

## Cue reactivity towards shopping cues in female participants

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**Background and aims:** It is currently under debate whether pathological buying can be considered as a behavioural addiction. Addictions have often been investigated with cue-reactivity paradigms to assess subjective, physiological and neural craving reactions. The current study aims at testing whether cue reactivity towards shopping cues is related to pathological buying tendencies. **Methods:** A sample of 66 non-clinical female participants rated shopping related pictures concerning valence, arousal, and subjective craving. In a subgroup of 26 participants, electrodermal reactions towards those pictures were additionally assessed. Furthermore, all participants were screened concerning pathological buying tendencies and baseline craving for shopping. **Results:** Results indicate a relationship between the subjective ratings of the shopping cues and pathological buying tendencies, even if baseline craving for shopping was controlled for. Electrodermal reactions were partly related to the subjective ratings of the cues. **Conclusions:** Cue reactivity may be a potential correlate of pathological buying tendencies. Thus, pathological buying may be accompanied by craving reactions towards shopping cues. Results support the assumption that pathological buying can be considered as a behavioural addiction. From a methodological point of view, results support the view that the cue-reactivity paradigm is suited for the investigation of craving reactions in pathological buying and future studies should implement this paradigm in clinical samples.

**Keywords:** pathological buying, compulsive buying, cue reactivity, craving, behavioural addiction, electrodermal activity

### INTRODUCTION

Pathological buying is characterized by extreme and maladaptive shopping behaviour leading to social, personal and financial problems (e.g. Faber & O’Guinn, 1992). Diagnostic classification of this disorder is still under debate; while some authors classify pathological buying as a behavioural addiction (Grüsser, Poppelreuter, Heinz, Albrecht & Saß, 2007), others classify it as an impulse control disorder (McElroy, Hudwon, Pope, Keck & Aizley, 1992), or more generally as an obsessive-compulsive spectrum disorder (Hollander & Wong, 1995). In the diagnostic criteria of the ICD-10 (World Health Organisation, 1994) and the DSM-IV-TR (American Psychiatric Association, 2000) pathological buying is not defined as a discrete disorder but it is subsumed under the “disorders of impulse control not elsewhere classified”. In the current paper, the neutral term pathological buying is used (Müller & de Zwaan, 2010). Models of aetiology and pathogenesis of pathological buying emphasize dysfunctional affective (avoidance of negative emotions, pleasure seeking, and craving) and cognitive processes (impulsivity, loss of self-control, dysfunctional decision making) (Kyrios, Frost & Steketee, 2004) as relevant for the development and maintenance of pathological buying. Epidemiological studies estimate a prevalence between 5.8 percent (Koran, Faber, Aboujaoude, Large & Serpe, 2006) to 11.3 percent in a student population (Villegla et al., 2011). Consequences for the individual include severe distress, feelings of guilt and remorse, suicide attempts, familiar and occupational conflicts, excessive debt, bankruptcy, and engaging in illegal activities in order to provide money or shopping goods (e.g., Christenson et al., 1994;

O’Guinn & Faber, 1989). Consequences for society include treatment costs (although they are hard to quantify because many pathological buyers are in treatment due to other psychiatric conditions) and also the costs for discharge of residual debt (Neuner, 2001). Despite the high prevalence and the detrimental impact for both, the individual and the society, studies investigating single facets of pathological buying such as neuropsychological or neurobiological correlates are scarce so far. The serotonergic, dopaminergic and opioide systems may be involved in the aetiology and pathogenesis of pathological buying (Grant, 2003; Koran, Aboujaoude, Solvason, Gamel & Smith, 2007; Koran, Chuong, Bullock & Smith, 2003). On a neural level, one assumes dysfunctions in cognitive (dorsolateral prefrontal cortex, nucleus caudatus) and affective brain circuits (ventromedial prefrontal/orbitofrontal cortex, nucleus accumbens, anterior cingulate cortex, basolateral amygdala) (review in Black, 2007). However, empirical evidence is still lacking and the assumptions are based on findings from other so-called behavioural addictions, impulse control disorders and obsessive-compulsive spectrum disorders.

