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Central activation of the sexual system

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Chapter 6

Practical Applications

This chapter includes two sections: (1) patient study and other clinical research, and (2) directions for future research.

Patient Study and other Clinical Research

A Priming Study with Sexually Dysfunctional Male Patients

As we described in the General Introduction (Chapter 1), the origin of the priming paradigm stems from psychological assessment in the diagnosis of male erectile dysfunction. After we methodologically refined the paradigm and were more certain about the effect it produced, we conducted a patient study to investigate its clinical value (Spiering, Everaerd, Van Lunsen, Laan, 2003). If different patient groups could be distinguished with priming tasks, the paradigm might develop into a noninvasive and objective diagnostic tool. At this moment, 18 participants have been tested, and some preliminary results can be reported. Four groups of participants were included: men with psychogenic erectile dysfunction, men with sexual trauma, men with testosterone insufficiency and a control group of sexually functional male volunteers. Participants were presented with four experimental tasks (as well as a recognition test), which require different stages of responding.

We will first describe the experimental tasks in more detail and predict responses for sexual functional participants. Then we describe the patient groups and set out our predictions with respect to these.

Experimental Tasks

Task 1, cognitive 30 ms. The first experimental task equaled the categorization task we described in Chapter 2 (Experiment 1). Participants were requested to categorize sexual and neutral targets that were preceded by subliminally presented sexual and neutral primes. For sexual functional participants, it was predicted that preceding sexual primes compared to neutral primes facilitate recognition of sexual targets. The underlying mechanism is presumed to relate to implicit activation of the sexual system. Because perceptual thresholds increase with age (Sara & Faubert, 2000), prime presentation time was longer compared to our previous studies (Chapter 2; Chapter 3).

Task 2, cognitive 100 ms. The second experimental task was identical to Task 1, only now primes are presented for 100 ms.

In a pilot study (Spiering, Everaerd, Van Der Linden, & Witteman, 2002), we tested whether short conscious presentation of primes would reveal effects in the same direction as subliminal prime presentations. It was hypothesized that unconscious perception is not necessarily needed to investigate automatic activation (see Chapter 1 for definitions of unconscious vs. automatic). Controlled processes are assumed to start 300 ms after stimulus presentation; although participants would consciously perceive the priming pictures when presented for 100 ms, this presentation time can be assumed to be too short to regulate responses (Fazio et al., 1986; Hermans et al., 1994; Posner & Snyder, 1975; Neely, 1977). An advantage of these short conscious presentations could be larger facilitation effects compared to subliminal presentations. Results of this pilot study confirmed these hypotheses. Sexual primes facilitated recognition of sexual targets. In addition, this facilitation effect was larger as compared to the effect after subliminal prime presentations.

Regarding the patient study, the prediction for sexual functional participants is identical to Task 1: preceding sexual primes facilitate recognition of sexual targets. The underlying mechanism is presumed to relate to automatic activation of the sexual system.

Task 3, cognitive 1000 ms. The third experimental task equaled the categorization task we described in Chapter 2 (Experiment 2). For sexual functional participants, it was predicted that preceding sexual primes compared to neutral primes decelerate recognition of sexual targets. The underlying mechanism is presumed to relate to cognitive interference caused by activation of attentional resources.

Task 4, affective. The last experimental task is an adapted version of the affective task we earlier described (Chapter 2, Experiment 2; Chapter 4). Sexual and neutral primes were presented for 1000 ms. Compared to the earlier version this task differed on the content of the targets. We did not present neutral and sexual targets for three reasons. (1) Responses on neutral targets are theoretically less meaningful. (2) Because ratings after neutral targets in earlier studies (Chapter 2; Chapter 4) showed to be very low, they were statistically difficult to analyze. (3) The high sexual valence of the sexual targets could overrule the effects of the primes. Although priming effects were found with respect to ratings to sexual targets, these could be

stronger if the targets have a more ambiguous valence (cf. Murphy & Zajonc, 1993).

