Irrelevant, NonTarget Probe and NonTarget Irrelevant at the Pz electrode as a function of time f(t) in ms.

Table 2. Significant differences in activation of ERP data in the ANOVA

Time window	200-600 ms (Stimulus 1)			1800-2200 ms (Stimulus 2)		
Effect	*df*	*F*	*p*	*df*	*F*	*p*
Memory	**x**	**x**	**x**	13	6.52	0.01
Attention	**x**	**x**	**x**	13	9.03	0.024
Attn x AP x LAT	**x**	**x**	**x**	2.85	2.96	0.047

Note: Memory (Probe vs. Irrelevant), Attention (Target vs. Nontarget), AP (Frontal, Central, Parietal & Occipital), LAT (Left, Central and Right).

Impact of Memory and Attention on the Spatial Distribution

Further ascertaining was a highly interesting, significant three-way interaction effect between Attention, Scalp Location and Lateralization F (2.85, 37)= 2.96, MSE=1.23, p<.05, *partial eta squared =.19* found. This reflects how the oddball effect of Attentions impact on the P300 amplitude seems to be differentiated on different levels of the spatial distribution.

To deepen the knowledge about this effect were planned polynomial contrasts conducted. They gave a significant quadratic effect, F (1, 13) =5.25, MSE = 1.06, p<.05, *partial eta squared* = .29. Which, as illustrated on the next page by Figure 3, reveal´s how Attention and there specifically the presence of Target is locked to the parietal Scalp location and the middle Laterality -corresponding to the electrode of Pz. This replicates how a dominant effect over the Pz electrode often is mentioned as correlating to Attention (Luck, 2005).

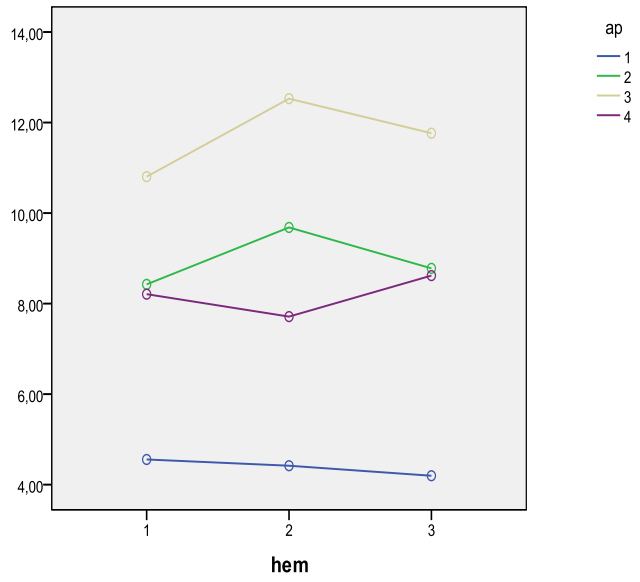

Figure 3. Differences in the Spatial Distribution over AP (frontal, central, parietal and occipital scalp location) and Laterality (left hemispheric, central and right hemispheric dominance) as a function of Attention (Target vs. NonTarget).

Something which was not found for the possible three-way interaction of Memory, Scalp Location and Lateralization, F<1. This is possibly reflecting how the recoding of Memory gives rise to a more widely spread spatial distribution (emerged by the recognition response) - compared to the locked spatial distribution of Attention (see Figure 4).

Though, the optimal, confirming four-way interaction of Memory, Attention, Scalp Location and Lateralization failed in significance $F<1$

