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Brief guided imagery and body scanning interventions reduce food cravings

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Abstract

Elaborated Intrusion (EI) Theory proposes that cravings occur when involuntary thoughts about food are elaborated; a key part of elaboration is affectively-charged imagery. Craving can be weakened by working memory tasks that block imagery. EI Theory predicts that cravings should also be reduced by preventing involuntary thoughts being elaborated in the first place. Research has found that imagery techniques such as body scanning and guided imagery can reduce the occurrence of food thoughts. This study tested the prediction that these techniques also reduce craving. We asked participants to abstain from food overnight, and then to carry out 10 minutes of body scanning, guided imagery, or a control mind wandering task. They rated their craving at ten points during the task on a single item measure, and before and after the task using the Craving Experience Questionnaire. While craving rose during the task for the mind wandering group, neither the guided imagery nor body scanning group showed an increase. These effects were not detected by the CEQ, suggesting that they are only present during the competing task. As they require no devices or materials and are unobtrusive, brief guided imagery strategies might form useful components of weight loss programmes that attempt to address cravings.

[203 words]

Introduction

Desires for food are common, everyday experiences, and are highly adaptive in signalling the need to eat sufficient food to fuel activity and maintain healthy physiological systems. However, when desires become intense cravings and cannot immediately be satisfied, they are aversive, and when they trigger significant distress or excessive eating or impair our ability to perform other important cognitive tasks, they may become highly dysfunctional.

The Elaborated Intrusion Theory of Desire (EI Theory; Kavanagh, Andrade & May, 2005) explicates processes underpinning the onset, exacerbation and termination of desires for appetitive targets including food. Initially, desire-related cognitions typically appear spontaneous, because they are triggered by associated environmental or internal cues rather than being deliberately elicited (Kavanagh et al., 2005). If other later cognitions capture attention, intrusive desire-related thoughts may not be processed further (Kavanagh, May & Andrade, 2009). However, if the pleasure or relief from these cognitions gives them greater salience than other concurrent experiences, they are consciously elaborated, further increasing their affective power. Central to the theory is that sensory imagery is especially likely, and because it simulates the actual experience, it conveys a stronger affective pull than other cognition and is therefore more likely and more vivid when craving is intense (Kavanagh, Statham, Feeney, et al., 2012; May, Andrade, Kavanagh & Hetherington, 2012; Andrade, May & Kavanagh, 2012; Statham, Connor, Kavanagh, et al., 2011).

According to EI Theory, the elaboration of craving imagery places demands on limited-capacity working memory systems, and in particular, on the visuospatial sketchpad, which is required for construction of visual images (Baddeley & Andrade, 2000). Concurrent

tasks that require attention to other visuospatial information reduce the vividness of imagery and blunt the intensity of associated craving, especially if they impose a working memory load. So, Andrade, Pears, May and Kavanagh (2012) found that constructing shapes from clay that was hidden behind a screen reduced craving for chocolate: This task requires repeatedly comparing visual imagery about a desired product with imagery constructed from tactile information, as well as co-ordination of hand movements based on this imagery. Instructions to create competing, emotionally neutral imagery also reduce cravings, including ones for coffee (Kemps & Tiggemann, 2009), cigarettes (May, Andrade, Panabokke, & Kavanagh, 2010; Versland & Rosenberg, 2007), chocolate (Kemps & Tiggemann, 2007) and other food (Harvey, Kemps, & Tiggemann, 2005; Kemps & Tiggemann, 2007). In contrast, since food-related craving rarely requires auditory imagery, tasks that load on the phonological loop have only weak effects at best (Kemps & Tiggemann, 2007; May, Andrade, Panabokke & Kavanagh, 2010), unless they impose heavy general cognitive (or 'central executive') load (Andrade et al., 2012).

Another approach to the management of cravings uses mindfulness (Alberts, Mulkens, Sweets & Thewissen, 2010; Alberts, Thewissen & Raes, 2012), which involves enhancement of non-judgemental awareness of the present moment or experience (Brown & Ryan, 2003). The absence of a necessity either to control or elaborate thoughts, and an attention to ever-changing experiences, join to liberate the person from entanglement in rumination (Kabat-Zinn, 2003).

