



Desire thinking as a mediator of the relationship between novelty seeking and craving



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ABSTRACT

Background: The construct of craving has been shown to play a crucial role in the development and maintenance of addictive behaviors. Both novelty seeking and desire thinking have been identified, respectively, as important temperamental and cognitive predictors of craving.

Aims: In the present study we aimed to explore the relative contribution of novelty seeking and desire thinking towards craving, hypothesizing a sequence of multiple mediating relationships starting from novelty seeking and moving onto imaginal prefiguration, verbal perseveration and craving in serial fashion.

Method: A convenience sample of 270 individuals completed measures assessing novelty seeking, desire thinking, and craving relating to a chosen activity.

Results: Findings showed that, controlling for age and gender, desire thinking components predicted craving over and above novelty seeking. The indirect effect from novelty seeking to craving, via desire thinking components, was significant thus supporting a multiple-mediational sequence. Finally, the relationship between imaginal prefiguration and craving was found to be partially mediated by verbal perseveration.

Conclusions: The findings provide support for the conceptualization of desire thinking as an independent construct in predicting craving over and above novelty seeking.

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1. Introduction

Craving has been defined as a subjective experience that prompts individuals to seek out and achieve a target, or practice an activity, in order to reach its desired effects (Marlatt, 1987). This construct has long been identified as an important contributor to behavioral loss of control and is considered a key area of treatment focus for the addictive behaviors (e.g. O'Malley, Krishnan-Sarin, Farren, Sinha, & Kreek, 2002; Paille et al., 1995). Craving has also been shown to be a major risk factor in triggering relapse (Evren, Cetin, Durkaya, & Dalbudak, 2010; Killen & Fortmann, 1997) and in predicting generally worse outcomes in the treatment for substance abuse (Cooney, Litt, Morse, Bauer, & Gaupp, 1997; Miller, Westerberg, Harris, & Tonigan, 1996).

Research has shown that craving is influenced by a variety of individual and contextual variables such as perceived drug availability

(Dar, Rosen-Korakin, Shapira, Gottlieb, & Frenk, 2010; Dar, Stronguin, Marouani, Krupsky, & Frenk, 2005), expectancies (Dols, van den Hout, Kindt, & Willems, 2002) and stress (Koob, 2008). Psychobiological models of craving have emphasized that craving is directly influenced by biological and temperamental individual differences (Cloninger, 1996). In particular, novelty seeking has shown to play an important role in predicting craving. Novelty seeking is defined as a temperament trait moderately heritable, normally distributed, and developmentally and situationally stable (Cloninger, 1986) which makes individuals quick-tempered, excitable, exploratory, curious, enthusiastic, ardent, easily bored, impulsive and disorderly (Kose, 2003). With respect to the relationship between novelty seeking and craving, research has shown that the most vulnerability to alcohol dependence may be linked to high levels of novelty seeking (Mulder, 2002); moreover, high novelty seekers have been described as at increased risk of using drugs of abuse relative to low novelty seekers (Bardo, Donohew, & Harrington, 1996; Wills, Vaccaro, & McNamara, 1994). Finally, research has suggested that novelty seeking represents a vulnerability factor for substance abuse in general (Gabel, Stallings, Schmitz, Young, & Fulker, 1999; Hosak, Preiss, Halir, Cermakova, & Csemy, 2004). With respect to the risk of relapse, Evren, Durkaya, Evren, Dalbudak, and Cetin

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(2012) have found novelty seeking to be related with relapse both directly and indirectly via craving.

More recently, in the elaborated intrusion (EI) theory of desire (Kavanagh, Andrade, & May, 2005; Kavanagh, May, & Andrade, 2009; May, Andrade, Panabokke, & Kavanagh, 2004), it has been suggested that the intensity and duration of craving may be, in part, determined by the activation of a cognitive elaboration process defined as ‘desire thinking’ (Caselli & Spada, 2010, 2015). Desire thinking has been described as a voluntary cognitive elaboration of a desired target imaginal prefiguration and verbal perseveration (Caselli & Spada, 2010; Kavanagh, Andrade, & May, 2004). Imaginal prefiguration refers to the allocation of attention to target-related information and to the tendency to anticipate positive imagery or positive target-related memories. Verbal perseveration refers to prolonged self-talk about reasons for engaging in target-related activities and their achievement (Caselli & Spada, 2015). Desire thinking has been shown to have a significant effect on craving across a range of addictive behaviors in a community sample (Caselli, Soliani, & Spada, 2013), predict craving in alcohol abusers independently from level of alcohol use (Caselli & Spada, 2011), and play a role across the continuum of drinking and smoking behavior (Caselli, Ferla, Mezzaluna, Rovetto, & Spada, 2012a; Caselli, Nikčević, Fiore, Mezzaluna, & Spada, 2012b). Similar findings have been replicated in problem gambling and problematic Internet use (Ferne et al., 2014; Spada, Caselli, Slaifer, Nikčević, & Sassaroli, 2014).