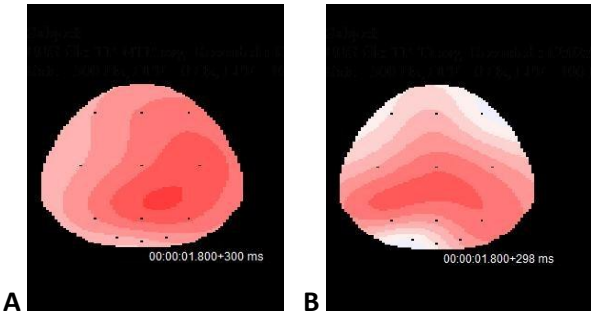

Figure 4. The spatial distribution illustrated in 2D in 1800-2200 ms (Stimulus 2), from the three-way interaction of, **A**, Attention (Target vs. NonTarget), Scalp Location (frontal, central, parietal and occipital) and Lateralization (left hemispheric, central and right hemispheric dominance) and **B**, Memory (Probe vs. Irrelevant), Scalp Location (frontal, central, parietal and occipital) and Lateralization (left hemispheric, central and right hemispheric dominance)

Discussion

The initiating example, of the witness who´s testimony is considered insufficient and untrustworthy. Illustrates a situation where an index that confirms the recognition of the culprit could have been a prosperous tool -able to give justice a hand.

The purpose of the present study was to develop the foundations for such a tool. Namely an ecological valid paradigm that is sensitive enough to investigate the feasibility of using the P300 as a neurophysiological index of recognition -in an eyewitness lineup. I hypothesized that this was possible through an enhanced elicited P300 response when the culprit was present. I further stretched that there should be an independency of the Memory oddball from the Attention oddball, i.e. that a P300 response of recognition should be present without the P300 response to the decision task.

Stimuli 1

The expected enhanced P300 response, elicited due to recognition of the Probe in Stimulus 1 , did unfortunately default. This can be argued as result of the scarce encoding of the stimuli. Which, probably was a direct cause of the insufficient instructions to focus on the individual on the photograph. Instead was the encoding of the individual over rode by the participants task-focus to push a button. Which can be linked to Meijer et al (2007), who proclaim a correlation of absence of instructions with the absence of a P300 response. According to several participants when being debriefed did they indeed focus on the button pressing task–“I barely saw the Photo, I was only engaged in pressing the right button”, was one persons

statement in the question. The instruction and design of the task did indeed permit a lack of encoding of the Photo, it was actually manageable to conduct the task focusing on the keyboard using only the peripheral vision to detect a change on the screen. Rosenfeld et al (2008) solved this issue by cutting the test at (for the participant) unexpected occasions where the participants were asked to describe in detail what was on the screen after the stimuli had disappeared. Thereby forcing the participant´s engagement to the encoding of Stimuli 1. I reasoned, though, that a description of this kind would be inappropriate when dealing with photographs of individuals since they consist of a rather homogenous gathering (compare a picture of a car vs. one of a house to two pictures of two rather alike individuals) and hence the confound safety would have been lost. This reasoning returned to bite me thought. A possible solution to gain enhancement of the GFT in this matter would be e.g. to induce an ISI between number of Stimuli 1´s were the participant would be asked questions about the individual on the photograph´s gender and eye color. This could force attention to a deeper encoding of Stimuli 1 and as such lay up for the elicitation of a more prominent P300 response.

Memory

A main effect was detected in the analyses of Stimulus 2 for Memory (Probe vs. Irrelevant). This verified the hypotheses of how the P300 component could confirm recognition of a facial stimuli. The main effect was detected trough a significantly higher amplitude of the P300 response when the photograph contained the culprit compared to when it did not. This is promising results for the future enhancement of the GFT (see section *improvements of the GFT and future venues)* but this only confirms the presence of the Memory oddball and we still need to be able to separate it from the Attention oddball to gain an ecological valid result.

Attention

The second main effect gave the grounds for just that. There was a significant effect of Attention (Target vs. NonTarget) that resulted in an increased amplitude of the P300 when a Target was present, i.e. when the individual on the photograph had a dot on the left cheek in the color lime, compared to when a NonTarget was present (a dot with one of the NonTarget colors: blue, fuschia, gold maroon and purple). This describes how the attention directed towards the decision task of whether Stimuli 2 was a Target or not per see gave rise to a P300. To be able to differentiate for sure if these two main effects were indeed independent of one another (which was a necessity for the paradigm to be able to perform if it should be prosperous in further developments such as a true lineup and since the primary analyses of

two-category paradigm of Status of Stimuli (Related vs. Unrelated) left this unanswered) and to be able to respond to the secondary hypotheses that stretched just this differentiation were completing analyses conducted on NonTargetProbe vs. NonTargetIrrelevant.