Consistent with this idea, in Berry, May, Andrade & Kavanagh (2010) people who were naturally mindful had less distress in response to intrusive desire-related thoughts and had lower craving than less mindful people. Similarly, Alberts et al. (2012) found that people who undertook 8 weeks of mindfulness-based cognitive-behaviour therapy had

greater decreases in food cravings and in their eating in response to sensory cues or negative emotional states than did others on a wait list. Jenkins and Tapper (2013) found that people who were trying to reduce their chocolate consumption ate less chocolate when following a mindfulness-based cognitive defusion strategy (seeing their thoughts as merely thoughts) than a control (muscle relaxation) group, or a group who accepted chocolate thoughts (by 'urge surfing', using the knowledge that urges are transient, to help with resisting desires to indulge). Papies, Barsalou and Custers (2012) also found that brief training in 'mindful attention', viewing thoughts as transient mental events, reduced approach responses to appetitive foods.

Body scanning is a technique commonly used in mindfulness training, where the focus of attention is consciously directed around the body, while concurrently maintaining an awareness of breathing (Cropley, Ussher & Charitou, 2007). As in other mindfulness exercises, the person is encouraged to attend to changing experiences without questioning, suppressing or being judgemental of ones that come to mind (Kristeller & Hallett, 1999). If other thoughts and emotions arise, they are noted briefly before returning attention to the body.

While mindfulness exercises including body scanning are derived from ancient Buddhist traditions, their expected effects on craving are highly consistent with EI Theory. For example, the attentional demands of body scanning would reduce cognitive capacity for the elaboration of craving imagery, while a focus on new, emerging experiences would introduce craving-irrelevant content. Accepting desire-related thoughts rather than trying to suppress them would avoid the risk that monitoring the suppression would ironically provide a trigger for their occurrence (Wegner & Erber, 1992), while adopting the stance of

a curious bystander would blunt the affective intensity of the thoughts (and their ability to maintain a cyclical elaboration of craving cognitions).

There are indications that body scanning may indeed help people to address food cravings. A small randomised controlled trial by Alberts et al. (2010) with attendees at a weight reduction program reported lower food cravings after a 7-week mindfulness-based intervention where body scanning was an important component. In a more controlled setting, May, Andrade, Batey, Berry & Kavanagh (2010, Experiment 2) examined the effect of 10 mins of Body Scanning instructions on thoughts and craving for snack foods by students who were attempting to reduce consumption of snack foods and had not eaten for 2 hours. Effects were compared with those from Guided Imagery and Control (mind wandering) instructions. During the experimental period, Body Scanning and Guided Imagery reduced concurrent thoughts about snack foods, relative to 10-min Baseline and Post-task periods, but the control instructions did not. However, there were no Condition by Time effects on single-item ratings of craving for snack foods that were taken at the end of each period. In contrast, May, Andrade, Willoughby and Brown (2012) found that both craving and thought frequency about smoking were reduced in the experimental period by body scanning, relative to mind wandering. That study applied a 2-session within-subjects design with smokers who were asked to abstain from smoking for 2 hours, and measured craving by Factor 1 of the Questionnaire on Smoking Urges (Tiffany & Drobes, 1991), but otherwise had a similar procedure to May, Andrade, Batey et al. (2010).

The current study attempted to address two potential reasons for the lack of effects on craving for snack foods in May, Andrade, Batey et al. (2010). Firstly, it increased the period of food deprivation from 2 hours to at least 9 hours (in recognition of the need to induce a stronger sense of deprivation, such as we saw after abstention from smoking).

114 Secondly, it sampled craving during the baseline, experimental and post-task periods rather
115 than relying on craving assessments after completion of the instructional task (when
116 competing tasks were no longer present). The study retained the three-group Between-
117 subjects design and instructional procedures used by May, Andrade, Batey et al. (2010),
118 allowing it to examine whether body scanning had similar effects to those from a task that
119 should interfere with imagery-based aspects of craving (Guided Imagery), and whether Body
120 Scanning and Guided Imagery produced differential effects from a Mind Wandering control.

