Classical conditioning in an immersive 3D interactive environment

Project Presentation
BCBT13

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Introduction

Experiments on human cognition and behavior are normally conducted under controlled lab conditions.

Virtual Reality allows to:
- setup ecologically valid environments;
- control systematically the stimuli presented;
- measure the user’s (implicit and explicit) reactions.
The question

1. Can we reproduce a standard classical conditioning experiment in life-like conditions?

2. Is it possible to “transfer” the conditioning effects to the natural world?

Pavlov, 1927; Stuart et al. 1987; Elnora et al. 1990, Huff et al. 2010
Methods: the XIM

The eXperience Induction Machine is an immersive space equipped with a number of sensors and effectors to conduct experiments on human behaviour in ecologically valid conditions.
Methods: the IAPS database

The International Affective Picture System (IAPS) is a database of pictures used to elicit a range of emotions (Bradley et al., 1997).

The images are classified on the basis of self-assessment reports of hundreds of participants.
Methods: the sensing glove

We used a prototype wearable sensing glove that:

• records the subject’s EDA;
• detects single-finger movements (e.g. grabbing).

ElectroDermal Activity is a measure of the sweat gland activity, directly controlled by Sympathetic Nerve Activity (SNA) [Fowles et al. 1981, Boucsein et al. 2011], that allows to monitor the Autonomic Nervous System (ANS).
Experimental design: Self-Assessment of emotions

SAM QUESTIONNAIRE

(However) SAM presents some limitations:
• Low resolution scales (7 or 9 points)
• Images can be confusing
• Dominance not always clear
Experimental design: Self-Assessment of emotions

The Affective Slider

- Measures Valence ("Positivity") and Arousal ("Excitement")
- High resolution scale (from 0 to 1 with .01 step)
- Use of cool and warm color gradients to convey respectively Valence and Arousal.
The 3D virtual world
The 3D virtual world
Experimental setup: protocol

Olson et al. 2002
Experimental design: overview

**H1** = the subjects undergo conditioning after being exposed to the experiment in the XIM, subsequently the conditioning effect is transferred in the natural world.

**Independent samples design:**
- 1 control group
- 1 experimental group

**Variables:**
- Independent: cues and stimuli in the virtual world.
- Dependent: self-assessment questionnaire, EDA.

**Sample:** 4 Subjects (1 female, mean age 26.3 +/- 4SD). 30 Trials per subject
Experimental design: cues and stimuli

Cues

Stimuli
Images from the IAPS database with:
- high arousal, low valence (experimental group)
- low arousal (control group)
Experimental setup

A participant in the XIM while exposed to the conditioning experiment
Results: self-assessment

Self-Assessed Arousal associated to the negative cue is significantly higher in the experimental group when compared to the control group ($p < .05$) *

* The result accounts for a minimal trend: the distribution of trials and the sample size are not sufficient for statistical inference.
Results: EDR

Electrodermal response recorded from one subject exposed to the experimental condition in the XIM. N.B. Presence of artifacts due to the grabbing
Discussion

- Preliminary results are promising
- Some issues in the Unity Application
- (A new experiment with) A larger sample is needed
- Psychophysiological data recorded from the glove (EDR) must be cleaned to remove artifacts and analyzed
Future improvements

- Improve the VR application
- Expose subjects to the conditioning objects in the natural world after the experiment (and measure their EDA).