Memory Independent from Attention

The paired t-test that was conducted, to investigate if the Memory oddball was present at times when the Attention oddball was not, did indeed confirm the secondary analysis. These results are standing as an antipole to Gamer & Berti´s (2010) claim of how the P300 amplitude in their study was enhanced for items requiring a deviant behavioral response but not sensitive to concealed knowledge. Something that my results does not replicate. It means not only that recognition of the Probe occurs independently of the presence of a Target but also that the GFT was prosperous in differentiating between a P300 that was elicited due to attentional processes and the one elicited due to recognition! This leads to enhanced insights of how the neural correlates acts independently of Probe vs. Target and as such provides a recognition related response due to Probe allodial from the decision task of Target.

The results does thus both confirm an elicitation of the orienting response (shown and detected through an increased amplitude of the P300) due to the presence of the culprit, it further clarifies the anticipated independence of Probe from Target. It thereby succeeds in confirmation of the primary hypothesis claiming for the P300 to pertain as a reliable index in witness confirmation from the GFT so far. I am with that able to replicate the results from Lefebvre (2007) as well as confirming the PCT design of Rosenfeld et al (2008). And as such does the results portray an elaboration from the GKT (Farwell & Donchin, 1994) into the field of eyewitness identifications.

The Interaction of Attention and the Spatial Distribution

I gained further exciting results in shape of the significant three-way interaction between Attention, Scalp Location and Lateralization. Something which was not found on the interaction between Memory, Scalp Location and Lateralization. This seems to be reflecting, at the case of Attention, how Target is locked to the parietal Scalp location and the middle Laterality corresponding to the electrode of Pz which is often mentioned as correlating to Attention (Luck, 2005). The non significant three-way interaction of Memory, Scalplocation and Lateralization (which as illustrated in Figure 4 reflects a more widely spread spatial activation to the presence of the Probe) is perhaps the result of a correlation with the belief of how the retrieval cue based reestablishment of recognition memories, here within the episodic

memory category, is dependent on the re enlightening of the (at consolidation and pattern separation in CA3 in hippocampus) formed index which is distributed allover neo cortex (Gazzaniga, 2002). This estimated tendency of how a different temporal distribution underlies the decision making process vs. the recognition process is further strengthened ,and as such illustrated by Figure 4, where 2D animations of the temporal distributions is shown.

Although it is important to press that this is at writing only tendencies since the confirming four-way interaction between Memory, Attention, Scalp Location and Lateralization did not prove to be significant.

But it is possible that this failure in significance could be due to a lack of power as a consequence of few participants. Considering the small amount of degrees of freedom sustained due to the massive amount of levels used in this interaction.

Therefore I see in this twist a challenge that needs to be responded to for a more thorough knowledge of the interpretations of the amplitude of the elicited P300 in tasks that combine recognition with attention and decision making processes. Such as the situation of a witness identification indeed is!

Future Venues for the GFT to take on

Above gives a lovely standpoint for the GFT to provide the requested attempt towards witness identification becoming a reliable and accurate tool in the courtroom (Lefebvre, 2007). It also prepares the ground for future improvements of the GFT, that will be done to enhance its strength but also to be able to use it in even more demanding situations which I will describe below. The index is here thought to simultaneously serve as backup for correct identifications, false rejections and false identifications and thereby a huge helping hand in improving witness´s capabilities.