In a pilot study (Spiering et al., 2002), we presented target pictures of heterosexual clothed couples with a romantic atmosphere (e.g., a man and women embracing each other, a man and women walking down the beach). Targets were preceded by consciously presented (1000 ms) sexual and neutral primes. After each target two questions were presented: Question 1 "To what degree do you feel sexually aroused at this moment?", Question 2 "To what degree did you find the sexual pictures sexually arousing?" The questions could be answered on a 7-point scale (cf. Chapter 3, Experiment 2). Results of this pilot study confirmed our hypotheses; sexual primes elicited more subjective arousal compared to neutral primes, measured on ratings to the romantic targets.

For sexual functional participants it was predicted that responses to romantic targets were higher when preceded by sexual primes compared to neutral primes. The underlying mechanism is presumed to relate to the elicitation of subjective arousal.

Patient Groups

The main objective was to investigate if our priming approach was capable of revealing during which stage of activation the sexual response is impaired. Two essential conditions for response activation are hormone dependent sensitivity of the brain and positive memories of sexual events. The three patient groups we included were selected to differ with regard to these conditional variables. We now describe the patient groups and present our predictions.

Men with psychogenic erectile dysfunction. Recent psychological theories on erectile dysfunction have emphasized the role of conscious cognitions (Everaerd, Laan, & Spiering, 2000). Theorizing started from the observations of Masters & Johnson (1970), which were highlighted in the associated features section of DSM-III-R: "Almost invariably a fear of failure and the development of a 'spectator' attitude (self-monitoring), with extreme sensitivity to the reaction of the sexual partner, are present" (p.292, APA, 1987). Conscious cognitive interference has been explored both in experimental and treatment studies. These studies show that inhibition of subjective excitement and penile engorgement may be alleviated when one is able to control the sexually non-relevant negative conscious processing

(Barlow, 1986; Chapter 1). Dysfunctional subjects seem to focus on, or attend to, task-irrelevant context, at least when they aim to become sexually aroused (Everaerd, Laan, & Spiering, 2000). We presumed that inhibition of the erectile response is caused by cognitive interference on a conscious level. This group may have both lower sexual sensitivity and more negative sexual memories.

Our predictions for this group were as follows. In Task 1 and 2 sexual primes were presented below the level of controlled information processing. Because inhibition was presumed to occur on this level, we predicted no differential responding compared to sexual functional men (see Figure 6.1). Regarding Task 3, cognitive interference caused by sexual primes could be larger, resulting in a larger deceleration effect compared to control participants. Regarding Task 4, a lower sensitivity of the sexual system was predicted to result in lower ratings of subjective arousal compared to control participants.

Men with sexual trauma. Permanent neuronal changes might be present in traumatized participants and lead to an impairment of learning, habituation, and stimulus discrimination. Implicit sexual memory may have a negative content. In sexually traumatized men, sexual features might unconsciously activate traumatic representations in memory (cf. Shalev & Rogel-Fuchs, 1993).

Our predictions for this group were as follows. In Task 1 and 2, sexual primes automatically elicit negative representations. Consequently, there is no facilitating effect towards recognition of sexual targets. Regarding Task 3 and 4, we predicted responses in the same directions as in the group of men with psychogenic erectile dysfunctions, though these effects may be accentuated in this group (see Figure 6.1).

Men with testosterone insufficiency. It has become clear that the brain is sensitive to androgens in relation to sexual function. Exactly how this influence takes place remains unanswered (McCarthy & Albrecht, 1996). In a number of studies, testosterone appeared to be necessary for cognitive sexual functioning (fantasy, sexual daydreaming, the experience of desire), and for erections during REM sleep periods. In hypogonadal men, a supplement of testosterone may induce spectacular changes in functioning and experience (Bancroft, 1989). Men with testosterone insufficiency were expected to have diminished sexual desire, sexual thoughts, intensity of

sexual feelings, and sexual activity. In these men, a low sensitivity of the sexual system does not necessarily coexist with negative sexual memory.

Since these men are capable of erectile responding, activation of implicit memory might be normal. In view of our activation model of sexual response (Chapter 7, Figure 7.3), diminished subjective responding could reflect impairment in the pathway from explicit memories to cold cognitions, or the pathway from physiological arousal to hot cognitions.