One mechanism that may help maintain substance dependence and trigger relapse is craving. Craving is defined as a very strong urge to consume a substance. Craving reactions can be elicited by cues such as pictures or odours of the substance. Cue reactivity is frequently assessed by ratings of

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valence, arousal, and subjective craving elicited by the respective cues (e.g., Stippekohl et al., 2010) and/or physiological or neural reactions towards the cues (e.g., Braus et al., 2001; Szegedi et al., 2000). A meta-analysis covering 41 studies indicates that patients suffering from substance dependence not only show higher subjective, but also higher physiological (particularly electrodermal) reactions when confronted with substance-related cues compared to neutral cues (Carter & Tiffany, 1999). Studies using functional imaging techniques report increased neural activation in cognitive (dorsal striatum) and particularly in affective circuits (ventromedial prefrontal/orbitofrontal cortex, nucleus accumbens, anterior cingulate cortex, basolateral amygdala) in addicted patients when confronted with substance-relevant cues (Heinz, Beck, Grüsser, Grace & Wrase, 2009). Particularly, physiological and neural reactions appear to be associated with relapse after withdrawal (Wrase, Grüsser & Heinz, 2006).

An emergent development is that researchers have transferred the concepts of craving and cue reactivity to behavioural addictions such as pathological gambling and excessive computer gaming (Grüsser et al., 2007). There are some recent studies investigating craving reactions towards addiction-relevant visual cues vs. neutral cues in patients suffering from excessive behaviour vs. healthy controls. Patients suffering from pathological gambling demonstrate subjective craving (Grüsser, Plöntzke & Albrecht, 2005) and increased brain activations in cognitive and affective circuits (Crockford, Goodyear, Edwards, Quickfall & el-Guelbaly, 2005; Goudriaan, de Reuter, Van den Brink, Oosterlaan & Veltman, 2010). Some recent studies also show cue reactivity in persons who excessively play online-games including heightened electroencephal reactions (Thalemann, Wölfling & Grüsser, 2007), and increased brain activations in cognitive and affective circuits (Han, Hwang & Renshaw, 2010; Ko et al., 2009). One recent study investigated whether subjective cue reactivity to internet-sex stimuli could predict problematic internet-sex usage (Brand et al., 2011). Results demonstrate that subjective sexual arousal rating of visual internet-sex cues was a significant predictor of scoring in the Internet Addiction Test (Young, 1998) modified for internet sex.

Thus, participants who suffer from behavioural addictions can show heightened subjective, electroencephal and neural reactions towards visual cues associated with the respective addiction. In the current study, we tested subjective evaluations of shopping-related pictures and electrodermal reactions towards these pictures in female participants. Besides, participants were screened for pathological buying tendencies and baseline craving for shopping. A non-clinical sample was investigated in this first approach to address the relationship between cue reactivity and pathological buying tendencies. A homogenous sample has the advantage that one does not have to control for demographic variables or co-morbid disorders. Thus, we assume that when finding effects in a non-clinical sample the probability for finding effects in a clinical sample is quite high. We hypothesize that the subjective and electrodermal reactions towards the pictures are related to the pathological buying tendencies beyond simple baseline craving towards shopping as found in other substance (review in Carter & Tiffany, 1999) or behavioural addictions (e.g., Goudriaan et al., 2010; Grüsser et al., 2007). We also expect that the subjective and electrodermal reactions towards the pictures are interrelated.

## METHODS

### *Participants*

In this study, 66 females participated (mean age = 22.93,  $SD = 4.34$ , range = 19 to 55 years). The sample was a non-clinical sample that was not examined extensively for neurologic or psychiatric diseases. All participants filled out the questionnaires described below and subjectively evaluated the shopping cues. In a subgroup of 26 participants, electrodermal reactions towards the shopping cues were additionally assessed. Most of the participants (more than 90 percent) were students or academics that were recruited through advertisements on the campus Duisburg. All participants provided written informed consent and the study was approved by the local ethics committee of the University of Duisburg-Essen (INKO Department, Campus Duisburg).