121 Method

122 **Participants**

123 Participants were recruited from Plymouth University's Psychology student pool and
124 received participation credit for their participation, which they could use in their own
125 research. The experiment was conducted in accordance with the ethical guidelines of the
126 British Psychological Society and had approval from the University's Faculty of Science and
127 Technology Ethics Committee. Ninety-eight participants (75 female, 23 male, *M* age = 20,
128 range = 18-45) took part.

129 **Assessment Instruments**

130 A *single-item craving intensity measure* (0, no craving, to 10, intense craving) was
131 used for repeated measurements during the experimental phase of the study. Before and
132 after the imagery task, the *Craving Experience Questionnaire* (CEQ; May, Andrade, Kavanagh
133 et al., submitted) was used to measure the strength of food craving (CEQ-S), and the
134 frequency of craving thoughts (CEQ-F). The CEQ-S and CEQ-F each have 10 items, over three
135 subscales measuring craving intensity, use of imagery and intrusiveness. Using data from
136 twelve studies on chocolate, other food, alcohol and cigarettes, May et al. (submitted)

found that the internal structure of the CEQ was robust across substances and timeframes over which desires were assessed, and that internal consistencies of the total CEQ-S and CEQ-F were high. CEQ-S items focused on current craving. At Baseline, participants completed the CEQ-F on the frequency of cravings since they last ate: at the end of the session, they rated the frequency of cravings during the session.

The *Eating Attitudes Test* Factor 1 (EAT26; Garner, Olmsted, Bohr & Garfinkel, 1982) was used to identify whether any participants screened positive for an eating disorder, while a *Brief Mindfulness Measure (BMM;* Berry et al. 2010*)* and an *Emotional and Behavioural Reactions to Intrusions Questionnaire* (EBRIQ; Berry, et al. 2010) checked whether levels of trait mindfulness and usual reactions to intrusive thoughts were equivalent across conditions.

Procedure

Sessions were held between 9am and noon. Participants were asked to abstain from eating since midnight the night before, so that they were food-deprived for at least 9 hours. They were asked to bring a breakfast item to the session. After providing informed consent, they placed their breakfast item alongside a selection of other breakfast bars on the table, in order to augment their craving at Baseline. If they did not bring an item, they were offered a bar to take at the end of the study. They then completed the CEQ, EAT26, BMM and EBRIQ, and were asked a series of questions about when they last ate, their usual breakfast habits and favourite foods, in order to reinvoke craving. The breakfast bars were then covered, to reduce distractions during the session's experimental phase.

Random allocation to conditions controlled for Baseline CEQ-S scores by using separate random sequences for those above and below the running average. All conditions involved a 10-min audio recording being played through headphones, while a craving scale

was displayed on a computer screen. An instructional statement was heard every 20 seconds: This instructional frequency kept them on task, while allowing them time to undertake the task between statements. A bell sounded ten times within each recording (at intervals of between 38 to 80 seconds, using the same pseudo-random sequence across conditions), at which points participants reported their craving on the 0-10 scale.

The audiotapes were the same as those used by May, Andrade, Batey et al. (2010). In *Mind Wandering,* participants were instructed to think about 'anything or nothing at all' and let their 'mind wander wherever it will go'. In *Body Scan*, they focused on specific parts of the body, starting with their toes and moving to the top of their head, relaxing, while noticing and accepting thoughts. Instructions included 'notice any sensations here right now' and 'focus on breathing'. *Guided imagery* involved imagining a forest walk, using multiple senses (e.g. 'brightly coloured birds call from the wood'; 'feel the path beneath your feet as you travel through the wood'). The random allocation gave 33 participants in Mind Wandering, 34 in Body Scan and 31 in Guided Imagery.

At the end of the recording, participants again completed the CEQ-S and CEQ-F, were debriefed and then were allowed to see and take their breakfast item.