A usage of this kind in the courtroom should be thought of only as a tool in helping the process on the right way and not as the direct link to a final judgment! In one of its best appearance it could show the way when the witness is e.g. facing a threat or when the witness is in a dependent state to the perpetrator (Jensen et al, 2005, Berliner & Conte, 1990). This ability constitutes of the trickybusiness the twosided coin of lies consists of. One side gives name to the issue that e.g. children in a much larger extent than adults is prone to identify a filler in a targetabsent lineup as the culprit (Pozzulo et al, 1998). Which in real life mean big trouble since you can´t know for sure who is the true culprit. This may be due to the larger

experienced amount of pressure children feels which yields into a will to please the surroundings (parents, interviewer etc.) with an identification. Even if they feel unsure. Wells & Luus (1990, reviewed in Pozzulo et al, 1998) reason that this is founded in a dissociation between the underlying processes in correct identification vs. correct rejection. Where a correct identification may be predominantly determined by cognitive memory processes while correct rejection may be mostly influenced by social (and cognitive factors). A targetabsent lineup elicits an incorrect response because the child thinks she is required to make an identification and therefore selects the lineup member who looks most like the target (Pozzulo et al, 1998). Bias is also contributed through the tendency to incorporate new information externally acquired by e.g. the interviewer, information mentioned in previous interviews or information inferred from the gist of the experience, and implement it as original information in the memory (Suggestibility effects).This leads to false positive recognitions of fillers in a targetabsent lineup and as such dangerous source memory distortions. (Bainerd & Reyna, 1994). This is troubles that the GFT and the P300 could possibly eliminate.

The other side of the coin contains the sensitive situation that occurs when the witness is in a dependent state to the perpetrator and the paradigm of lies that then come up (Jensen et al, 2005, Berliner & Conte, 1990). This state is composed due to the negative consequences that making an identification results in, i.e. the witness feels threatened by the culprit (doesn´t have to be a pronounced threat) or worries about what will happen to the family. Even fear due to concern about the perpetrator can lead to a false rejection of a targetpresent lineup. (Berliner & Conte, 1990). This side of the coin thus reflects the unwillingness to identify a culprit in a targetpresent lineup, which results in a false rejection. Consequently an inhibition of the truth response -which is a part of lying.

If the witness is a child will that only make matters worse since a lying child is not easily discovered by behavioral measures and Edelstein (2006) among others has found in contradiction to earlier studies that children posses as good deception abilities as adults and when they volitionally do so observers can´t detect their deception (Lewis et al, 1989). Especially if the statement is prepared (Stromvall et al, 2007, reviewed in Leach et al, 2009). One behavioral way of solving the issue of lies is the usage of the CBCA (Criterion Based Content Analysis). This is a behavioral measure for detection of deception where verocity is compared to the “quantity of details” criterion. Result from Pezdek et al (2005) points in the direction that CBCA though does not seem to be as reliable as one first thought in detection of

lies. It seems that information from prior experiences may play a more crucial role in affecting children´s account of information retained from the specific episode being recalled. As a result does children´s account of familiar events contain more details and coherent structure (something that according to CBCA is classifies as truthful) and therefore does familiar events bring higher CBCA scores than unfamiliar events. Thus a child can gain script-relevant information about e.g. an abuse from television which would activate familiarity and become classified as truthful even though lying. This means that other aspects of information given by the child as well will gain higher status including the possible identification of a filler or a false rejection.

This further pushes on the need for a more reliable tool than behavioral measures in detecting lies. It also implicates that practice of lying makes perfect and therefore influence the behavioral measures such as decreased disparity between response time in telling the truth vs. lying. Which gains support from Johnson et al (2005). They reason that responses that conflict with the truth about perceived or remembered items produce the same pattern of slower RT´s and decreased LPC amplitudes (Johnson et al, 2005). With practice this slower RT vanish and deception detection thus becomes even more difficult. Though the use of P300 left the amplitude unaffected by practice which implies that the conceptually driven response conflicts underlying lying appears to be resistant to practice induced changes (Johnson et al, 2005). As such P300 could provide an index for the orientation response elicited by the culprit even if the truth response about its presence is being inhibited.

Above correlates with the results from GKT that provides detection of deception even if it´s behaviorally denied (Mertens & Polish, 1997)). Further could a P300 serve as a detection (in line with Lefebvre et al´s results) of the differentiable “real” P300 response during targetpresent and that elicited by “highest culprit member” during targetabsent and therefore even perhaps as safety precautions against children´s proneness to identifying a filler in a targetabsent lineup .