### *Pathological buying and baseline craving*

The Compulsive Buying Scale (CBS; Faber & O'Guinn, 1992) was used to screen for pathological buying tendencies. It has seven items about emotional and financial aspects of pathological buying that have to be answered on a five-point scale (1 = "very often" or "very much"; 5 = "never" or "not at all"). In line with Faber and O'Guinn (1992), answers are weighted according to a specific formula which is based on a regression model and then summed up to create an overall score. The formula is:  $-9.69 + (1a \times .33) + (2a \times .34) + (2b \times .50) + (2c \times .47) + (2d \times .33) + (2e \times .38) + (2f \times .31)$ . If people have a score smaller than  $-1.34$  (representing two standard deviations below the mean) they are screened as at risk for pathological buying. Thus, the smaller the overall scores are the higher is the risk for pathological buying. Faber and O'Guinn reported very good construct and criterion validity of the CBS (correctly classifying 88% of persons with clinically confirmed compulsive buying) and very good internal consistency (Cronbach's  $\alpha = .95$ ). Although the scale was originally developed to distinguish pathological from non-pathological buyers, some recent studies have used the CBS as a continuous variable to detect relationships between the severity of pathological buying and personality or co-morbid disorders (e.g., Müller et al., 2011).

A craving questionnaire that was modified for craving for shopping from the Drug and Alcohol Questionnaire (DAQ; Love, James & Willner, 1998) was used to determine baseline craving for shopping (see Appendix A). It contains 14 items that have to be answered on a seven-point scale ( $-3$  = "complete disagreement" to  $3$  = "complete agreement"). Results are summed up after recoding of two negatively formulated items to create an index of current craving for shopping. Baseline craving for shopping was assessed in order to disentangle general craving for shopping from cue reactivity. Questionnaires were administered before the cue rating task started.

### *Subjective cue rating*

Photographs of shopping goods or shopping scenes were taken including pictures of general scenes (distal cues) such as paying at the cash desk, leaving a shop with shopping bags; and pictures of typical shopping items (proximal cues) that females with pathological buying preferentially buy.

For the proximal cues the categories “clothes”, “shoes”, “CDs/DVDs”, “jewellery”, “cosmetics”, and “household aids” were chosen (e.g. Black, 2007). A recent study revealed that both proximal and distal cues are able to elicit subjective cue reactivity in smokers (Conklin, Robin, Perkins & Salked, 2008), albeit reactions were higher for proximal cues. A total of 80 pictures were selected from a pre-study (see Appendix B); 20 of them depicted distal cues and 10 of them depicted the proximal cues of each category. Examples of one distal and two proximal cues can be viewed in Figures 1A–1C. Participants were shown a list of the proximal cue categories and were asked which two categories from the list they would prefer to purchase in order to individualize cues according to preference. This was done because persons strongly differ in their shopping preferences and being exposed to an individually uninteresting proximal cue would not elicit cue reactivity at all. Thus, each participant saw 40 shopping cues – 20 distal cues and 20 proximal cues, the latter ones individualized according to the participants’ preference. Pictures, sized 700 × 500 pixel or 500 × 700 pixel, respectively, were presented in a randomized order via the program Presentation (Neurobehavioral Systems, Albany, USA) and rated on the dimensions valence (1 = “very negative” to 5 “very positive”), arousal (1 = “not at all arousing” to 5 “very arousing”), and craving to shop elicited by the picture (1 = “not at all” to 5 “very strong”). Each picture was shown until a rating is given on the respective dimension. Scores were then transformed into percentage values (0 to 100) to increase intuitive comprehensibility.

#### Electrodermal activity

In a subgroup of 26 participants, electrodermal activity was recorded while the pictures were presented but before the cues were rated. Skin conductance responses (SCRs) were measured using two Ag/AgCl electrodes (0.5 V) with electrode paste (0.05 M NaCl). The electrodes were attached to the thenar and hypothenar palm of the subjects’ non-dominant hand. SCRs were recorded with the V-Amp System (Brain Products, Munich, Germany), and were saved on a computer with the V-Amp analyzer-system and software. To minimize artefacts, subjects were seated in a comfortable chair and were asked neither to move nor to speak. Markers were set automatically during data collection, thus, whenever a picture was presented via the program Presentation, a marker was set in the SCR data. Each picture was shown for seven seconds followed by a fixation cross that was shown for five seconds. The inter-stimulus intervals were used to ensure that stimulus SCRs did not overlap and to allow skin conductance levels to return to baseline (Boucsein, 1992). Data were analysed with the program LEDALAB (Benedek