To our current knowledge, no study has explored the relative contribution of the temperamental facet of novelty seeking and desire thinking components towards craving. We hypothesized a sequence of multiple mediating relationships that begin from novelty seeking (as a broad vulnerability component) affecting imaginal prefiguration and verbal perseveration in a serial fashion (see Fig. 1). The order of mediators has been chosen on the basis of a conceptual model of the relationship between desire thinking and craving (Caselli & Spada, 2015). Following this model, imaginal prefiguration represents a more distal predictor on craving that is partially mediated by the activation verbal perseveration. This assumes that decision-making processes and mental planning about target achievement (verbal perseveration) should have a stronger impact on craving and may be activated by the multi-sensory elaboration of target-related information (imaginal prefiguration).

2. Methods

2.1. Participants

A convenience sample of 270 individuals (140 female) agreed to take part in the study. For purposes of inclusion participants were required to be at least 18 years of age and to be fluent in Italian. The mean age for the total sample, which consisted primarily of Caucasians, was 36.3 years ($SD = 15.4$) and the age range was 18 to 65 years.

2.2. Self-report instruments

2.2.1. Temperament and Character Inventory (TCI; Cloninger, Przybeck, Svrakic, & Wetzel, 1994)

For evaluating novelty seeking, the TCI of Cloninger et al. (1994) was used in its Italian version (Fassino et al., 2002). Novelty seeking is a 40-item higher order temperament trait composed of four aspects of lower order traits: Exploratory Excitability versus Stoic Rigidity (NS1), Impulsiveness versus Reflection (NS2), Extravagance versus Reserve (NS3), and Disorderliness versus Regimentation (NS4). Participants are asked to answer on a true/false scale. The TCI has good internal consistency (Cloninger et al., 1994; Sato et al., 1999), inter-tester reliability and test–retest reliability (Cloninger et al., 1994).

2.2.2. The Desire Thinking Questionnaire (DTQ; Caselli & Spada, 2011)

This self-report instrument consists of 10 items assessing desire thinking. It consists of two sub-scales of five items each. The first sub-scale concerns the perseveration of verbal thoughts about desire-related content and experience (verbal perseveration) and includes items such as: “I mentally repeat to myself that I need to practice the desired activity”. The second sub-scale concerns the tendency to prefigure images about desire-related content and experience (imaginal prefiguration) and includes items such as: “I imagine myself doing the desired activity”. Items are general in content and refer to the desired activity that may be specified in the instructions. Higher scores indicate higher levels of trait desire thinking. The DTQ total score and factor scores have showed good factor structure, internal consistency, test–retest reliability, predictive and discriminative validity (Caselli & Spada, 2011).

2.2.3. The General Craving Scale (GCS)

The GCS is a modified version of the Penn Alcohol Craving Scale (PACS; Flannery, Volpicelli, & Pettinati, 1999). The PACS includes 5 self-report items that measure the duration, frequency and intensity of craving. Each question is scaled from 0 to 6. In the general version adopted in this study the 5 self-report item structure was maintained but items were rephrased so as to not refer to a specific desire target but to that which participants had previously indicated. For example item 1 of PACS “How often have you thought about *drinking* or how good a *drink* would make you feel?” was modified to: “How often have you thought about *your desired target* or how good *achieving it* would make you feel?”

2.3. Procedure

Participants were recruited from e-mail contacts in a viral-like fashion, starting from the University of Pavia (Italy) mailing list. Participants who received the e-mail request to visit the study website were also asked to forward the address to individuals in their e-mail contacts and ask those individuals to do the same.

