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"I see myself": Craving imagery among individuals with addictive disorders

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ABSTRACT

Background: Craving has been put forward as a core feature of addictive disorders.
Objective: The present qualitative study investigated the experience of craving among individuals with addictive disorders and recent experiences of cravings.
Methods: Eleven individuals with Gambling Disorder and ten with Alcohol Use Disorder (n = 21) were recruited. A semi-structured interview explored: (1) modes of thought during craving (mental imagery or verbal thoughts), (2) craving content, (3) coping strategies and (4) craving context.
Results: The thematic analysis showed that cravings were initially dominated by imagery, with a subsequent conflict between imagery and verbal thoughts. Craving content included imagery of *preparative rituals, anticipation, and sensory activation*, imagery of the addictive behavior *"me, there and then imagery"* and anticipating that *"something good will come out of it."* Some participants related to craving as a *symptom of sickness,* and coping with craving were through *distraction,* reminding oneself of negative consequences, or via *sensory control:* avoiding stimuli associated with the addiction. Craving contexts included typical settings of drinking or gambling and engagement of both positive and negative emotions. Alcohol craving was described as an expected relief from internal stimuli, such as anxiety or stress, whereas gambling craving was more often described as an expectancy of financial reward.
Conclusions: Craving was experienced mainly through imagery containing the preparative routines and expected outcomes. Future research and clinical practice should incorporate mode of thought in cravings to better understand its role in the maintenance of the disorders and their treatment.

KEYWORDS
Craving; addiction; imagery; gambling; alcohol

Introduction

Addictive disorders all over the world are causing substantial negative impact on people's lives and their families. Alcohol use was the seventh most common risk factor for death worldwide in 2016[1] and problem gambling (PG) can cause long-term impairment in social, financial and health related well-being.[2] At its most severe form, the clinical diagnosis of Gambling Disorder (GD) is associated with an increased risk of death by suicide.[3,4] Despite available recommended psychological treatments for both GD and Alcohol Use Disorder (AUD), less than 10 percent among those suffering enter treatment, leaving a wide treatment gap.[5–8]

There are many challenges in the recovery from an addiction and treatment strategies typically include a range of cognitive, behavioral, motivational and pharmacological interventions.[9–11] A phenomenon often addressed in treatment is the occurrences of cravings, their management and role in relation to relapses. Despite its long history within the addictions, there is no consensus on the definition and craving role in treatment and relapses remains poorly understood.[12,13] Some argue strongly that difficulties in self-regulation of craving is a central component in the development and maintenance of addictive disorders[14] and a meta-analytic review concluded that craving is a risk factor for

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relapse but also acknowledges the lack of consensus in conceptualizations.[15] For individuals with GD who had participated in treatment, giving in to irresistible cravings accounted for 11% of relapse episodes.[16]

Craving is a state that fluctuates over time and can be described as an urgent and pressing impulse, derived from learning history, to engage in one's addictive behavior despite knowledge of its negative consequences.[13,17,18] Craving, or the synonymously used terms, *urge* or *desire* or even *drive,* has been investigated from perspectives of motivation, cognition, conditional models, neurobiological mechanisms and regulation of emotion to name a few.[18,19] The Diagnostical and Statistical Manual (DSM 5) outlining the psychiatric disorders, has acknowledged craving, or a desire or urge to use alcohol, as a criterion for AUD but it is currently not a criterion for GD.[20] Nevertheless, evaluation of treatment of GD continues to target craving, using a variety of scales measuring the intensity, frequency, or the duration of craving episodes.[13,19]

So, what passes through the mind of an individual with addiction when cravings emerge? Recently, research has drawn attention toward the role of mental imagery in psychiatric disorders, including addiction.[21,22] Mental imagery has been described as "seeing with the mind's eye" or as brief flashes of future behavior, termed *flashforwards.*[23,24] Mental imagery is associated with an enhanced emotional activation and memory function as compared to verbal thoughts[25] and to influence future behaviors.[26] Verbal thoughts, on the other hand, also referred to as inner speech[27] are verbal stimuli involving higher levels of cognitive control.[28] Verbal thoughts are commonly more abstract than imagery and refer to a finite set of categories.[29] Instruments aiming at measuring aspects of addictive behaviors such as motives[30] or cognitions[31] are typically constructed as verbal accounts resembling inner speech.

