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May, Jon

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Imagery and strength of craving for eating, drinking and playing sport

Jon May¹, Jackie Andrade¹, David Kavanagh², & Lucy Penfound¹

¹University of Sheffield

²University of Queensland

Address for correspondence:

Prof. Jon May, School of Psychology, University of Plymouth, Drake Circus, Plymouth
PL4 8AA, UK.

email jon.may@plymouth.ac.uk

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Abstract

The Elaborated Intrusion (EI) Theory of Desire (Kavanagh, Andrade & May, 2005) attributes the motivational force of cravings to cognitive elaboration, including imagery, of apparently spontaneous thoughts that intrude into awareness. We report a questionnaire study in which respondents rated a craving for food or drink. Questionnaire items derived from EI Theory formed a single factor alongside factors for Anticipated Reward/Relief, Resistance, and Opportunity. In a multiple regression predicting strength of craving, the first three factors accounted for 36% of the variance. Opportunity did not enter the model. In a second study, the difference between individuals' strong and weak cravings to take part in a sporting activity was shown to be related to visual, auditory and general imagery, and to anticipated reward or relief from engaging in the activity. Implications for treatment of craving related disorders are discussed in the light of these results and of other research indicating that interference with imagery can reduce the strength of craving.

(159 words)

“...I see your face in every flower, your eyes in stars above,

It is the thought of you, the very thought of you, my love.” (Ray Noble, 1934)

The idea that sensory mental images are key features of emotion or desire is not new to introspection or to popular culture. Kosslyn (1994) argues that imagery appears to play a special role in representing emotionally charged material, and in clinical psychology, imagery is often linked to affect (Holmes & Hackmann 2004), especially in Post-Traumatic Stress Disorder (Bryant & Harvey, 1996; Cuthbert *et al.*, 2003). It has long played a role in treatments such as systematic desensitization (Wolpe, 1958), implosive therapy (Stampfl & Levis, 1967) and covert conditioning (e.g., Cautela & Kearney, 1990), and has been especially useful where the image of a situation or a stimulus acts a proxy for one which is too difficult, dangerous or aversive to recreate or physically present. Lang's (1979) influential bio-informational theory of emotion incorporates affective imagery, although it does not give this type of affective cognition a special status. There has also been use of imagery to elicit craving or desire: for example, imagery scripts have been shown to reliably elicit craving in the laboratory (e.g. Drobles & Tiffany, 1997), and imagery has been used to enhance motivation in sport (Paivio, 1985).

Despite this background, imagery has not formed a central component within contemporary psychological theories of desire (e.g., Tiffany, 1990) or motivation (e.g., Robinson & Berridge, 1993). This reflects the fact that these theories have been based on conditioned learning (environmental or physiological cues triggering automated responses or action patterns) or neurophysiological changes brought about by use of an addictive substance (such as increased dopaminergic responses, or sensitization of reward pathways). Craving is seen by these theories as epiphenomenal: a consequence of conditioned responses, physiological deficit or substance dependence.

The recently published Elaborated Intrusion (EI) Theory (Kavanagh, Andrade & May, 2005) remedies this neglect, giving craving a motivating role in substance dependence, and in desire more generally (Figure 1). It helps to explain the transient nature of craving episodes and the disruptive effects of craving on concurrent cognitive activity (e.g., Zwaan & Truitt, 1998). In EI Theory, craving thoughts arise from any number of triggers including cues in the environment, physiological and affective states, associative stimuli and related thoughts; but when these associations occur outside awareness the initial thought of a desired target is experienced as spontaneous or intrusive (Berry, Andrade & May, 2007).

[Figure 1 about here]

EI Theory argues that this initial intrusive thought can then be elaborated upon, by the retrieval of related memories and in particular the creation of mental imagery of the target. The controlled processes of image generation, elaboration and maintenance are central to the subjective experience of desire and to the detrimental effects of desire on concurrent activities. Articulation of the image is enhanced by the recruitment of additional information from memory, by the elicitation of anticipatory somatic reactions such as salivation, and by additional cues encountered as the target is approached. In turn, this greater articulation of imagery confers enhanced motivational power. Imagery is also seen as critical to the planning and direction of target acquisition when the target is not in immediate view.

Awareness of the image is initially pleasurable, because it reminds one of getting or having the target, and of all the sensations associated with consummation of the desire. However, it also increases awareness of physiological states, both currently and projected into the future, including deficits such as hunger, thirst or drug withdrawal. As a result, the desire becomes unpleasant if achievement of the target is expected to be delayed or prevented. Additionally, where one is seeking to abstain from the target, the initial intrusive thought and subsequent

elaboration can cause feelings of guilt and negative affect because of failure to avoid thinking of the forbidden target, or expected difficulty in preventing target acquisition.