When participants first visited the study website, the first webpage explained the purpose of the study: “To investigate the relationship between craving, thinking and temperament”. Participants were then

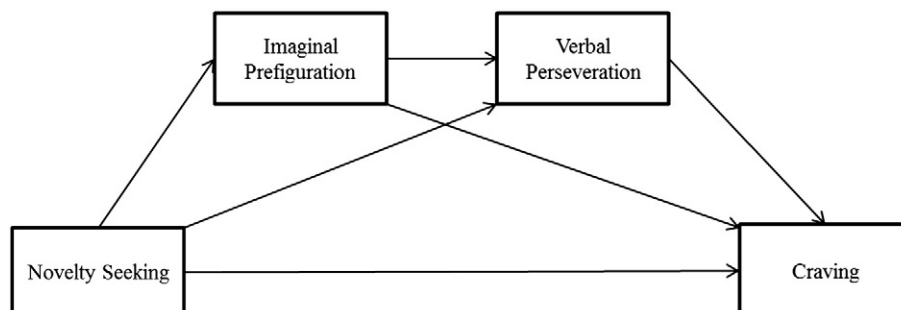


Fig. 1. Multiple-step multiple mediational conceptual model of desire thinking components mediators in serial in the relationship between novelty seeking and craving.

directed, if consenting to participate in the study, to a second webpage containing basic demographic questions. Then, on a further webpage, they were invited to think about a specific activity for which they usually felt a moderate or high level of desire toward, and to write it on a blank line. Following this, the measures were administered. Participants indicated their response to the items on the measures by selecting one of a series of “radio buttons”. Once the measures were completed participants were again informed that, should they consent to participate in the study, they should click on the “submit” button. Once participants had clicked on “submit”, their data was forwarded to a generic postmaster account. This ensured that participants’ responses were anonymous. All participants were then debriefed following the completion of the measures. If on clicking “submit”, participants had omitted any items from the measures or demographic questions, a window would appear informing them of the item they had failed to complete and their data would not be e-mailed. This ensured that only completed data were used for the analysis. A second submission from the same IP address was not allowed so as to avoid multiple submissions from the same participant.

3. Results

3.1. Data configuration and descriptive statistics

Analysis of the frequencies of desired target selection were as following: 20.5% for foods, 18.3% for physical activity, 16.8% for sexual activity, 15.7% for practice of hobbies, 10.8% for shopping, 7.8% for smoking, 5.6% for internet use, and 4.5% for alcohol use. A multivariate analysis of variance was run, with selected desired targets as a fixed factor, to investigate potential differences in craving. Craving was used as dependent variable. Significant differences were found for craving, [$F(7, 260) = 3.97; p < .001$]. Bonferroni pairwise comparisons indicated that craving for sexual activity was significantly greater than craving for shopping (mean difference = 5.86, $p = .001$) and eating (mean difference = 3.73, $p = .01$). No other significant differences were found.

Descriptive statistics for all variables from the final sample are presented in Table 1. An inspection of skewness coefficients showed that all measures were symmetrically distributed. We tested for the presence of multivariate outliers by calculating the distance of Mahalanobis (D^2), which identified two participants as multivariate outliers. These were eliminated from further analyses to ensure a linear relationship between variables. The coefficient of Mardia, which represents the multivariate kurtosis coefficient, was 111.01, lower than the critical value (120.0) for an asymmetrical multivariate distribution, indicating a multivariate normal distribution. An inspection of graphical distribution of D^2 on Q–Q plots also supported this finding.

We then examined multicollinearity using the Tolerance Index (T_i) and the Variance Inflation Factor (VIF). A T_i over .02 and a value under 5.0 for VIF are considered reliable cut-off points for the absence of multicollinearity. The T_i and VIF were measured for gender ($T_i = .98$; VIF = 1.03), age ($T_i = 0.96$; VIF = 1.04), novelty seeking ($T_i = 0.97$; VIF = 1.03), imaginal prefiguration ($T_i = 0.52$; VIF = 1.91) and verbal

perseveration ($T_i = .54$; VIF = 1.87). These analyses supported the absence of multicollinearity between variables.