& Kaernbach, 2009). The time window for analysing SCRs was one to five seconds after each pictures’ presentation. During this time window, the maximal deflection (difference between nadir and peak) was analysed. SCRs were measured in Micro-Siemens (μS) and the threshold value for analysing SCRs was set to 0.05 μS. Results of the SCRs are provided in range-corrected values between zero and one. For range-correction the SCRs were divided by the maximum SCR over the session for each participant according to Lykken and Venables (1971) and the square root was taken. The following formula was used:  $SCR_{corrected} = \sqrt{(SCR_{raw} \text{ score} / SCR_{maximum})}$ .

## RESULTS

#### Statistical preconditions

All variables that were used for analysis were normally distributed which was confirmed by the Kolmogorov–Smirnov test. Therefore, parametric testing was done in all analyses. Furthermore, in the regression models there were no signs of strong multicollinearity as shown by tolerance, variance inflation factor, and condition number test.

#### Descriptive data of pathological buying, baseline craving and cue ratings

The CBS scores ranged from –4.50 to 3.61 (mean = .83, *SD* = 1.76). Eight participants were screened as compulsive buyers. Current craving scores that were assessed before the cue presentation ranged from –2 to 2 (mean = –.65, *SD* = 1.09). Results of the cue ratings can be found in Table 1.

Table 1. Descriptive results of the shopping-cue ratings on the dimensions valence, arousal and subjective craving

| Ratings in percent | Minimum | Maximum | Mean  | <i>SD</i> |
|--------------------|---------|---------|-------|-----------|
| Valence            | 23.60   | 92.20   | 64.83 | 13.17     |
| Arousal            | 21.53   | 83.90   | 55.49 | 14.14     |
| Craving            | 24.10   | 81.60   | 53.90 | 14.51     |

#### Relationship between pathological buying and subjective cue reactivity

Scores of the CBS were significantly negatively correlated with cue-ratings concerning valence ( $r = -.33$ ,  $p < .01$ ), arousal ( $r = -.28$ ,  $p < .05$ ), and subjective craving ( $r = -.31$ ,  $p < .01$ ). This inverse correlation means that high cue reactivity is associated with high pathological buying tendencies, since smaller CBS scores indicate higher tendency to-



Figures 1A–1C. One distal cue and two proximal cues from the categories cosmetics and household aids (brand names are blackened, but were originally shown)



wards pathological buying. Baseline craving for shopping was controlled for in these partial correlations.

We further evaluated the relationship between the CBS score as dependent variable and cue-ratings and baseline craving as predictors in a hierarchical regression analysis. In a first step, baseline craving slightly failed to reach significance as a predictor of the CBS ( $R^2 = .051$ ,  $F = 3.41$ ,  $df1 = 1$ ,  $df2 = 64$ ,  $p = .07$ ). When adding (second step) cue-rating (valence, arousal, and craving) as predictor, the changes in  $R^2$  were significant (changes in  $R^2 = .118$ , changes in  $F = 2.88$ ,  $df1 = 3$ ,  $df2 = 61$ ,  $p < .05$ ). The whole model was also significant and the two predictors together explained 16.9 % of variance ( $F = 3.09$ ,  $df1 = 4$ ,  $df2 = 61$ ,  $p < .05$ ). For further values see Table 2.

Table 2. Hierarchical regression analysis with the CBS score as dependent variable

| Main effects step 1 | Beta | T     | p   |
|---------------------|------|-------|-----|
| Baseline craving    | -.23 | -1.85 | .07 |
| Main effects step 2 | Beta | T     | p   |
| Baseline craving    | -.23 | -1.81 | .08 |
| Valence             | -.23 | -1.24 | .22 |
| Arousal             | .05  | .21   | .84 |
| Craving             | -.20 | -1.01 | .32 |

### Electrodermal reactions

In the subgroup of the 26 participants in which electrodermal reactions were recorded, three of the compulsive buyers were represented. Range-corrected SCRs ranged from .05 to .35  $\mu$ S (mean = .16,  $SD = .07$ ). SCRs were not related to the values of the CBS ( $r = -.07$ ,  $p = .73$ ). For the subset of proximal shopping-cues, SCRs and subjective valence rating were significantly related ( $r = .42$ ,  $p < .05$ ), and the relationship between subjective arousal and SCRs showed a trend ( $r = .35$ ,  $p = .08$ ). Further relations between subjective cue ratings and electrodermal reactions were not observed.