Recent questionnaire data support the claim that imagery characterizes desires for nicotine, soft drinks, and food (May, Andrade, Panabokke & Kavanagh, 2004). Respondents were asked to wait until they were craving a substance, and then to rate 22 items describing the cause or nature of their craving. Items were chosen to address different aspects of craving according to current theoretical positions on the behavioral role of craving, including potential cues to elicit craving, contextual aspects, expectancies about submitting to the craving, and nature of the craving experience.

Seventy percent of the sample said that cravings were seen as occurring suddenly (and perhaps without conscious effort, consistent with EI theory). They were triggered by physiological states (63% agreeing with 'I felt hungry') and mental images (65% agreeing with 'I imagined the smell/taste of it', and 59% with 'I pictured myself having it'). Once a craving had begun, respondents reported expectations about relief or reward following consumption. Sixty-five percent said they imagined the taste and 61% visualized it, although only 9% said they had auditory imagery. Visual, taste and olfactory imagery were concluded to be part of the experience of everyday cravings. Support for this conclusion came from a replication using the same items (Tiggemann & Kemps, 2005) and from dual task studies showing that disrupting visual and/or olfactory imagery reduces craving for cigarettes (Panabokke, 2004; Versland & Rosenberg, in press), chocolate and food (Kemps, Tiggemann, Woods & Soekov, 2004; McLelland, Kemps & Tiggemann, 2006)

If imagery and intrusive thoughts are central to desire generally, rather than being limited to eating and drinking, these features should also be seen in subjective reports about behaviors that do not involve food or drink but which people still feel they are impelled to do. There should also be some relationship between the degree to which the imagery is felt to be part of the

subjective state and the strength of the craving that is being experienced. A greater degree of imagery should, if EI theory is correct, be associated with a stronger craving; weaker imagery should be associated with weaker cravings. The two studies in this paper tested these predictions.

The first study examined the relationship between subjective features of craving and strength of craving, using the questionnaire approach of May et al. (2004). We asked respondents who received a questionnaire to wait until they were craving a product that they could eat or drink, to rate the strength of their current craving, and to then rate statements about the nature of that craving. This questionnaire was received without warning, carried no reward for completion, and asked respondents to put it to one side until they had a craving (i.e., a time when they will be motivated to go and do something else), so we sent it to a large number of people to compensate for an expected low response rate.

The second study explored the generality of the relationship between imagery and craving by examining the role of imagery in craving for a behavior that does not involve eating or drinking, namely the playing of hockey (specifically, Field Hockey, the dominant form of the sport in Europe). Sporting activities and physical exercise are widely reported to be compelling (Hausenblas & Symons Downs, 2002), and so should fall within the compass of a general theory of desire such as EI theory. In Study 2, we applied the factor structure found in study one, and sought repeated assessments of the nature and strength of craving to play hockey from the same smaller sample of individuals over the course of a week, to assess the within-person relationship between imagery and craving strength.

Study 1

Method

A one-sheet questionnaire on craving was constructed, following the format used in May et al (2004), with craving defined to respondents as:

‘an intense desire for something like food, or tobacco, or a drink of some kind, which at one time or another we have all experienced.’

The questionnaire requested respondents to ‘complete this questionnaire first thing tomorrow morning. If you smoke, complete it BEFORE you smoke your first cigarette of the day.’

The first side of the questionnaire asked people to report biographical details and, if they smoked, asked them a number of questions about the nature of their cravings for cigarettes. If respondents were non-smokers, they were asked to turn the page and ignore the cigarette craving section; smokers were asked to turn the page after completing the cigarette craving section. The second page displayed a large image of an octagonal road-side STOP sign, and in large bold type asked respondents to ‘wait until you are craving some food or drink, and then complete this side’. We adopted this approach, rather than asking respondents to wait until just before a meal (for example) so that we could obtain data on any naturally occurring cravings noticed by our sample, rather than constraining them to a particular context and type of substance. This method was designed to allow a measure of respondents’ concurrent assessment of everyday cravings that had not been induced artificially. It aimed to avoid measurement problems that arise from averaged or summary measures across several episodes, and to minimize the risk of potential memory biases in retrospective reports.