Our predictions for this group were as follows. We expected no differential responding compared to control participants with respect to Task 1 and 2, since implicit activation is intact. With respect to Task 3, we speculated that men with testosterone insufficiency might respond without the delay. When sexual valence of the primes is low, activated attentional resources are not as large as in control participants. Therefore, cognitive interference does not take place. In Task 4, we predicted that sexual primes elicit less subjective arousal compared to control subjects (see Figure 6.1).

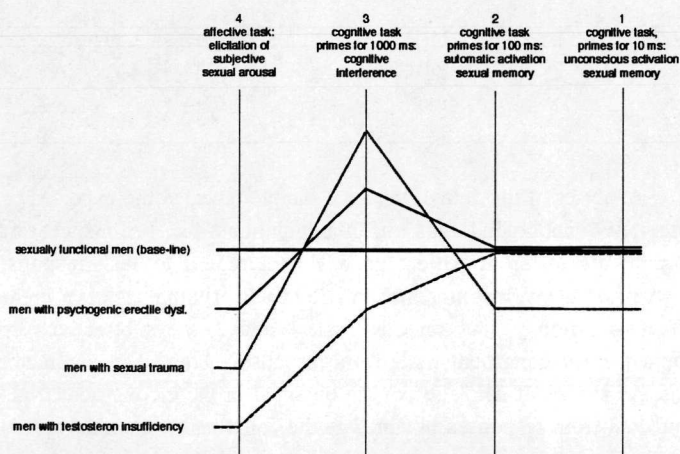


Figure 6.1. Predictions of responses of sexually dysfunctional patients to the different experimental tasks.

Participants were recruited through the Academic Medical Centre (AMC) in Amsterdam. To assess androgen levels, participants were tested in the morning and blood samples were taken. After the experiment was

finished, participants were asked to complete the Questionnaire for Screening Sexual Dysfunctions (Vroege, 1994). To assess sexual trauma, we administered the NEGSEKS (Negative Sexual Experiences) questionnaire.

Results and Discussion

We now report preliminary results for 18 participants. Mean age was 54.1 years ($SD = 12.0$). Eight participants were diagnosed as having psychogenic erectile dysfunction and two as having a sexual trauma. Four participants had relatively low bioavailable androgen levels with normal/low gonadotropins (see Table 6.1). Because these levels were too high to diagnose the participants as hypogonadal we defined this group as testosterone insufficient. Four sexually functional participants functioned as controls.

Table 6.1 *Androgen Levels of the Hypogonadotropic Participants (SHBG = Sex Hormone Binding Globulin; FAI = Free Androgen Index; lowered or elevated levels are represented with a - or +)*

participant	prolactine	LH	FSH	testosterone	SHBG	FAI
1	<1	6.3	9.9	8.8 -	17	51.8
2	28 +	3.3	3.1	14.6	38	38.4
3	9	8.8	14.1	10.9 -	20	54.4
4	8	2.6	2.7	8.4 -	11 -	76.4 +

Analyses of the data of the total sample revealed the expected priming effects. We concluded that our manipulations had been successful. To compare the different patient groups with regard to task responses the following strategy was undertaken. For each priming task we created an "effect of priming". As regards Task 1 and 2, we subtracted responses obtained in the congruent trials from responses obtained in the incongruent trials. As regards Task 3, responses obtained in the incongruent trials were subtracted from responses obtained in the congruent trials. As regards Task 4, we subtracted responses to neutrally primed targets from responses to sexually primed targets. To compare effects of the different tasks, the priming effects were transformed into z-scores. The data of one control participant in Task 1 was missing due to technical failure.

Table 6.2 *Reponses (z-scores) in Three Cognitive Tasks and an Affective Task (Question 1, Sexual Arousal; Question 2, Arousability of Pictures) for Sexually Dysfunctional and Functional Men*