## DISCUSSION

Results of the study indicate that subjective ratings of shopping cues are related to pathological buying tendencies even when baseline craving for shopping is controlled for. Electrodermal reactions towards the cues are partly related to the subjective cue ratings, but not to pathological buying tendencies.

The relationship between subjective rating of the shopping cues and pathological buying tendencies provide first evidence that subjective cue reactivity is a potential correlate of the development and maintenance of pathological buying in females. On a methodological level, results give rise to the assumption that the cue-reactivity paradigm is a suitable measure to investigate craving in pathological buying. We believe that the correlations are reliable and not simply an artefact of scoring high on rating scales, because the compulsive buying scale and the subjective cue ratings are inversely coded. Furthermore, baseline craving was controlled for in order to disentangle craving for shopping prior to the cue ratings from cue reactivity. The regression analysis supports the assumption that baseline craving alone does not predict pathological buying tendencies, but adding the three components of cue reactivity the regression model does pre-

dict them. The relationship between cue rating and pathological buying tendencies is in line with recent studies that investigated subjective cue reactivity in other behavioural addictions. One recent study also demonstrates that subjective cue reactivity to internet-sex stimuli predicts problematic internet-sex usage in a non-clinical sample (Brand et al., 2011). In a clinical sample including patients suffering from pathological gambling, subjective cue reactivity towards gambling-related cues could be demonstrated (Grüsser et al., 2005).

The relationship between the subjective rating of the proximal shopping cues and the electrodermal reactions towards these cues illustrates that the selected shopping-stimuli are in principal suited for this kind of research. The idea behind measuring electrodermal responses is to detect correlates of arousal that is not under volitional control and therefore not susceptible to social desirability or other response tendencies (e.g., Boucsein, 1992). However, electrodermal responses towards addiction relevant cues cannot be unambiguously attributed to craving reactions. Electrodermal responses towards cues have been found to be lower than subjective reactions (Carter & Tiffany, 1999), but they can also be larger than subjective responses – at least in a subgroup of patients who do not report subjective craving (Szegedi et al., 2000). We also expected a relationship between the electrodermal responses towards the shopping cues and the tendencies for pathological buying, because studies in patients with substance use disorder have clarified that substance-related cues elicited electrodermal reactions in the addicted patients (Carter & Tiffany, 1999; Szegedi et al., 2000). However, this prediction was not confirmed by our results. Reasons for not finding a relationship between pathological buying tendencies and electrodermal reactions may be that, contrary to the aforementioned studies, a non-clinical sample was used. Additionally, the subsample in which electrodermal reactions were measured was quite small. We assume that studies including both a clinical group of pathological buyers and healthy control participants should also detect physiological cue reactivity in the pathological buyers.

Several limitations have to be kept in mind when interpreting the results. First, a non-clinical sample was investigated. This is instructive as a first approach, but naturally results do not reflect cue reactivity in patients with severe pathological buying. Additionally, the subsample in which electrodermal responses were recorded was quite small. Thus, future research is needed in which a patient sample is compared with healthy control participants concerning both, subjective and physiological cue reactivity. Another critical point is related to the participants' shopping preferences. Persons (whether pathological buyers or not) differ very strongly concerning their shopping habits, so we individualized the shopping cues of specific product categories. This results in the fact that the cues varied across participants. However, this problem is hard to solve if one aims to show specific proximal shopping cues. This is different compared to cue reactivity measures in for example smoking related or alcohol related cues. Finally, baseline craving was assessed with a questionnaire in the current study and not with non-shopping cues. The comparison between reactions towards shopping cues versus non-shopping cues should be added in future studies.

Despite these caveats, current results provide preliminary findings that subjective cue reactivity is a potential correlate of the development and maintenance of pathological buying in females. The cue-reactivity paradigm is consid-

ered as a suitable measure of subjective craving reactions in female participants with pathological buying tendencies. The stimuli are also seen as well suited for eliciting physiological reactions. Thus, future studies could use this paradigm for clinical studies with females suffering from pathological buying. In these studies, craving reactions can be investigated in order to support the assumption that pathological buying can be considered as a behavioural addiction. Given the lack of empirical studies on this topic, the current investigation may inspire future research to better understand mechanisms contributing to pathological buying.