Finally, an inspection of residual Q–Q plots, skewness (–0.26), and kurtosis (0.89) showed that: (1) residuals met the requirements for normality; (2) there was no indication of non-linearity; and (3) variance was constant for each combination of variables supporting their homoscedasticity. An inspection of correlation coefficients between standardized residuals and independent variables showed that there were no significant correlations. The Durbin–Watson coefficient was 1.82, identifying the absence of autocorrelation. The inspection of Cook’s distance and influential data points showed that no participants’ data would significantly change the regression analyses coefficients. Pearson product-moment correlations are presented in Table 1 and showed that age, novelty seeking, imaginal prefiguration and verbal perseveration were positively correlated with craving. In addition, novelty seeking was positively associated with imaginal prefiguration.

3.2. Multiple-step multiple mediator analysis

To investigate whether the effect of novelty seeking could be accounted by desire thinking we used a multiple-step multiple mediational analysis. This test allows verification of the extent to which the proposed chain of mediators carries the influence of an independent variable to a dependent variable. In our model, novelty seeking was entered as independent variable, while imaginal prefiguration and verbal perseveration were sequentially entered as proposed mediators. Craving was entered as dependent variable. Statistical analyses were carried out using PROCESS script version 2.13 for SPSS version 21.0 for Windows (Hayes, 2013).

The bootstrap test of indirect effects confirmed that imaginal prefiguration mediated the effect of novelty seeking on craving (See Fig. 2). In addition, verbal perseveration partially mediated the effect of imaginal prefiguration on craving. The final equation accounted for 47% of variance with imaginal prefiguration ($t = 4.89; p < .001$) and verbal perseveration ($t = 5.09; p < .001$) as the only significant predictors of craving. The direct effect of novelty seeking on craving lost its significance when controlling for desire thinking components ($t = 1.49; p = .14$). The indirect effect estimate from novelty seeking to craving via imaginal prefiguration was (IE) = –.12, 95% CI [–.22, –.02]. The indirect effect estimate from novelty seeking to craving via verbal perseveration was (IE) = –.01, 95% CI [–.06, .03]. The total indirect effect estimate of the whole chains going from novelty seeking to craving through imaginal prefiguration and verbal perseveration in serial was (IE) = –.05, 95% CI [–.10, –.03]. These results supported: (1) the mediation of imaginal prefiguration on novelty seeking; (2) the mediation of verbal perseveration on imaginal prefiguration; and (3) the whole multiple mediational sequence from novelty seeking to craving via imaginal prefiguration and verbal perseveration in serial (See Fig. 2). The mediation of verbal perseveration on novelty seeking was not significant. Among covariates, gender showed no significant effect ($t = 1.62; p = .11$) while age showed a significant effect ($t = –4.53; p < .001$).

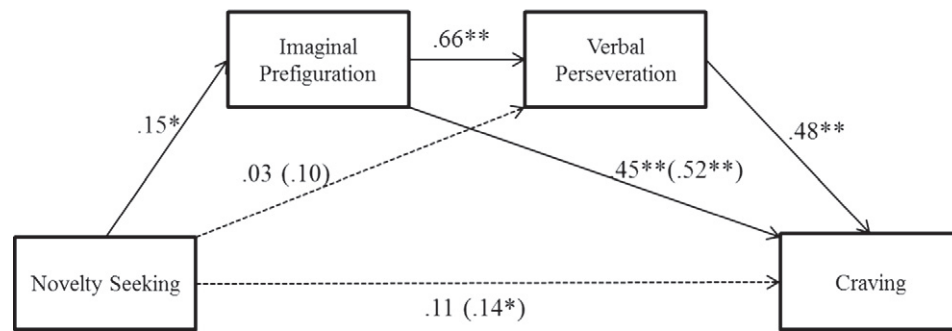
Table 1
Mean, standard deviations (SD), ranges, and two-tailed Pearson correlations of study variables.

	Mean	SD	Range	TCI-NS	TCI-HA	TCI-RD	DTQ-IP	DTQ-VP	GCS
Age	36.3	15.4	18–65	.04	.07	.05	–.18**	–.13*	–.30**
Novelty seeking (TCI-NS)	22.2	3.4	14–31	–	.10	.40**	.13*	.10	.16*
Harm avoidance (TCI-HA)	18.7	4.6	8–33	–	–	.22**	–.10	.03	–.11
Reward dependence (TCI-RD)	14.8	3.4	5–23	–	–	–	.12	.05	.07
Imaginal prefiguration (DTQ-IP)	10.8	3.7	5–20	–	–	–	–	.60**	.55**
Verbal perseveration (DTQ-VP)	9.5	3.6	5–20	–	–	–	–	–	.56**
Craving (GCS)	12.7	5.3	0–30	–	–	–	–	–	–

Note: n = 268.