The first items on the second page were open-ended, asking for the date and time, and the substance being craved. The next items asked for reports of the strength of typical and current craving for the substance (‘Right now, how strong is your craving’). Each of these items was printed above a horizontal array of the numbers 1 to 10, with ‘Very slight’ as an anchor to the left of 1 and ‘overwhelming’ as an anchor to the right of 10.

Beneath this was a table headed ‘How well do these statements describe your craving right now?’ The table listed 14 items (see Table 1) which were adapted from those used in May *et al.*

(2004), and addressed possible cues for the craving (four items), contextual aspects (five items), expectancies about submitting to the craving (two items), and items about the craving experience derived from the EI theory (three items). As in the May *et al.* (2004) study, the items were not intended to form subscales, but to cover different components of four aspects of craving derived from current theoretical positions. These items were all answered by circling a number from 1 to 5, where 1 was labeled 'Not at all', 3 'Moderate' and 5 'Definitely'.

Questionnaires, together with a reply paid envelope, were included in the 'welcome mailing' sent out during August 2004 to 1,500 of the 4,954 UK residents who had been accepted on undergraduate degree courses at the University of Sheffield due to start in the final week of September 2004. The recipients were chosen by the admissions office of the University, and we had no role in selection of recipients or any further information about them.

Results

By the cut-off date (Oct 1 2004), 218 (14.5%) correctly completed questionnaires were returned, with replies from 137 women and 63 men (18 did not state sex). The sex ratio of 2.17 appeared higher than the ratio in the incoming student population (1.26), and an odds ratio test indicated a 95%CI of 1.29 to 2.29. The average reported age of the 187 respondents who provided date of birth was 19 years 3 months (median 18 years 8 months), with only 5 (2.3%) aged 25 or over. In the University as a whole in 2004, 8% of the 16, 087 undergraduates were aged 25 or over, although this included second and third year students not being targeted by our sampling. An Odds Ratio test indicated a 95%CI of 0.19 to 0.55, so our respondents included fewer people aged 25 or over than the undergraduate population as a whole.

Only 24 respondents (11%) reported smoking on the first page of the questionnaire, so data on cigarette smoking are not examined in this paper. Targets for craving ratings reported on the second side of the questionnaire fell into categories of food (98), chocolate (70), non-alcoholic drink (31), activities or unspecified cravings (11), and alcoholic drinks (8). Since we had set out

to investigate cravings for non-addictive food and drink, the ‘activities/unspecified’ and ‘alcoholic drinks’ categories were excluded from subsequent analysis, leaving 199 respondents.

[Table 1 about here]

The mean reported strength of craving was 4.8 on the 1-10 scale, with 54% rating it as 5 or above. A one-way ANOVA showed no difference between the strength of cravings reported by the food, chocolate and non-alcoholic drink subgroups ($F_{2, 193} < 1$), and so these groups were pooled in subsequent analyses. Table 1 shows the percentage of respondents giving each item a rating of 3 or above on the scale of 1 to 5, the mean of each item, and their correlations with the strength of craving. More than half of the sample reported that their cravings were characterized by having nothing else to do, the desired substance being available, and expecting to feel comforted and relaxed if they had the substance. They reported suddenly thinking about it, picturing it, imagining the smell/taste of it, and trying to resist having it.

[Table 2 about here]

Correlations between the fourteen items are shown in Table 2. While it was apparent that the two *expectancy* and the three *EI Theory* items correlate within their sets and could be seen as forming coherent sets of items, the other two categories did not show such a clear internal coherence. This is not surprising, given that they were not intended to form subscales, but to assess different aspects of categories of potential causes of craving. Exploratory Factor Analysis (using direct oblimin rotation and maximum likelihood extraction) suggested that a four-factor solution best explained the overall variance. The pattern matrix is shown in Table 1. Factor 1 brought together the similarly worded *Context* items ‘It is easily available right now’ and a negative loading from ‘I am not able to have it right now’, together with a small loading from ‘I always have it at this time/place’, and so was labeled Opportunity, reflecting the ease with which the substance could be obtained if the respondent wished to satisfy their craving. Factor 2 combined the two *Expectancy* items with the negative affect item from the *Cues* category, ‘I feel

stressed / anxious / sad', and also had smaller loadings from the items 'I want it because I'm tired / uncomfortable' and 'I physically need it', so was labeled Anticipated Reward/Relief. Factor 3 represented the items 'I have nothing else to do / I am bored', 'I try to resist having it', a negative loading from 'I physically need it' and a small negative loading from 'I always have it at this time/place'; this factor we tentatively labeled Resistance, because it seemed to reflect a craving that they did not really want to satisfy, that was not driven by physiological need or habit, but which had arisen when the craver had nothing else occupying them. Finally the fourth Factor represented the three *EI Theory* items 'I suddenly think about it', 'I picture myself having it', and 'I imagine the smell/taste of it', together with a small loading from 'I saw / heard / smelt it' (the loadings on this factor were all negative, so have been reversed for ease of interpretation). Although an oblique factor analysis allows the factors to be correlated, the only correlation greater than .15 was one of .52 between the factors for Anticipated Reward/Relief and EI Theory, which indicated that (consistent with EI Theory) the greater the degree of intrusion and imagery, the higher the anticipated reward or relief from satisfying the desire.