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## APPENDIX A

## MODIFIED CRAVING QUESTIONNAIRE

The Drug and Alcohol Questionnaire that measures current craving for drinking was modified to measure current craving for shopping. The modified items are listed below:

- I want to go shopping so much, I can almost feel it.
- My desire to go shopping now seems overwhelming.
- I would do almost everything to go shopping now.
- I am going to go shopping as soon as I possibly can.
- I would consider to go shopping now.
- I would accept to go shopping now if it was offered to me.
- I would feel as if all the bad things in my life had disappeared if I could go shopping now.
- Even major problems in my life would not bother me if I could go shopping now.
- I would feel less worried about my daily problems if I could go shopping now.
- Going shopping now would make me feel less tense.
- If I started shopping now I would be able to stop.
- I could easily limit how much I would shop if I would go shopping now.
- Going shopping would be satisfying now.
- Going shopping would be pleasant now.

## APPENDIX B

## CUE SELECTION

Overall, 74 female participants aged between 18–79 years (mean = 26.26,  $SD = 10.92$ ) took part in the pre-study for the cue selection. They were not screened for any psychiatric disease or shopping preferences. A total of 160 shopping pictures were taken: 40 of them depicted distal cues/general shopping scenes such as paying at the cash desk or leaving a shop with shopping bags; and 20 depicted each of the categories “clothes”, “shoes”, “CDs/DVDs”, “jewellery”, “cosmetics”, and “household aids”. Participants had to rate each picture concerning “valence” and “arousal” on a seven-point scale (0 = “very negative” to 6 = “very positive”; 0 = “not at all arousing” to 6 = “very arousing”). For this rating, the tool “LimeSurvey” ([www.limesurvey.org](http://www.limesurvey.org)) was used. Out of each category, half of the pictures which were rated high concerning valence and arousal, were selected for the main study. In Figure 2, mean percentage values are presented for those pictures that were selected for the main study.

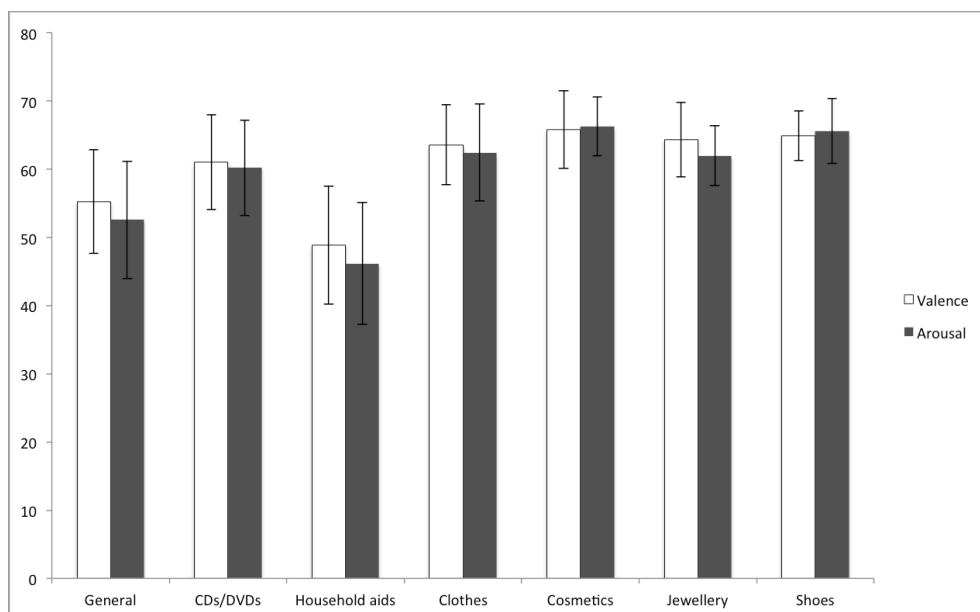


Figure 2. Percentages of means and standard deviations concerning valence and arousal of the pictures selected