* $p < .05$.

** $p < .01$.



Note: n=268; parameter estimates are standardized coefficients; value in parentheses is standardized coefficient of the direct effects; * $p < .05$, ** $p < .01$.

Fig. 2. Multiple-step multiple mediational model of desire thinking components as sequential mediators in the relationship between novelty seeking and craving.

4. Discussion

The goal of this study was to explore the relative contribution of novelty seeking and desire thinking towards craving in a community sample. Our findings showed that novelty seeking, imaginal prefiguration, and verbal perseveration were associated with craving. In addition, novelty seeking was positively associated with imaginal prefiguration, but not with verbal perseveration. Moreover, controlling for age and gender, desire thinking components were found to predict craving over and above novelty seeking. The indirect effect going from novelty seeking to craving via the desire thinking components in serial was significant, supporting a multiple-mediational sequence (Fig. 2). Finally, the relationship between imaginal prefiguration and craving is partially mediated by verbal perseveration.

These results provide support for the conceptualization of desire thinking as an independent construct, from novelty seeking, in predicting craving. The combination of repetitive self-talk regarding the need to approach the target (verbal perseveration) and the multi-sensory anticipation of the target approach (imaginal prefiguration) may be reinforcing in the short term, as they help to manage the sense of deprivation by temporarily shifting attention away from the target and onto the elaboration of the desired target (Caselli & Spada, 2010, 2011). In the medium to longer term, however, engagement in desire thinking brings to an escalation of craving, as the desired target is perseveratively elaborated upon but not achieved. This, in turn, can lead to perceive the concrete approach to obtaining a target as the only way to attain relief from the sense of deprivation. Temperamental facets like novelty seeking may act as a more distal risk factor. In particular, high novelty seekers may show a tendency to seek hypothetical rewarding stimuli in order to avoid being bored, with the effect of increasing desire-related intrusions that, in turn, may lead to craving once desire thinking is activated.

The results of this study have a number of possible implications for both educational and prevention programs aimed at reducing vulnerability to addictive behaviors. In particular, desire thinking may be conceptualized, assessed and treated in order to reduce the risk of craving, especially among high novelty seekers. The assessment of desire thinking may help to identify individuals that are at risk of developing addictive and risky behaviors. With respect to prevention programs, the facilitation of skills that promote a metacognitive mode of processing and a flexible control over attention and thinking may be helpful in order to: (1) reduce the risk of developing cognitive strategies such as desire thinking; (2) build awareness of idiosyncratic maladaptive cognitive responses to the felt sense of deprivation; and (3) facilitate effective control upon deprivation by abandoning any further form of cognitive elaboration (both imaginal and verbal). In view of the fact that these aims may be pursued regardless of temperament characteristics, like novelty seeking, which can even carry a number of positive outcomes in a chosen pursuit when not accompanied by an engagement of desire thinking.

This study has several limitations that will have to be addressed by future research. Firstly, it relies solely on self-report data, which is subject to errors in measurement. Secondly, a cross-sectional design was adopted which precludes hypothetical causal inferences. Thirdly, the presence of concurrent psychological disorder was not assessed. Future studies may wish to employ longitudinal designs to assess the relative contribution of novelty seeking and desire thinking towards both craving and severity of addictive behavior presentations. Finally, it would be important to evaluate the mediating role of the direct change in desire thinking in reducing the frequency and intensity of craving in high novelty seekers.

In conclusion, these findings show that a temperament characterized by high levels of novelty seeking is associated with craving the mediational role played by desire thinking.

Authors disclosures

Authors declare that:

1. The manuscript has not been submitted elsewhere.
2. The named authors have agreed to the submission with authorship in the indicated order.
3. The research has not been published in part or as a whole in any other journal.
4. There are no conflicts of interest to declare.
5. Research has been approved by the University of Pavia research and ethical board.

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