participant	Erectile dysfunction								Sexual trauma		Testosterone insufficiency				Control			
	1	2	3	4	5	6	7	8	1	2	1	2	3	4	1	2	3	4
Task 1																		
Cognitive, 10 ms	0.3	0.5	-1.0	0.2	1.3	-2.0	0.4	0.5	-0.5	-0.9	0.0	-1.2	-0.5	0.5	-0.3	2.4	0.1	
Task 2																		
Cognitive, 100 ms	0.8	0.4	-0.5	-0.1	0.0	-1.6	-0.4	-0.5	0.7	2.3	-0.4	0.9	0.8	0.6	-0.3	0.3	-0.9	-1.1
Task 3																		
Cognitive, 1000 ms	0.4	3.0	-1.4	-0.5	0.1	-0.5	0.4	0.8	0.1	-0.7	0.6	0.1	0.1	-0.9	-0.2	-1.7	0.3	-0.1
Task 4																		
Affective, Question 1	0.0	0.1	-0.1	-0.4	-0.3	-0.6	-0.4	-0.4	-0.3	0.5	-0.4	-0.3	-0.4	-0.7	-0.4	-0.3	0.7	3.8
Affective, Question 2	1.0	1.0	-0.1	2.1	-0.7	-0.7	-0.4	0.2	0.2	1.3	-0.1	-0.1	0.4	-2.6	-0.1	-0.1	-0.7	-0.4

Table 6.2 shows which participants responded above or below the mean for each task (a z-score of 1 represents one standard deviation). From these preliminary results, systematic differences between the four groups of participants were not revealed. The z-scores of the two traumatized men in Task 1 are taken as an example; we predicted no facilitation effects of sexual primes. Conforming to prediction, the z-scores were negative, however, negative z-scores were predicted but absent in Task 2 for this group. Also, three participants from other groups (i.e., Erectile dysfunction, Participants 3 and 6; Testosterone insufficiency, Participant 2) revealed z-scores that were even lower compared to the traumatized men in Task 1.

Regarding our other predictions, similar comparisons can be made. With larger groups of participants, systematic differences may occur, yet the relatively small effect sizes seems to make an application to individual differences problematic.

Automatic Bi-directional Sex to Power Associations in Child Molesters

In this section we summarize a study (Kamphuis, De Ruiter, Janssen, & Spiering, in press) with sexual offenders to further discuss the clinical value of the priming approach.

Treatments for sex offenders are modestly effective and recidivism remains a key problem. A better understanding of the motivation of sexual offenders may help point the way to the development of more effective treatments. Implicit, automatic cognitive and motivational processes have been understudied in the field of sexual delinquency. A notable exception is

the Bargh et al. (1995; Bargh, Raymond, 1995) analogue study. Using a subliminal priming paradigm, these investigators examined the possible automaticity in sexual aggression and sexual harassment. The automatic nature of the putative behavior refers to the activation of concepts related to sex *through* the activation of other concepts (i.e., power). Bargh showed automatic links between the concepts of power and sex among male students who indicated on a self-report measure that they were attracted to sexual aggression.

Unobtrusive assessment of preconscious cognitive links and motivation is of particular interest in the forensic population. First, sexual offenders may not be aware of implicit attitudes and may lack introspective access to what motivates their behavior. Second, forensic patients may be invested in presenting themselves in a socially desirable way, for example to become eligible for parole or termination of treatment. As a consequence, there is a clear need to develop techniques to assess attitudes in ways that circumvent problems resulting from limited introspective access and social desirability concerns.

We replicated the (Bargh et al., 1995) study with a group of (a) sexual offenders, more specifically child molesters, (b) forensic controls, consisting of non-sexual violent offenders, from here on referred to as violent offenders, and (c) student controls. Child molesters and violent offenders were recruited through the Dr. Henri Van Der Hoeven clinic, a 130-bed forensic psychiatric hospital in Utrecht, The Netherlands. In our lexical decision experiment, each trial showed the participant a "target" string of letters that was either a (Dutch) word or a pronounceable non-word. The participant's task was to decide, as quickly as possible, whether the letter string was a word or a non-word. Shortly before the presentation of the target string, the subject was shown a "prime", also a word. The lexical decision was to be made on the target string only. Accordingly, three types of trials were presented: (1) non-word trials, where the target was a non-word, (2) unrelated (neutral) word trials, where the target was a word and the prime was presumably unrelated to the target, and (3) possibly related word trials, where the target was a word and the prime and target may have critical associations. Three types of stimuli were developed: *power*, *sex*, and *neutral* words. All three word types were used as both prime and target. We presented the prime for a period short enough (40 ms) to assure that conscious elaboration was impossible.