[Table 3 about here]

The factor scores from this analysis were then used to predict the strength of the craving being experienced (Table 3). Forward and Backward entry produced the same model, with Anticipated Reward/Relief, Resistance, and EI Theory factors collectively accounting for 36% of the variance; Opportunity accounted for a non-significant additional 0.6% of variance. Partial correlations of each factor with strength of craving, controlling for the other three factors, showed that the EI theory factor had the highest unique relationship ($r=.31$), followed by Reward/Relief ($r=.26$), Resistance ($r=-.17$) and Opportunity ($r=.10$).

Discussion

Sensory images and sudden, intrusive thoughts were very common in episodes of craving for chocolate or other food or for non-alcoholic drinks. They intercorrelated strongly, producing

a recognizable factor. This supports the argument of EI theory that imagery plays a central role in the elaborative aspect of cravings, with strong cravings being typified by a greater degree of imagery than weaker cravings: imagining the target is as often associated with craving as actually seeing the substance or experiencing a physiological need for it. This factor, together with factors reflecting the absence of other mental tasks and the amount of anticipated reward or relief, predicted a significant amount of the variance in the strength of craving. Opportunity for eating and drinking was not related to strength of craving. Tiffany's (1990) cognitive model of craving, which attributes craving to unfulfilled action plans, would be consistent with a negative correlation between Opportunity and craving strength; while we have failed to support this, it may reflect a lack of variation in the situations which gave rise to our respondents' cravings.

The low response rate from this survey was anticipated because of the need to put the questionnaire aside until the next day, and then again until a craving occurred; but along with the age and gender differences from the overall population, it does mean that results should be interpreted with caution. For example, it may be that some stronger or more overwhelming cravings were not captured by the survey, because recipients were more motivated to satisfy their craving than to locate and complete the survey. However, the mean strength of craving ratings (4.8 on our 1-10 scale) is similar to the rating of 4.6 on a 0-10 scale reported for alcohol cravings by 232 participants in treatment for alcohol abuse or dependence (Kavanagh *et al.*, in preparation). It is also possible that, despite instructions, some participants may have completed the survey after eating or drinking their target substance, or at some later time, although there was no inducement to complete the survey that may have led to a systematic non-adherence to instructions.

The EI theory claims to be applicable to all forms of desire, not just those that involve appetitive consumption. It should therefore be able to predict the desire to take part in activities such as sport. To test this prediction, we adapted our questionnaire, using the factor structure obtained in Study 1 but tailoring the items towards a physical activity rather than eating or

drinking, and asked a group of regular hockey players to rate their sport cravings. We also wanted to find out whether changes in the strength of an individual's craving were related to the degree to which they reported particular characteristics of the craving. We therefore requested multiple ratings from each participant over the course of a week, so that we could contrast the descriptors of their strongest and weakest cravings.

Study 2

Method

An A6 booklet (10cm by 15cm) was constructed with eight pages, each containing a set of items on hockey craving. The booklets were given to the first 50 of the 140 members of the University of Sheffield male and female undergraduate Hockey clubs who responded to a recruitment poster and email sent by one of the authors (who was also a member of the women's hockey club). Participants were asked to keep the booklet nearby until they had an urge to play and then to fill out a questionnaire. It was emphasized that they were to fill out the scales during the craving and not afterwards, so they were to carry this booklet around during the week. On each page, they rated the strength of their craving on a scale from 1 (slight) to 10 (overwhelming), and gave the date and time of the craving. They were then asked to rate the craving on each of 12 items on a scale that now ranged from 1 (not at all) to 10 (definitely). This change was made to increase the sensitivity of the measures. Other adaptations to the items were mainly to alter the focus from eating or drinking (i.e., 'having it') to an activity (i.e., 'doing it'). The Opportunity factor was represented by two items 'I can easily do it right now' and the negative 'I am not able to do it right now'; the Reward/relief factor by the items 'My body needs to do it' and 'I would feel better if I did it'; the Resistance factor by 'I have nothing else to do', 'I am trying to resist doing it' and negatively 'My body needs to do it'; and the EI theory factor by 'I suddenly thought about it', 'I am visualising it', 'I can hear myself doing it', and an

additional item 'I am imagining myself doing it' which was added in an attempt to access tactile or physical body state imagery. The items 'I saw people doing it' and 'I always do it at this time/place' which were used in Study 1, but which did not load highly on any of the four factors, were also included in the questionnaire.