Another future venue for the GFT to take on is the problematical situation child witnesses encounter when the culprit has changed his/hers appearances since the time of the crime. Studies have shown how this not only affect decreased correct identifications at a target present lineup but also false identifications at target absent (Shapiro & Penrod, 1986 ; Pozzulo & Balfour, 2006). This is due to the children´s encoding style that constitutes of feature encoding (compared to the adults holistic one which is more constant to attributive changes)

that complicates matching their stored memory picture with the stimulus presented if this stimulus has changed in facial features such as growing a moustache since the time of the crime. When the situation today embeds for this kind of changes, due to time delays before the police is ready to show a lineup, this founds for further false identifications and fewer correct ones. More often than not is a delay period that allows a feature change the case, since it takes a while until the police is ready for a witness parade. Adding to the time delay is the fact that it is not unusual for culprit´s to try to conceal or change their appearance to avoid being recognized by wearing masks, stockings, hats and so on. Cutler et al (1987) found a grave decrease in correct identifications when the culprit was wearing a hat during the staged robbery (27% correct ones) which was almost half of the recognition rate when the culprit did not try to conceal his identity. You can also like Shapiro & Penrod (1986) let the culprit´s attribute change between the time of the crime and the recognition phase. They changed among other things having a moustache and found that if there was no congruence between encoding and recoding (e. g. newly shaved at encoding and moustache at recoding) it resulted in decreased correct identifications at target-present condition and increased incorrect one´s at the target-absent condition. Pozzulo & Balfour (2006) found that only as little as 10% of the children made a correct identification when changes in facial features such as moustache and hairstyle had been made. Even O´Donell & Bruce (reviewed in Memon, 2003) has come up with similar results which show that when participants were required to describe an unfamiliar person focused 27% on features such as hairstyle etc. They consider further (like Shapiro & Penrod, 1986) that a relatively simple change in these attributes makes the identification process much harder (Memon, 2003).

It is here the P300 and GFT enters the stage because there is reason to believe that face recognition and awareness of face recognition might be independent of one another. It has been found that individuals with Prosopagnosia (who are not able to overtly or consciously recognize faces) has certain types of unconscious responses present, e.g. greater Skin Conductance response to a picture of a familiar face (Moskowitz, 2005 ; Bauer, 1984 reviewed in Allen et al, 2008). Thus an unconscious recognition of faces. Further has GKT (wh shown that P300 can be detected even in the absence of an overt response from the participant as long as it is attended to (Mertens & Polish, 1997)). As such could the GFT and P300 be able to correct for children´s encoding style and thereby improve their abilities as witnesses and in the long run their reputations as such.

Even if the present study is conducted on an adult population above shows how the results can be implemented and with advantage developed in a child population as well. These are also the main developmental areas for the GFT that is prospected for further investigations .Where the correction for encoding strategies hides an extra point in presenting a new possible arena for the FIE effect. Leder and Bruce (2000 reviewed in Marzi et al, 2007) reason that the enhancement effect on the N170 response by inverted faces in adults is due to the more difficult encoding when the inversion disrupts the configural processing -*The perceptual field hypothesis* (Rossion, 2009).

The Face Inversion Effect however does not seem to affect children. With age, development makes us prone to holistic encoding on behalf of the feature based one, which is shown by the FIE. It appears that children process upright and inverted faces in a way comparable to their processing of non facial stimuli, i. e. analytical processing (feature based). Whereas adults and young adults process only upright faces holistic -due to their expertise encoding. (Schwartzer, 2000; Hay & Cox, 2000). This could be applied to the GFT as a line in the investigation of encoding style. The P300 response here correlating to a present recognition that is overtly disturbed by the child´s limited capability to convey it –the semantic classification. It could be conducted by implementing a possible Viewpoint Dependency task where the children is (if a double dissociation is the case between the *perceptual field hypothesis* and sensitiveness towards facial feature change) in a reversed manor superior vis-a-vis the adults in recognition of a photograph picturing a face that has been turned in 90 degrees since the time of the encoding -thus a discrepancy in viewpoint. But is inferior when it comes to overt (covertly detected through an enhanced P300 response) recognition when changes in facial features has taken place since the encoding.