The major findings of the present study can be summarized as follows. Student controls responded faster across all prime by target combinations, and all participants responded slowest to power target words. With regard to the central aim of our study, that is, investigating the automaticity of sex-power links in child molesters as compared to forensic and student controls, the following can be concluded. Compared to both forensic and student controls, child molesters exhibited a significant sex-to-power facilitation effect (i.e., were relatively faster to respond to power words when primed by sex words as compared to when primed by neutral words), and a trend toward a power-to-sex facilitation effect. Conversely, compared to child molesters and normal controls, violent offenders showed a power-to-sex inhibition effect and a trend toward a sex-to-power inhibition effect (see Figure 6.2).

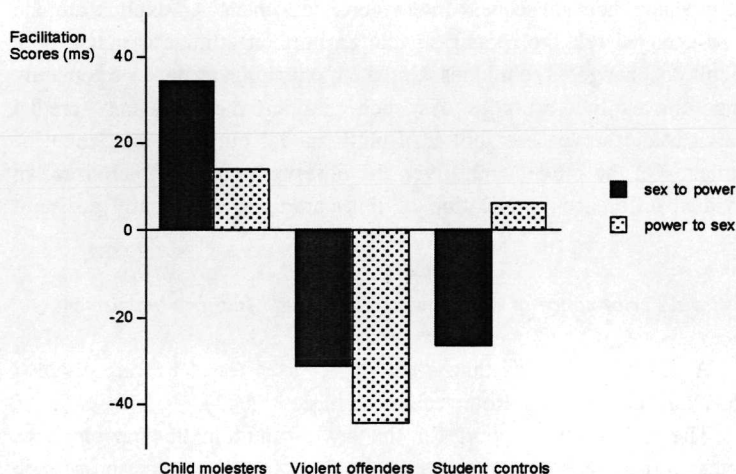


Figure 6.2. Facilitation scores in a lexical decision task for child molesters, violent offenders, and student controls. "Sex to Power" represents mean decision time to sexually primed power targets subtracted from neutrally primed power targets. "Power to Sex" represents mean decision time to power primed sex targets subtracted from neutrally primed sex targets.

In sum, the hypothesis that power and sex words were automatically linked in child molesters could not be rejected. Subliminal activation of the concept of sex led to preferential processing of power related concepts, and likely vice versa. Our results constitute a partial replication of the findings reported in the Bargh et al. (1995) analogue study. Consistent with Bargh et al., our findings suggest an automatic link between the concepts of power and sex among child molesters.

The findings from the present study support the notion put forward by Ward and Hudson (2000) that early phases of the offensive process may involve automatic actions and implicit planning in sex offenders. Recent theories of social cognition are based on the assumption that past experience moderates behavior through the elicitation of implicit and explicit cognitions. Implicit attitudes exist outside of conscious awareness and control and shape people's automatic reactions to attitude objects and thereby shape their subsequent interactions with them. An explicit attitude can be changed relatively easily, while an implicit attitude is much more difficult to change. Techniques aimed at changing attitudes often only change the explicit attitudes. As such, implicit measures may predict recidivism and serve as a tool in a multi modal outcome assessment of treatment. On the other hand, given the observed modest effect sizes, an individual differences application of this paradigm is currently a distant target.

Visual Performance of Adults with Pre-Lingual Auditory Impairment

A last clinical study that is shortly reported tested hearing disabled adults (Rietveld, Spiering, Rotteveel, & Van Beest, 2002).

There is mixed support for the lay assumption that people have adapted to their sensory impairment by an increased cognitive processing capacity regarding remaining senses (cf. Grant, Thiagaraja, & Sathian, 2000; Lessard, Pare, Lepore, & Lassonde, 1998; Morgan, 1999). Early physiologists have suggested that a restriction in sensory stimulation favors a progressive lowering of sensory thresholds of cross-modal senses. For example, one week's deprivation of visual or auditory stimulation resulted in cross modal perceptual improvement, which lasted several days after termination of deprivation (Bross & Zubek, 1975; Harper & Bross, 1978). It could be expected that people with long-term and particularly congenital

sensory impairment have developed stable cross modal sensory compensation (Carey & Blake, 1974; Cohen et al., 1997; Kujala et al., 1997).