Results

Four participants did not comply with the task requirements (two Mind Wandering and two Guided Imagery), giving minimum or maximum ratings to all items on one or more scales, and their data were removed from the analyses. One way ANOVA on the remaining 94 participants showed that the three groups (see Table 1) did not differ on Mindfulness (BMM: $F(2,91) = 1.70$, $p = .19$, $\eta^2 = .04$), Reactivity (EBRIQ), eating attitudes (EAT) or baseline craving (CEQ) totals (all Fs<1).

Table 1 About Here

A repeated measures ANOVA on the ten single-item craving ratings obtained during the imagery showed no main effect of time ($F(9,819) = 1.05$, $\eta^2 = .011$, $p = .40$) or of condition $F(1, 91) = 2.11$, $\eta^2 = .044$, $p = .13$), but a significant interaction ($F18, 819) = 1.90$, $\eta^2 = .04$, $p = .013$), as shown in Figure 1. Follow-up ANOVAs on each group showed no effects of time for the bodyscan or guided imagery groups ($Fs<1$), but a significant effect of time for the control group ($F(9,270) = 3.31$, $\eta^2 = .10$, $p = .001$). Contrasts showed significant Linear ($F1,30) = 4.59$, $\eta^2 = .13$, $p = .04$) and Quadratic ($F1,30) = 4.51$, $\eta^2 = .13$, $p = .04$) effects, indicating a rise in craving over the first half of the mind wandering task, which then levelled off.

Figure 1 About Here

Repeated measures ANOVA was also conducted on the before and after task totals from the CEQ. There were no statistically significant effects for the scale totals or any of the subscales (Figure 2), although for the CEQ-S Imagery subscale the effect of time approached significance ($F(1,91) = 3.43$, $p = .067$, $\eta^2 = .04$), as did the interaction of time x condition ($F(2,91) = 2.39$, $p = .098$, $\eta^2 = .05$), as the mind wandering group's scores rose while the other two groups' fell.

Figure 2 About Here

Discussion

The single item craving measures obtained during the experimental task rose for participants who allowed their mind to wander, but remained constant for those in the

guided imagery and body scanning conditions. We have therefore extended the findings of May, Andrade, Batey et al. (2010) to show that these attentional control tasks can prevent the occurrence of cravings for food as well as reducing the frequency of intrusive thoughts, as it did for cravings and thoughts about smoking in May et al. (2012). As in May, Andrade, Batey et al. (2010), the before and after measures of craving did not show an effect, suggesting that craving is only supressed while the imagery interventions are being conducted.

In practical terms, this research suggests that the body scanning and guided imagery tasks could be helpful for people who are trying to resist the cravings that occur during abstinence or reduction attempts, and which lead to relapse (Sitton, 1991; Massey & Hill, 2012). While body scanning is a core mindfulness technique because of its links to Buddhist meditation practice and the idea that thoughts are, like physical sensations, transitory, the guided imagery script used here had identical effects. In fact, many mindfulness tapes available commercially also make use of a 'forest walk' script, directing the listener's imagery to different sensory modalities. Guided imagery shares many facets with mindfulness exercises, such as relaxation and directed mental activity, without explicitly including key aspects such as thought acceptance and non-judgementalism. In our work we use it as a form of comparison task to assess the contribution that body scanning has beyond relaxation and the control of mental imagery, and in this study, as in May, Andrade, Batey et al. (2010) and May et al. (2012), find that the two are identical in effectiveness.

This indicates that supressing food related imagery during a potential craving episode is the most important factor in preventing a rise in craving intensity, in line with the predictions of Elaborated Intrusion Theory. An alternative explanation, of course, is that the mind wandering condition, intended as a control condition, is exacerbating craving rather