Results

Twenty-three players (18 females, 5 males; age range 18-24) returned booklets containing reports of two or more cravings (seven, six, five and five reporting 2 to 5 cravings respectively, a total of 77 reports; the booklets of six other players who only reported one craving were not analyzed). The included respondents reported playing sport on average 5.5 times a week (range 2 to 9). For each player, the strongest and weakest cravings were identified, and factor scores for these two cravings were computed by finding the mean of each factor's component items.

Table 4 lists the means of each item and factor scores for the strongest craving, the weakest craving, and for the difference between the two cravings, together with correlations with strength of craving in each case and t-tests to compare the means for the two cravings. Items are listed in descending order of their mean rating for the strongest craving.

[Table 4 about here]

According to the items that were rated as 5 or above by more than half the sample, strong cravings were associated with suddenly thinking about the activity, visualizing, and imagining the activity. Players were often in the time/place where they usually played hockey, and had nothing else to do. They felt as if their body needed to play hockey, and that they would feel better after playing it. Weak cravings were also characterized by suddenly thinking about it, by visualizing and imagining hockey, by feeling as if their body needed to play it and expecting to feel better after playing it, but by being unable to play right away instead of being in the usual time or place.

Of the individual items, only the visualization item correlated significantly with strength of craving at the time of both the strongest and weakest cravings, although 'I would feel better if I did it' correlated with strength of the weakest craving. Because of this, the EI Theory was the only factor score to correlate with these between-subject measures.

Items whose responses significantly differed between the two cravings (according to paired sample t tests) were the five items with the highest mean for the strongest craving episode, together with 'I saw people doing it'. All of these items were rated lower during a weak craving. Both components of the Anticipated Reward/Relief factor and two of the components of the EI Theory factor were among these items, so these two factor scores also differed between the strong and weak cravings. The difference in craving strength between the strongest and weakest cravings also correlated with differences in the three imagery components of the EI Theory factor and its factor score, but with no other items or factor scores.

Discussion

As in Study 1, cravings (strong and weak) were associated with the presence of imagery, spontaneous thoughts, and anticipated reward and relief from consummating the desire, although the target was now an activity rather than food or drink. Over the whole sample, the degree of visual imagery and general imagery differed between strong and weak cravings, as did the sense that respondents' bodies 'needed to do it' and the thought that they would feel better if they did it. The two items that did not enter into the factor structure in Study 1, seeing people do it and being in the habitual time or place, also differed between strong and weak cravings, suggesting that the strongest cravings were occurring when the respondents were just about to engage in the activity.

Within an individual, differences in visual, auditory and general imagery were associated with the difference in strength between the weakest and strongest in strength of craving, as was the EI Theory factor score derived from them. We have argued previously that while visual

imagery is likely to play a functional role in situations where it helps in locating and identifying the target of the desire, other modalities of imagery might be important where they are relevant to the target substance or behavior. Previously our data have shown little relationship between auditory imagery and cravings for food and drink. Here we have shown that, although it receives low ratings, the degree of auditory imagery involvement reported by an individual does seem to be associated with the strength of their desire to play hockey. Because the University of Sheffield hockey pitch is next to the Department of Psychology, we can confirm from personal experience that hockey is noisy. For the hockey player, it may be that auditory imagery can act as a vicarious fragment of the actual experience, providing momentary pleasure and awareness of absence, just as visual imagery did for quieter desires in Study 1.

None of the differences in other items or factors were associated with this difference between an individual's strongest and weakest cravings, although the 'I would feel better if I did it' item and the Anticipated Reward/Relief factor score correlations fell between the .10 and .05 levels of significance. The associations with imagery and the craving difference scores have been found despite the fact that difference scores are notoriously unreliable, because they include error variance from both positive and negative components. The absence of relationships with other items may be due to this lack of power rather than a real absence of relationship. Overall, comparing the between-individual and within-individual results this study suggests that, in addition to the EI theory items, variations in the intensity of the Anticipated Reward/Relief items are related to variations in craving strength.