Otherwise, Myklebust (1964) emphasized that inter-modality connections may enhance difficulties in information processing when specific sensory pathways are no longer functional. Indeed, Carey and Blake (1974) observed that hearing disabled people had a worse short-term memory for visual stimuli than controls. Recent studies have confirmed that early sensory disability may favor a general impairment in sensory afferent transfer, as well as restrictions in the development of sensory systems (Redd, Pongstaporn, & Ryugo, 2000). Consequently, enhanced cross modal task performances by sensory disabled people could be accounted for by acquired attentional strategies, rather than enhanced sensitivity of cross modal senses.

We conducted an experiment to test the hypothesis that hearing disabled adults are superior to controls in the quick recognition of pictures. This hypothesis was tested in two priming tasks. The specific predictions for this study were that (1) responses of hearing disabled participants were faster as compared to controls, (2) priming effects would be stronger in hearing disabled participants as compared to controls.

Participants were 18 hearing disabled adults and 18 controls that took part in two tasks. The hearing disabled participants were pre-lingual deaf, which means an auditory impairment before the third year of age. Controls were matched on sex and age. All participants took part in two different priming tasks, each consisting of three conditions, differing in duration of prime presentation (i.e., 15 ms, 100 ms, and 1000 ms). Task 1 contained the three cognitive tasks that were described in our study with sexually dysfunctional patients (p. 111-113). Task 2 resembled the methodology previously used by Murphy and Zajonc (1993). Pictures with emotional faces, that is, happy and angry facial expressions, were used as prime pictures (Ekman & Friesen, 1976; Matsumoto & Ekman, 1988). A set of Japanese ideographs was used as target pictures. The participants evaluated target pictures on their emotional valence by pressing either a "positive" or "negative" button. The participants were informed that pictures of faces, which had to be ignored, could precede the Japanese ideographs they should rate on positive or negative emotional meaning.

The results of Task 1 did not support the expectation that hearing disabled adults (a) are overall faster than controls in their reactions to pictures, and (b) have more congruent responses to pictures during very

short (15 ms) and short prime presentations (100 ms). In fact, the hearing disabled were slower than controls. This effect was similar for sexual and neutral pictures, and irrespective of prime presentation time, that is, very short, short, or long prime pictures.

In Task 2, controls showed the usual congruent priming effect during very short prime presentation time, e.g., a positive response after a positive prime. Hearing disabled participants showed this effect only during short and long prime presentation time, against expectation. In summary, hearing disabled participants were slower than controls in Task 1, and did not show the expected congruent priming effect during very short primes in Task 2. In general, hearing disabled participants responded fairly similar during different prime presentation time, whereas controls tended to respond different after very short, short, or long prime pictures. Thus, hearing disabled participants were less capable than controls in using visual emotional information in their response pattern (cf. Mathews & Milroy, 1994; Mathews & Sebastian, 1993; Rotteveel, De Groot, Geutskens, & Phaf, 2001). It was concluded that hearing disabled adults are not superior to controls, but perhaps even worse in the perception of visual information.

The suggestion that hearing disabled adults are restricted in their responses to visual information may be premature. It remains possible that hearing disabled people are superior to controls in special aspects of vision, e.g., memorizing emotional information, or to perceive complex visual patterns. When hearing disabled people are more reliant on visual information, it is possible that not a quick reaction (Task 1) but rather a careful elaboration is adaptive. Nonetheless, their lack of differentiation in responding to prime pictures of different duration (Task 2) remains unclear. Particularly the lack of a congruent priming effect during very short prime presentation would be suggestive of a limited processing capacity of split-second visual information.

Research on the capacity of pre-lingual hearing disabled people to perceive, memorize and organize visual information may result in clinically relevant findings. It is unclear whether the current findings have such clinical relevance, in the sense that hearing disabled people have difficulties in understanding particular types of information, e.g., emotional information. Nonetheless, research in this area is important from a theoretical perspective beyond sensory impairment, because it could elucidate problems in the visual (emotional) development of subgroups of people.