229 than just allowing it to occur. Allowing the mind to wander allows any intrusive thought
230 about food to be elaborated, but it does not mean that it was elaborated using visual
231 imagery: in this experimental situation, having missed breakfast, a food related thought
232 might just be the most interesting thing to think about. Although a body of other research
233 has also shown that visual imagery is a central component of craving for a range of
234 substances (e.g., Salkovskis & Reynolds, 1994; May, Panabokke, Andrade & Kavanagh, 2004;
235 Harvey et al., 2005; Statham et al., 2011), and that visual imagery tasks can also weaken
236 craving and prevent craving developing (May, Andrade, Panabokke & Kavanagh, 2010;
237 Versland & Rosenberg 2007), further research could compare unrestricted mind wandering
238 with a mind wandering condition in which visual imagery is restricted, perhaps through a
239 visual monitoring task, or through exposure to a dynamic visual noise display (Quinn &
240 McConnell, 1996), which has been shown to interfere with craving (May et al, 2010; Kemps,
241 Tiggemann, Woods & Soekov, 2004).
242 In our research we have used recorded prompts to instruct our participants in the
243 body scanning and guided imagery, but people can learn to do both tasks without such
244 prompts. As an entirely cognitive strategy, requiring no devices or materials, taking a few
245 seconds to imagine oneself in a sensorially rich environment is an easy and practical self-
246 help technique that could form part of dietary restraint and weight-loss programmes. It is
247 unobtrusive and can be employed repeatedly, whenever needed, until the temptation has
248 passed. Knäuper, Pillay, Lacaille, McCollam & Kelso (2011) asked people to deal with
249 cravings over a four-day period by vividly imagining engaging in a favourite activity and
250 found that it reduced craving intensity, whereas three control conditions had no effect.
251 It is likely that the positive affective nature of the scenes imagined in our work and in
252 that of Knäuper et al. (2011) would motivate people to continue to use the strategy, but it

must also be recognised that the effects upon craving might be due more to the mood and relaxation effects than to the demands of imagery and attentional control, and further work should contrast these conditions with positive mood enhancement that does not include these cognitive aspects. Evaluation could also usefully focus upon the need for novelty in the imagined scenes, to assess the contribution of higher-order cognitive processes in the generation of imagery, as opposed to the retrieval of familiar scenes from memory.

References

Alberts, H.J.E.M., Mulkens, S., Smeets, M. & Thewissen, R. (2010) Coping with food cravings. Investigating the potential of a mindfulness-based intervention. *Appetite, 55*, 160-163. doi:10.1016/j.appet.2010.05.044

Alberts, H.J.E.M., Thewissen, R. & Raes, L. (2012) Dealing with problematic eating behaviour. The effects of a mindfulness-based intervention on eating behaviour, food cravings, dichotomous thinking and body image concern. *Appetite, 58,* 847-851. doi: 10.1016/j.appet.2012.01.009

Andrade, J., May, J., & Kavanagh, D.J. (2012) Sensory imagery in craving: From cognitive psychology to new treatments for addiction. *Journal of Experimental Psychopathology, 3(2) 127-145.* doi: 10.5127/jep.024611

Andrade, J., Pears, S., May, J., & Kavanagh, D.J. (2012) Use of a clay modeling task to reduce chocolate craving. *Appetite, 58,* 955-963. doi: 10.1016/j.appet.2012.02.044

Baddeley, A.D. & Andrade, J. (2000) Working memory and the vividness of imagery. J*ournal of Experimental Psychology: General, 129(1)*, 126-145. Doi:10.1037/0096-3445.129.1.126

Berry, L.-M., May, J. Andrade, J. & Kavanagh, D. (2010) Emotional and behavioural reaction to intrusive thoughts. *Assessment, 17(1),* 126-137. doi:10.1177/1073191109344694

Brown, K.W. & Ryan, R.M. (2003). The Benefits of Being Present: Mindfulness and Its Role in Psychological Well-Being. *Journal of Personality and Social Psychology, 84(4),* 822–848. doi:10.1037/0022-3514.84.4.822

Cropley, M., Ussher, M., & Charitou, E. (2007). Acute effects of a guided relaxation routine (body scan) on tobacco withdrawal symptoms and cravings in abstinent smokers. *Addiction, 102,* 989–993. doi:10.1111/j.1360-0443.2007.01832.x

Garner, D. M, Olmsted, M. P., Bohr, Y., & Garfinkel, P. E. (1982) The Eating Attitudes Test: psychometric features and clinical correlates. *Psychological Medicine 12*, 871-8.