The one EI Factor item that was not significantly related to changes in craving level was "I suddenly thought about it". This result was consistent with EI theory. While intrusive thoughts are predicted to relate to the occurrence of craving (as reflected in the moderately high mean scores for this item), the sudden, intrusive and apparently spontaneous nature of desire onset is not expected to vary across craving intensity.

General Discussion

In neither study were cravings typically attributed to external cues – seeing, hearing, smelling a substance, or seeing people playing hockey (although in Study 2, players did report being in the time and place where they usually played hockey). Instead, the cravings had a spontaneous quality, with people reporting that they suddenly thought about them. This is consistent with the EI theory's argument that the antecedents of craving operate outside of awareness, and that the subjective state of craving only occurs when the cognitive consequences of the antecedents intrude into the individual's train of thought. Once this had happened in Study 2, the degree to which the hockey players engaged in imagery, and the anticipated feelings of reward and relief associated with fulfillment, were indicative of the strength of their craving. Of course, causal direction is not clear: it could have been that the stronger their craving, the more likely they then were to engage in imagery, and the more rewarding an end to the craving would seem; but either way it is clear that visual imagery and anticipated reward/relief are important factors during desire. This finding supports EI theory, extends it to an activity other than eating and drinking, and gives further support to Holmes and Mathews's (2005) argument that there is a special relationship between imagery and emotion.

The emphasis on imagery within EI theory offers opportunities for new strategies to assist people in coping with cravings for substances or behaviors that they are trying to abstain from or reduce. Many people spontaneously attempt to defeat cravings by suppressing their desire-related thoughts, others try to think of something else to distract themselves. The literature on paradoxical effects on thought suppression suggests that simply trying not to think about something actually increases the incidence of intrusive thoughts, and so this strategy is not likely to be helpful. Attempts at suppression typically produce higher frequencies of the thought either during (Lavy & van den Hout, 1990; Merckelbach, Muris, van den Hout, & de Jong, 1991;

Salkovskis & Campbell, 1994) or after the attempted suppression (Clark, Ball, & Pape, 1991; Clark, Winton, & Thynn, 1993; Harvey & Bryant, 1998).

EI theory predicts that concurrent tasks that share a need for similar processing capacity to craving imagery will provide some relief from the craving, by reducing the vividness of the mental imagery. The craving might then become weak enough to withstand, even if it continues. The duration of a weakened craving might also be shortened, since there will be less motivation to continue the elaborative cycle. Initial work with non-clinical samples by Panabokke (2004), Versland & Rosenberg (in press), McLelland, Kemps and Tiggemann (2006) and Steel, Kemps and Tiggemann (2006) has given this hypothesis some support, showing that interference with visual imagery reduces the subjective strength of cravings for variety of substances including cigarettes, chocolate, and food, both for induced and naturally occurring cravings. The results of the two studies reported in this paper provide the first direct evidence that the degree of imagery is closely related to the strength of craving, both between different individuals' cravings and within an individual's cravings. If the causal direction is indeed from imagery to strength of craving, then this is further evidence that therapeutic interventions intended to weaken or prevent imagery should lead to a weakening of craving.

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Captions

- Figure 1: The EI theory, showing antecedents of an episode or desire, surrounding a central box that contains the subjective aspects of an episode. The initial desire thought is experienced as spontaneous, and is followed by an elaborative cycle in which imagery plays a central role. (From Kavanagh, Andrade & May, 2005).
- Table 1: Craving characteristics in Study 1, including: percentage of respondents giving rating of three or more (1=not at all, 5=definitely) and mean rating for each item; Communalities and Pattern Matrix from an Oblique Factor Analysis (loadings $>.20$ shown)
- Table 2: Correlations between the craving characteristics in Study 1. *** indicates $p \leq .001$, ** indicates $p \leq .01$, * indicates $p \leq .05$.
- Table 3: Prediction of Craving Strength from factor scores in Study 1. *** indicates $p \leq .001$, ** indicates $p \leq .01$, * indicates $p \leq .05$.
- Table 4: Characteristics of hockey players' strongest and weakest sport craving and correlations with strength of craving; differences between the strongest and weakest cravings and correlation with differences in craving strength. All items were rated on a scale running from 1 to 10.

Figure 1.