Directions for Future Research

To illustrate directions in which future research may develop, we shortly report some pilot studies that were conducted.

A Sex-in-the-Crowd Effect?

In Chapter 7 we propose that sexual features are subject of a preattentive search and would automatically attract focal attention. A straightforward test for this would be to include them in the face-in-the-crowd paradigm (Hansen & Hansen, 1988). Recently, we supervised a pilot study (Belarbi et al., 2003), which may be a first step in this direction.

Öhman, Lundqvist, and Esteves (2001) used schematic facial stimuli to replicate the original findings of Hansen and Hansen (1988). In different experiments, participants were presented with arrays of faces, in which one facial expression differs from the others regarding emotional valence. Participants were asked to detect the "odd face out" as quickly as possible. Angry faces were found more efficiently in happy crowds compared to happy faces in angry crowds. Also, the latency to discover an angry face in a happy crowd was not influenced by the number of happy-face distractors in the crowd, whereas the number of angry-face distractors dramatically influences the latency to discovery of a discrepant happy face.

We tried to replicate the Öhman et al. (2001) study with schematic sexual and neutral stimuli. We presented matrices that contained two types of stimuli in different configurations. A sexual stimulus was drawn to represent a female trunk; a neutral stimulus was composed of the same features and proposed to represent a face (see Figure 6.3). There were four types of matrices, which were composed of: (1) all sexual stimuli, (2) all neutral stimuli, (3) one sexual stimulus in a matrix of neutral stimuli, which could appear in all possible locations, and (4) one neutral in a matrix of sexual stimuli, which mirrors the one previously mentioned. Matrix' sizes were 3 X 3 and 4 X 4. Participants (20 men and 21 women) were requested to decide as quickly as possible whether an odd stimulus was in the matrix or not.



Figure 6.3. The schematic neutral (i.e., "face") and sexual (i.e., "trunk") stimuli.

Results indicated that participants were faster to detect a sexual stimulus in a matrix of neutral stimuli than vice versa. However, contrary to prediction, the time to detect a sexual stimulus increased with matrix-size. When matrices were preattentively searched for sexual features, matrix-size should not influence decision time. Nevertheless, we think it is to soon to reject our hypotheses. Since this is the first time we applied the face-in-the-crowd paradigm in sex research, many adaptations were proposed (e.g., the use of other schematic stimuli or pictures, the implementation of 5 X 5 matrices).

Effects of Photonegative Versions of Sexual Pictures

Brain imaging techniques could provide unique information with respect to activational pathways of sexual responding. To advise us about a research strategy that can be followed to design imaging studies, we contacted Prof. dr. ir. H. Spekreijse of the Netherlands Ophthalmic Research Institute (IOI/NORI). Following his consult, a pilot study (Vioen, Spiering, & Everaerd, 2000) was conducted as a first step.

A Visual Evoked Potential (VEP) study could possibly answer questions about cortical areas that transform stimulus information into sexually specific motor output. Because it can be expected that sexual stimuli produce to large cortical activation, which will mainly be not specific, we investigated effects of photonegative priming stimuli that could serve as control stimuli. A photonegative picture has the same physical properties as its positive equivalent. We hypothesized that the difference in VEP's of negative and positive sexual pictures would represent the sexual valence of the positive version (cf. Blum, Van Der Enden, Reits, &

Spekreijse, 1996-1997). Since temporal analyses of VEP can be made with a high resolution, it could also answer question about preconscious activation.

In a priming study (Vioen et al, 2000), we investigated effects of negative sexual priming stimuli. Sexual targets were preceded by sexual positive, sexual negative, and neutral primes. With respect to the cognitive tasks (Task 1, 2, p. 111, 112), results showed that only positive primes facilitated recognition of sexual targets. With respect to the affective task (Task 4, p. 112, 113), results showed that only positives primes elicited subjective sexual arousal. There were no significant differences in responses after negative and neutral primes. It can be concluded that photonegative versions of sexual pictures could serve as control stimuli in future brain imaging studies.