Harvey, K., Kemps, E. & Tiggemann, M. (2005) The nature of imagery processes underlying food cravings. *British Journal of Health Psychology, 10,* 49-56. doi: 10.1348/135910704X14249

Jenkins, K.T. & Tapper, K. (2013) Resisting chocolate temptation using a brief mindfulness strategy. *British Journal of Health Psychology, 18.* retrieved 17/5/2013.

Kabat-Zinn J. (2003). Mindfulness-based interventions in context: Past, present, and future. *Clinical Psychology: Science and Practice, 10,* 144-156. doi: 10.1093/clipsy/bpg016

Kavanagh, D.J., Andrade, J., & May, J. (2005) Imaginary relish and exquisite torture: The elaborated intrusion theory of desire. *Psychological Review, 112*, 446-467. doi:10.1037/0033-295X.112.2.446

Kavanagh, D.J., May, J., & Andrade, J. (2009). Tests of the Elaborated Intrusion Theory of craving and desire: Features of alcohol craving during treatment for an alcohol disorder. *British Journal of Clinical Psychology, 48,* 241–254. doi:10.1348/014466508X387071

Kavanagh, D.J., Statham, D.J., Feeney, G.F.X., Young, R. McD., May, J., Andrade, J. & Connor, J. (2012) Measurement of alcohol craving. *Addictive Behaviors,38*, 1572-1584 . Doi: 10.1016/j.addbeh.2012.08.004

Kemps, E. & Tiggemann, M., (2007). Modality-specific imagery reduces cravings for food: An application of the Elaborated Intrusion theory of desire to food craving. *Journal of Experimental Psychology: Applied, 13*(2), 95-104. doi:10.1037/1076-898X.13.2.95

Kemps, E. & Tiggemann, M., (2009) Competing Visual and Olfactory Imagery Tasks Suppress Craving for Coffee. *Experimental and Clinical Psychopharmacology, 17(1),* 43–50. doi: 10.1037/a0014962

Kemps, E., Tiggemann M., Woods, D., & Soekov, B. (2004). Reduction of food cravings through concurrent visuo-spatial processing. *International Journal of Eating Disorders, 36*, 31-40. doi: 10.1002/eat.20005

Knäuper, B., Pillay, R., Lacaille, J., McCollam, A. & Kelso, E. (2011) Replacing craving imagery with alternative pleasant imagery reduces craving intensity. *Appetite, 57(1)* 173-178. doi: 10.1016/j.appet.2011.04.021

Kristeller, J. L., & Hallett, C. B. (1999). An exploratory study of a meditation-based intervention for binge eating disorder. *Journal of Health Psychology, 4,* 357–363. doi: 10.1177/135910539900400305

Massey, A., & Hill, A.J. (2012) Dieting and food craving. A descriptive, quasi-prospective study. *Appetite, 58(3),* 781-785. doi:10.1016/j.appet.2012.01.020

May, J., Andrade, J., Batey, H., Berry, L.-M. & Kavanagh, D. (2010) Less food for thought: Impact of Attentional Instructions on Intrusive Thoughts about Snack Foods. *Appetite, 55(2)* 279-287. doi:10.1016/j.appet.2010.06.014

May, J., Andrade, J., Kavanagh, D.J., Feeney, G.F.X., Gullo, M., Statham, D.J., … Connor, J.P. (submitted). The Craving Experience Questionnaire: A brief, theory-based measure of consummatory desire and craving.

May, J., Andrade, J., Kavanagh, D.J. & Hetherington, M. (2012) Elaborated Intrusion theory: A cognitive-emotional theory of food craving. *Current Obesity Reports, 1(2),* 114-121. Doi: 10.1007/s13679-012-0010-22

May, J., Andrade, J., Panabokke, N., & Kavanagh, D. (2010). Visual imagery tasks suppress craving for cigarettes. *Behaviour Research and Therapy, 48*, 476-485. doi:10.1016/j.brat.2010.02.001

May, J., Andrade, J., Willoughby, K. & Brown, C. (2012) An attentional control task reduces intrusive thoughts about smoking. *Nicotine & Tobacco Research, 14(4),* 472-478. doi: 10.1093/ntr/ntr238