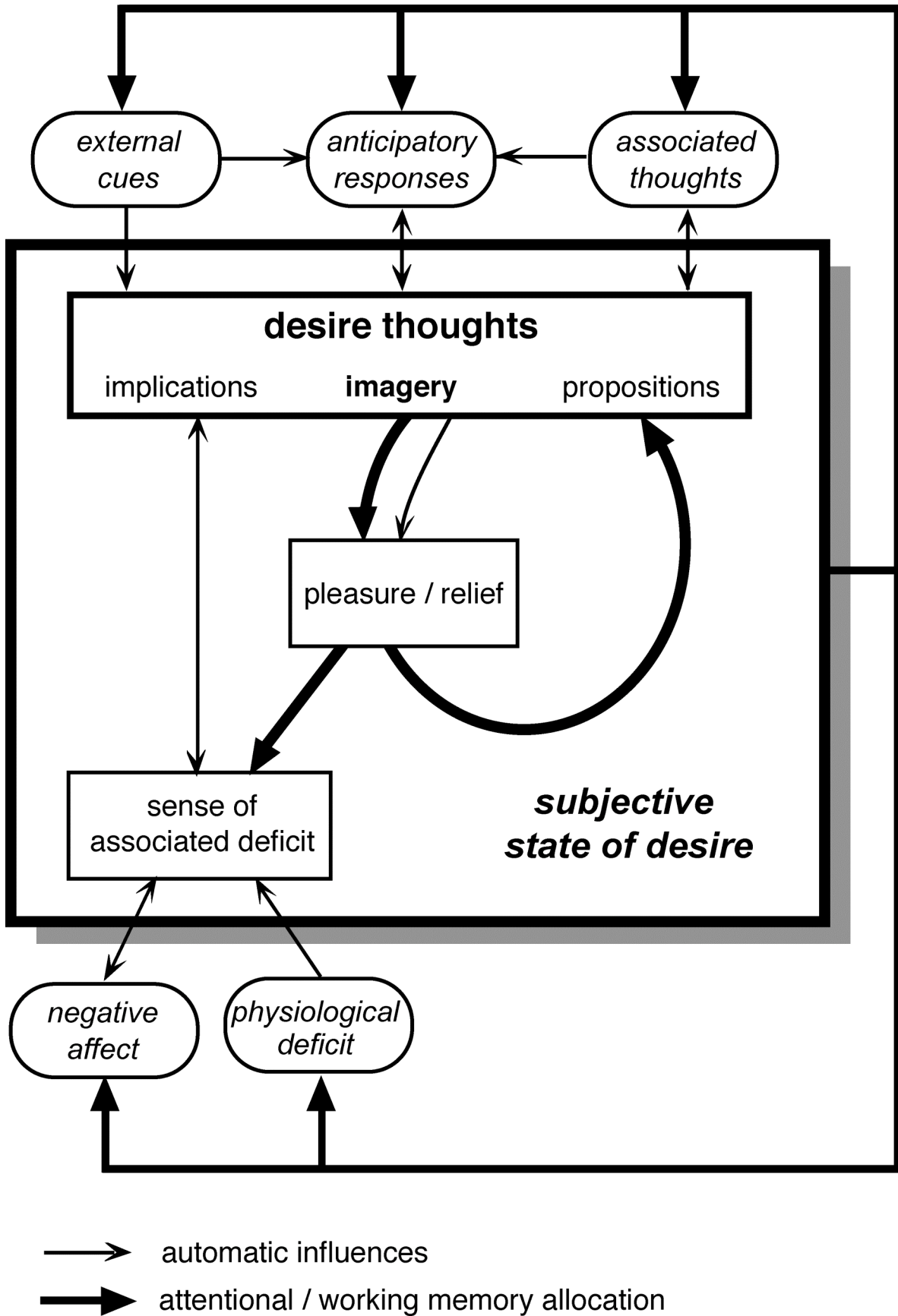


Table 1: Craving characteristics in Study 1, including: percentage of respondents giving rating of three or more (1=not at all, 5=definitely) and mean rating for each item; Communalities and Pattern Matrix from an Oblique Factor Analysis (loadings >.20 shown)