Automatic Activation of Approach Tendencies

Presenting stimuli below the level of awareness is only one way to investigate the effects of unconscious processes. Chen and Bargh (1999) investigated unconscious activation of approach versus avoidance behavior. In one condition, participants were asked to push a lever as quickly as possible in reaction to a stimulus presentation that consisted of the appearance of words in a random temporal sequence. Although stimuli were presented under full awareness and attentional mechanisms are clearly involved, there was no conscious and intentional goal of evaluating stimuli. Participants do not see the rationale of the task while pushing a lever as soon as a word appears. Data revealed that this avoidance-like muscle movement was faster in the presence of negatively valenced stimuli (words). In another condition, participants were asked to pull a lever as quickly as possible; this approach-like muscle movement was faster in the presence of positively valenced stimuli. Rotteveel and Phaf (2003) recently replicated these findings with emotional pictures. It can be concluded that stimuli are unconsciously classified as either "good" or "bad". This automatic evaluation results directly in behavioral predispositions towards the stimulus (Chen & Bargh, 1999; Fazio et al., 1986).

An experiment was conducted (Both, Spiering, & Rotteveel, 2003) to investigate whether sexual stimuli would automatically activate approach tendencies. Neutral, threatening, and sexual pictures were presented. As predicted there was no effect for neutral pictures, and pushing the lever was

faster compared to pulling for threatening pictures. For sexual pictures, there was no difference between conditions, however, exploratory analyses revealed a significant interaction with "Excitation", as measured by the Sexual Excitation Scale (Janssen, Vorst, Finn, & Bancroft, 2002). Participants scoring low on excitation were faster in approach movements compared to avoidance movements. An opposite pattern was found for participants low on this factor. In conclusion, results must be taken cautiously and this experiment awaits replication.

Assessment of Implicit Processing after Manipulation of Sexual Memory

To investigate the influence of memory in the generation of emotional responses, we (Everaerd, Spiering, & Gooren) supervised four master's degree research projects (Cornelisse & Molleman, 1999; Drosopoulos & Leuris, 2001; Roos, 2003; Schäfer, 2002). Although the specific research objective of these studies is beyond the scope of the thesis, it shows the utility of the preattentive priming paradigm to assess contributions of implicit memory.

Can sexual experience be degraded by modulating declarative sexual memories? Is it possible to predict subjective sexual experience from past sexual episodes? We tried to establish the contribution of declarative memory to subjective experience of emotion provoking situations. Modulation of declarative memories was studied by using pharmacological moderators of declarative memory consolidation processes. Consistent with previous results (Cahill, Prins, Weber, & McGaugh, 1994), propranolol impaired memory (recall and recognition) in participants who saw an emotional slide show (Van Stegeren, Everaerd, Cahill, McGaugh, & Gooren, 1998). These results indicate that the blockade of central β -adrenergic receptors is responsible for the reduction in storage of emotional events.

In three experiments, participants were presented with sexual and neutral pictures. Before watching these slides, participants were given propranolol or placebo. Propranolol impairs declarative memory for emotional (i.e., sexual) pictures. Since emotional responses depend on retrieval of representations in memory that match stimulus content, it was hypothesized that both groups would differentially respond when presented with the pictures the next day. Physiological and subjective arousal to sexual pictures was predicted to be lower in the propranolol group compared to

placebo. We predicted that within subjects, physiological and subjective arousal to "old" sexual pictures (i.e., presented one day before) would be lower compared to "new" sexual pictures (i.e., presented for the first time). Data of these three experiments were promising, however, leave room for alternative explanations that will not be elaborated on now.

On the second day of testing, we administered the priming task with subliminal prime presentations (Chapter 2, Experiment 1; Chapter 3). The objective was to test whether effects could be attributed to explicit (or declarative) memory only, or if implicit memory was also involved. Old and new sexual pictures functioned as primes. The results are not clear, one experiment showed a difference in responding to old and new primes between both groups (Cornelisse & Molleman, 1999), one experiment did not (Roos, 2003; Schäfer, 2002), and the data of the third experiment were lost because of technological failure (Drosopoulos & Leuris, 2001). These different findings can best be interpreted in view of the other results that were obtained in these experiments, which will not be done here. However, the priming task did succeed in providing useful additional information regarding implicit information processing mechanisms.