May, J., Panabokke, N., Andrade, J., & Kavanagh, D. (2004). Images of desire: cognitive models of craving. *Memory, 12,* 447–461. doi: 10.1080/09658210444000061

Papies, E.K., Barsalou, L.W. & Custers, R. (2012). Mindful Attention Prevents Mindless Impulses. *Social Psychological and Personality Science, 3(3)*, 291-299. doi: 10.1177/1948550611419031

Quinn, J. G. & McConnell, J. (1996a). Irrelevant pictures in visual working memory. *Quarterly Journal of Experimental Psychology, 49A*, 200-215. doi: 10.1080/713755613

Salkovskis, P. M., & Reynolds, M. (1994). Thought suppression and smoking cessation. *Behaviour Research and Therapy, 32(2)*: 193-291. doi: 10.1016/0005-7967(94)90112-0

Sitton, S. C. (1991). Role of craving for carbohydrates upon completion of a protein-sparing fast. *Psychological Reports, 69*, 683–686. doi: 10.2466/pr0.1991.69.2.683

Statham, D. J., Connor, J. P., Kavanagh, D. J., Feeney, G. F. X., Young, R. McD., May, J., & Andrade, J. (2011). Measuring Alcohol Craving: Development of the Alcohol Craving Questionnaire. *Addiction 106(7), 1230-1238*. doi: 10.1111/j.1360-0443.2011.03442.x

Tiffany, S. T., & Drobes, D. J. (1991). The development and initial validation of a questionnaire on smoking urges. *British Journal of Addiction, 86*, 1467–1476. doi:10.1111/j.1360-0443. 1991.tb01732.x

Versland, M. & Rosenberg, H. (2007) Effects of brief imagery interventions on craving in college student smokers. *Addiction Research and Theory, 15*(2), 177-187. doi: 10.1080/16066350701200582

Wegner, D. & Erber, R. (1994) The hyperaccessibility of suppressed thoughts. *Journal of Personality and Social Psychology, 63(6)*, 903-912. doi: 10.1037/0022-3514.63.6.903.

Table 1: Means (standard deviations) for the Eating Attitudes Test (EAT), Brief Measure of Mindfulness (BMM) ,Emotional & Behavioural Reaction to Intrusions Questionnaire (EBRIQ), and baseline Craving Experience Questionnaire Strength (CEQ-S) and Frequency (CEQ-F).

Imagery Condition	N	EAT	BMM	EBRIQ	CEQ-S	CEQ-F
Control	31	7.8 (7.1)	3.1 (0.5)	2.9 (0.7)	4.4 (1.9)	4.2 (1.6)
Body Scan	34	8.5 (5.6)	2.9 (0.5)	2.7 (0.6)	4.8 (2.2)	4.2 (2.1)
Guided Imagery	29	9.0 (7.0)	3.1 (0.5)	2.7 (0.6)	4.8 (1.9)	4.3 (1.9)

