

Induction and Measurement of Basic Emotions in Subjects and the Influence of Multisensory Stimuli

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ABSTRACT

In this study we are assessing whether we can induce positive and negative emotions in subjects as reflected in measures of the autonomic nervous system by administering pleasant and unpleasant odours. Subsequently we will assess whether a combination of visual, gustatory and olfactory stimulation results in stronger autonomic (emotional) responses as compared to either stimulus alone. We also want to assess whether there is a correlation between self reported emotional states and measures of autonomic nervous system reactivity. Four measurements of the autonomic nervous system are used: 1) the startle reflex, an eye blink reflex that is induced by an acoustic probe 2) the post auricular reflex, also induced by an acoustic probe 3) the skin conductance response and 4) the heart rate. They are chosen because of their differential susceptibility to habituation and positive and negative emotional states [1]. Next to the autonomic nervous system measurements an emotional state will be measured by self reports.

Author Keywords

Emotion, startle reflex, post auricular reflex, odour.

ETHICAL CONSIDERATIONS

The study has written approval by the Tilburg Medical Ethical Committee. The study has been conducted end 2009 according to the Declaration of Helsinki and The Medical Research Involving Human Subjects Act (WMO).

STUDY DESIGN

Thirty six healthy people between 18 and 55 years of age participate in the study. Odours are delivered through a custom built olfactometer. All psychophysiological measures are acquired through Psylab bio amplifiers

(Contact Precision Instruments (CPI), London UK).

The study consists of two experimental sessions conducted on two separate days. In the first session, subjects are presented with only odours: pleasant (peach, vanillin) and unpleasant (rotten eggs) [2]. These odours are presented via an olfactometer in short bursts, interspersed with clean air (not odourised). Every 30-50 seconds, very abrupt and loud noise bursts are delivered through in-ear phones. Throughout the experiment, startle blinks and post auricular reflexes (Electromyogram, EMG), skin conductance and heart rate (electrocardiogram, ECG) are measured. Subject's emotional state is measured via self report.

In the second session, the same subjects are presented with only the pleasant odour peach, but this is put in the context of more elaborate product experience. In addition to experiencing the odour via the olfactometer, participants drink a peach flavoured soft drink and are presented with short movie clips that are thought to be congruent with product experience (a terrace in summer).

METHODS

Startle Reflex

The human startle response is a defensive reflex that is mainly characterised by rapid eye closure or blink, of which the magnitude can be measured from electrodes placed over the orbicularis oculi muscle beneath the lower eyelid [3]. In human research, short bursts (around 50 milliseconds) of white noise with instantaneous onset and a sound level of about 100 dB (A) are the most commonly used startle probes.

The startle response is measured by two Ag/AgCl electrodes attached below the lower eyelid over the orbicularis oculi and one ground electrode attached to the forehead. The skin is cleaned with alcohol (70%) and slightly abraded. Special electrode paste is used to enhance conduction and special adhesive rings are used to attach the electrodes.

All signals are fed into a special purpose bioamplifier (Psylab bio2, CPI) with a 30Hz high pass and 500Hz low pass filter and a gain of 50 μ V. The raw signal is sampled with 200Hz and recorded as well as the rectified and

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integrated signal that is derived from an online rectifier/integrator (CPI, London). A 50 Hz bandstop filter is applied to reduce mains noise.

A loud burst (100dB (A)) of white noise with instantaneous rise time and a duration of 50 milliseconds is delivered through in-ear headphones by means of a noise generator unit (CPI). We hypothesise that the startle amplitude will be increased by the unpleasant odour and reduced by the pleasant odour [4].

Post Auricular Reflex

The post auricular reflex (PAR), also induced by an acoustic probe, has been described as a useful tool for measuring appetitive responding in human [5]. The PAR is measured from the tendon of insertion behind the pinna (outer ear) of the right ear by means of two Ag/AgCl electrodes. In order to attach the electrodes correctly, the pinna is pulled forward. The skin is cleaned with alcohol and slightly abraded. Electrodes are attached by means of adhesive rings and special conductive paste is applied. All signals are fed through a special purpose bioamplifier Psylab bio2, CPI) with a bandpass filter of 10 – 1000 Hz and a gain of 50 μ V. The signal is sampled with 250 Hz. A 50 Hz bandstop filter is applied to reduce mains noise. We hypothesise that the (appetitive) PAR amplitude will be increased by the pleasant odour and reduced by the unpleasant odour, so opposite to the defensive startle. Moreover, in a second session the pleasant odour peach will be paired with a film clip creating a specific positive emotional context and a gustatory stimulus. We expect that the startle modulation and the PAR amplitude will be largest when the odour is paired with the gustatory stimulus and a film clip with a content that is congruent with the emotion elicited by the odour alone

Skin Conductance Response

Skin conductance measurement is based on changes in the resistance of the skin caused when glands in the skin produce ionic perspiration. An increase of conductivity is caused when the skin is sweaty. The electrodermal conductivity is measured by passing a small current through a pair of Ag/AgCl electrodes placed on the thenar and hypothenar eminences of the palm of the non-dominant hand. The areas where the electrodes are attached are cleaned with alcohol and slightly abraded to enhance skin contact. Special SCR gel is applied to the electrode to increase conductivity. The signal is fed through a Psylab electrodermal amplifier (CPI, London) with an on-line 10Hz filter. The gain setting is 0.4 μ Siemens. The data are stored as a continuous signal at 200Hz. We hypothesise that there will be a significant difference in SCR amplitude

between odour and no-odour conditions, but not between odour conditions, as skin conductance covaries more with arousal than valence of the stimuli.

Heart Rate

Heart rate is measured by means of three disposable Ag/AgCl adhesive gel-disc electrodes, two of which are attached to the collarbone and one (ground) electrode is attached elsewhere on the chest. The skin is cleaned with alcohol and slightly abraded before electrodes are attached. The signal is fed into a Psylab bioamplifier (CPI, London, UK) with a high pass filter of 0.5 Hz and a low pass filter of 40Hz. For heart rate, we do expect to find a difference between odour conditions, with unpleasant odours/stimuli eliciting the greatest initial declaration of heart rate and pleasant odours/stimuli the greatest peak acceleration.

Verbal Emotion: Affect Grid

The affect grid is a scale designed as a quick means of assessing affect along the dimensions of pleasure-displeasure and arousal-sleepiness [6].

RESULTS

We are analyzing the data and expect to show the results on the Measuring Behaviour Conference 2010.

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