This could present a fresh corner to the rivalry whether the FIE default in children is due to true sensitivity to configural cues as proposed by e.g. Rossion, 2009. Or is more an effect of how diminished holistic encoding in early childhood really reflects an overall cognitive immaturity per see (Shroff, Gerhardstein & Yin, 2009).

Improvements of the GFT

Advancements of the paradigm are though necessary from my point of view to be able to handle, among other things, the delicate situation of having an e.g. relative in the lineup. This pushes for the need of the paradigm to be able to handle confounds due to recognition fuelled by the reconnaissance without regarding context errors –presenting the venue for the N400

component. This is possible since the N400 (in contrast to the P300) emerge when a stimuli do not meet with the expectations of it and/or don´t fit in to the prior context (Kutas & van Petten, 1988, reviewed in Boaz, 1991). The N400´s usage area has in recent years expanded to, among other things, detection of its ability to separate false and true episodic information a part (Boaz et al, 1991). But the more interesting for the GFT is the study were Bobes et al (2003) found the N400 effect to be reliable even for faces at both repetition (Mnatsakamnian & Tarkka, 2003 & 2004) and associations discrepancies. Schweinberger (1996) claims this to be the case since the N400 is reflecting the retrieval of postperceptual or semantic memory codes for human Person Identity Nodes. Schweinberger is here being backed up by Benton & Deouell (2000) whom are relating the N400 to semantic processing of familiar face recognition. In a witness confrontation could this lead to a reduction of the elicited N400 when there is a match between the culprit and the face presented in the lineup. I.e. when a P300 is elicited there is no N400 response. However, when there is no match (given that you induce a contextual or repetitive anticipation) you will receive a larger peak latency of the N400 component and no or a very small P300 response. This ability gives a fine complement to the P300 but perhaps the most useful arena for the N400 in the GFT could constitute of its appearance in a lineup that includes e.g. a family member (who unquestionably will elicit a P300 of recognition). There the N400´s task would be to control for context discrepancies to eliminate possible false identifications and false rejections –improving the paradigm.

With above said I reason that the future for the GFT looks useful, interesting, challenging and above all things fun!

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Appendix Note: The ten collages with the lowest ratings, and thereby not included in the study, is here colored in grey.

Collage							Sum
1	3	6	4	6	8	7	34
2	7	7	6	8	7	4	39
3	5	5	6	8	3	5	32
4	10	10	8	9	5	3	45
5	2	8	5	9	6	8	38
6	8	10	7	10	7	6	48
7	6	8	9	8	8	7	46
8	4	4	3	2	6	6	25
9	5	3	6	6	4	5	29
10	7	6	8	8	4	2	35
11	4	8	3	5	4	7	31
12	4	6	5	3	4	6	28
13	5	4	3	7	7	6	32
14	7	8	9	8	7	7	46
15	9	9	9	10	1	7	45
16	10	10	10	10	6	7	53
17	10	9	7	9	6	9	50
18	8	9	6	9	8	9	49
19	5	7	8	8	7	8	43
20	5	5	4	5	4	3	26
21	5	10	10	7	4	8	44
22	6	7	5	6	2	6	32
23	8	9	9	9	2	5	42
24	4	5	6	5	4	3	27
25	6	6	7	6	3	7	35
26	8	8	10	9	4	8	47
27	8	8	6	8	6	7	43
28	5	9	7	9	7	7	44
29	8	8	9	9	7	7	48
30	3	4	2	3	5	7	24
31	5	5	2	5	6	7	30
32	3	4	1	3	1	5	17
33	8	9	8	9	10	8	52
34	10	10	9	10	10	8	57
35	8	9	7	9	7	7	47
36	7	6	9	8	4	7	41

37	4	5	4	5	6	5	29
38	6	5	2	4	3	6	26
39	10	10	9	10	8	8	55
40	10	10	9	10	10	7	56