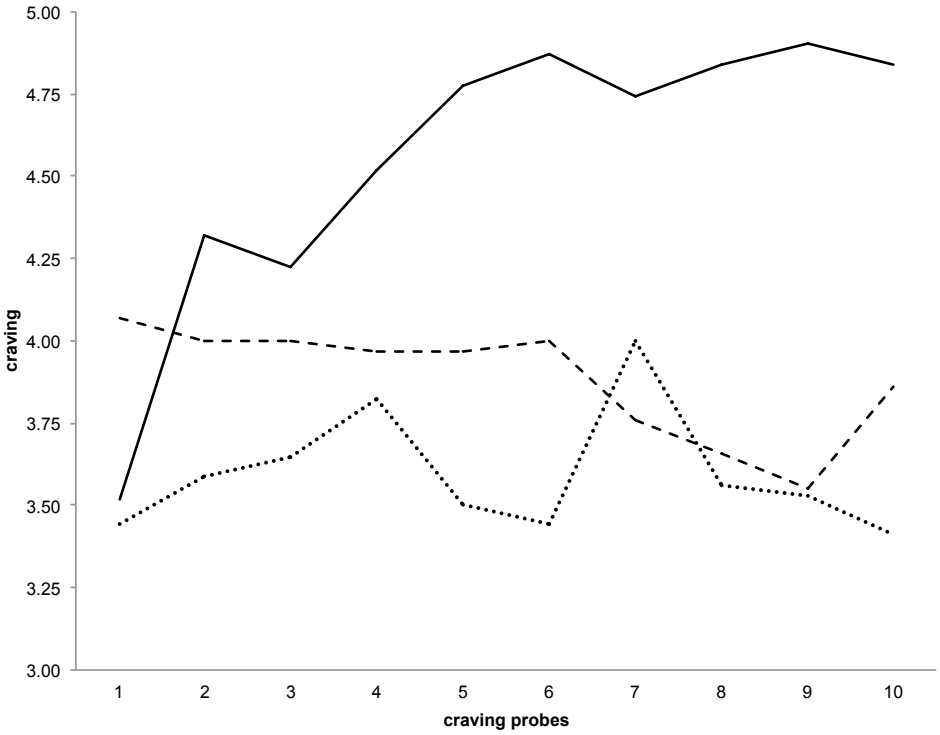

Figure 1. During the imagery tasks, craving did not change for the Body Scanning (dotted line) and Guided Imagery (dashed line) groups, but rose for the Mind Wandering control group (Solid line).

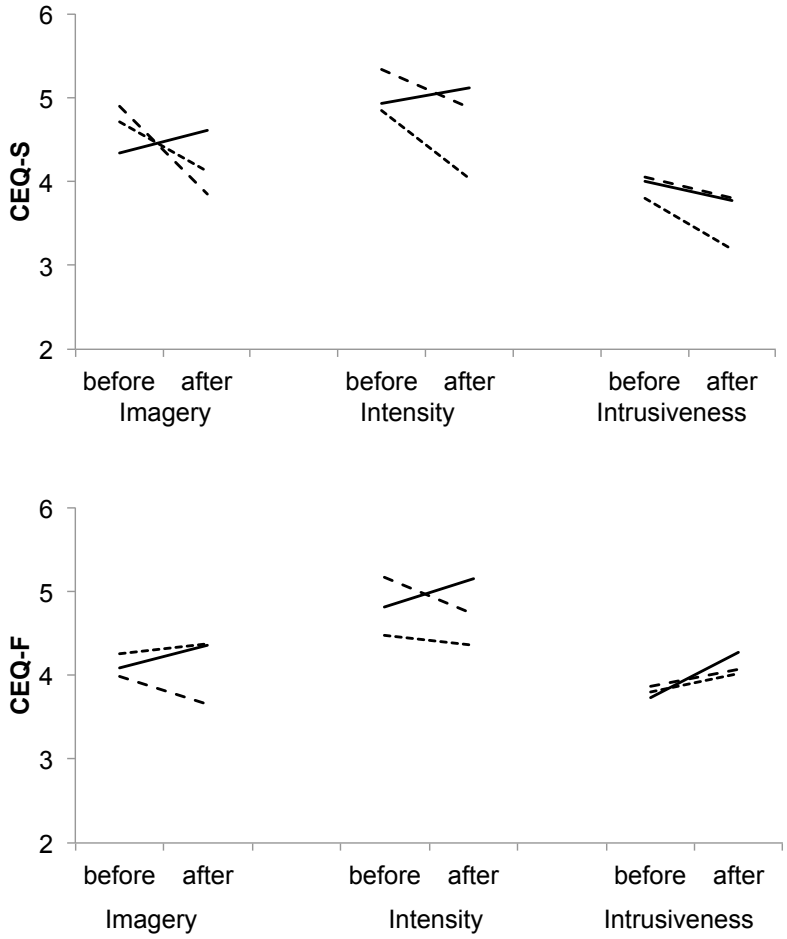

Figure 2. Although CEQ-Strength Imagery and Intensity scores declined for the Body Scan (dotted line) and Guided Imagery (dashed line) groups, compared to the Mind Wandering control group (Solid line), no interactions were statistically significant. CEQ-Frequency scores were unchanged for all three groups.