	<i>Item</i>	<i>% 3+</i>	<i>M</i>	<i>Communalities</i>		<i>Pattern Matrix</i>		
				<i>Initial</i>	<i>Extraction</i>	<i>Reward/relief</i>	<i>Resistance</i>	<i>EI theory</i>
<i>Cues</i>	I saw / heard / smelt it	24%	1.8	0.114	0.093			.24
	I want it because I'm tired / uncomfortable	36%	2.2	0.281	0.192	.31		
	I feel stressed / anxious / sad	23%	1.7	0.335	0.368	.62		
	I physically need it	21%	1.8	0.383	0.6	.32		-.63
<i>Context</i>	I have nothing else to do / I am bored	61%	3.0	0.196	0.212		.44	
	It is easily available right now	69%	3.4	0.289	0.999	1.00		
	I always have it at this time/place	33%	2.1	0.182	0.194	.21		-.26
	I am not able to have it right now	22%	1.8	0.252	0.184	-.43		
	I try to resist having it	55%	2.6	0.26	0.369		.59	
<i>Expectancies</i>	Having it would feel very comforting	79%	3.6	0.483	0.572	.65		
	I would feel more relaxed if I had it	63%	3.0	0.455	0.606	.81		
<i>EI Theory</i>	I suddenly think about it	66%	3.1	0.34	0.358	.27		.40
	I picture myself having it	51%	2.7	0.477	0.558	.23		.85
	I imagine the smell/taste of it	59%	3.0	0.391	0.632			.61

Table 3: Prediction of Craving Strength from factor scores in Study 1. *** indicates $p \leq .001$, ** indicates $p \leq .01$, * indicates $p \leq .05$.

	<i>B</i>	<i>Std Error</i>	<i>Beta</i>	<i>R² change</i>	<i>Adj R²</i>
<i>Step 1</i>					
Constant	4.765	.135		.294***	.290
EI Theory	1.354	.153	.542***		
<i>Step 2</i>					
Constant	4.765	.130		.047***	.341
EI Theory	.895	.194	.358***		
Reward/relief	.701	.192	.284***		
<i>Step 3</i>					
Constant	4.765	.129		.022*	.363
EI Theory	.901	.192	.361***		
Reward/relief	.674	.189	.274***		
Resistance	-.403	.160	-.148*		
<i>Not in model</i>					
Opportunity			.082	.006	

Table 4: Characteristics of hockey players' strongest and weakest sport craving and correlations with strength of craving; differences between the strongest and weakest cravings and correlation with differences in craving strength. All items were rated on a scale running from 1 to 10.

Item	strongest craving			weakest craving			difference between strongest and weakest cravings					
	% 5+	M	S.E.	r	% 5+	M	S.E.	r	t(22)	M	S.E.	r
Right now, how strong is this sports craving?	100	8.22	0.24		43	4.48	0.22			3.74	0.35	
I would feel better if I did it (F2)	96	8.39	0.34	.14	96	7.26	0.40	.50*	5.13***	1.13	0.22	.31
I am imagining myself doing it (F4)	91	7.91	0.45	.30	78	6.43	0.47	.12	3.40**	1.48	0.43	.41*
My body needs to do it (F2, F3)	83	7.13	0.53	.01	52	4.83	0.61	.13	4.97***	2.30	0.46	.26
I am visualising it (F4)	83	6.96	0.49	.41*	56	5.30	0.60	.44*	2.95**	1.65	0.56	.61***
I always do it at this time/place	61	5.78	0.85	.11	22	2.87	0.64	.07	2.67*	2.91	1.08	-.06
I have nothing else to do (F3)	61	5.70	0.72	.22	48	5.04	0.63	-.25	0.74	0.65	0.89	.19
I suddenly thought about it (F4)	70	5.52	0.57	.16	78	5.91	0.60	.30	-0.52	-0.39	0.77	.14
I am not able to do it right now (F1)	48	4.83	0.83	-.29	52	5.39	0.77	.03	-0.53	-0.57	1.06	-.20
I can easily do it right now (F1)	44	4.70	0.70	.31	30	3.43	0.58	.13	1.33	1.26	0.65	.16
I saw people doing it	43	4.17	0.73	.18	22	2.43	0.56	-.19	2.50*	1.74	0.70	.16
I can hear myself doing it (F4)	26	3.26	0.55	.26	22	2.61	0.45	.31	1.19	0.65	0.55	.37*
I am trying to resist doing it (F3)	35	3.04	0.52	-.13	17	2.48	0.49	.28	0.88	0.57	0.64	-.07
F1: Opportunity		-0.07	0.71	.32		-0.98	0.58	.05	0.96	0.91	0.96	.19
F2: Reward/relief		7.76	0.37	.38		6.04	0.47	.30	5.67***	1.72	0.30	.31
F3: Resistance		0.54	0.38	.09		0.90	0.34	-.09	-1.01	-.36	0.36	.01
F4: EI Theory		5.91	0.39	.37*		5.07	0.35	.45*	2.23*	0.85	0.38	.54**

Two-tailed paired sample t tests conducted to compare the sample's strongest and weakest cravings; *** indicates $p \leq .001$, ** indicates $p \leq .01$, * indicates $p \leq .05$.