The Elaborated Intrusion Theory of Desire (EIT) provides a transdiagnostic framework for cravings and places mental imagery as a core feature.[32,33] EIT conceptualizes craving as a higher order cognitive process that involves mental imagery of the desired object or behavior. External cues associated with the behavior set off anticipatory autonomous responses, e.g., increased arousal, commonly without conscious processing. In laboratory studies, cue-induced craving is a well-established paradigm where images of addiction stimuli is presented in a controlled settings to where participants with addictive behaviors have shown heighten reactivity and decreased inhibitory control.[34] Studies have also demonstrated that the subjective response to these specific cues correlated with an activation of the limbic reward system, even when presented as brief flashes of 33 milliseconds processed without conscious recognition.[35] Thoughts and mental imagery associated with the addictive behavior function as elaborations of the craving experience. Such craving imagery has the potential to activate sensory processing without actual sensory input, allowing for an elaboration of the emotional responses of pleasure or relief and a selective attention directed at the object of desire. A sense of associated deficit, "something needs to be fixed," sets off a vicious circle and in turn augments the impact of the craving imagery.

There is debate about the extent to which this focus on imagery is justified. Kavanagh et al.[36] found that individuals with AUD in treatment reported experiencing mental imagery while craving, with an average of 2.3 senses while craving, but they did not specifically survey verbal thoughts. In a qualitative study with 31 non-clinical gamblers, Cornil et al.[37] found a predominance of reports of mental imagery compared to (verbal) thoughts for gambling cravings. However, Caselli and Spada[38] work on the Desire Thinking Questionnaire suggests that there are elements of verbal and image-based elaboration during cravings for a range of activities in community samples and a sample of people seeking treatment for alcohol use disorder.

Therefore, there is a need for ecologically valid studies of cravings from the perspective of those suffering severe negative consequences from behavioral and substance addictions. An improved understanding of the mental processes involved in craving could shed light on the addictive processes and the challenges experienced in addictive disorders.

The aim of the present study is to explore the craving experience among treatment seeking

individuals suffering from AUD and GD, to identify any phenomenological differences and to describe the psychological processes involved.

Materials and methods

Design

The study uses a qualitative design, with semi-structured interviews analyzed via (reflexive) thematic analysis, with a deductive, or theoretical, approach where the theories of mental imagery and EIT "provide the lens through which we analyze and interpret data."[39,40] This approach was also present during the interviews, where participants were introduced to descriptions of mental imagery and verbal thoughts (see supplementary material). Domains of the analysis were preset, and themes were developed from coding and sub-themes.

With a purposive sampling strategy, participants with AUD and GD who had recent experiences of craving were recruited. Participants with AUD were screened for gambling problems and participants with GD were screened for alcohol problems to ensure that the focus of craving was either gambling or alcohol and not both. A varied sample was sought in terms of gender, age and type of game (for individuals with GD) in order to increase response variability.

Participants

Participants were recruited at The Center for Dependency Disorders Stockholm, Sweden, The Addiction Clinic, Region of Dalarna and through self-help groups for individuals with problem gambling. Inclusion criteria for the study were: (1) >18 years of age, (2) having had gambling problems OR problematic alcohol consumption within the last 12 months above threshold for AUD or GD as outlined in the DSM-5, (3) having experienced cravings related to gambling OR alcohol within the last month, (4) having had a period of at least five days of abstinence prior to the interview, (5) being fluent in the Swedish language, and (6) being treatment seeking. Participants were excluded if they reported primary cravings related to any other addictive behaviors or substances. All the study participants were enrolled or about to enroll in treatment within the above-mentioned health care services or at the municipalities' addiction care services. Three of the participants had previously participated in self-help groups and one at a 12-step facilitation.

Recruitment

Addiction clinics and self-help groups for individuals with GD were asked to inform potential candidates that the study aimed to better understand the phenomenon of craving, without detailing the content of the interview. Prospective participants were then contacted by the first author and given verbal and written information on the study purpose and data management. All enrolled participants provided their informed consent prior to any data collection. The study was approved by the Regional Ethical Review Board in Stockholm (ref.nr. 2017-1479-31/1). Two movie vouchers were renumerations for participating with a value of approximately 27.78 $.

Procedure

After a brief screening interview via telephone the participants who fulfilled the study criteria completed an online survey, described in supplementary material. In-person interviews were scheduled, and the participants were informed that five days of abstinence prior to the actual interview were required. If this criterion was not met on the day of the interview, the interview was rescheduled. Interviews took place mainly at addiction clinics in Stockholm or in Dalarna. One interview was conducted in the participant's home due to physical conditions hindering the participant from traveling and two interviews were conducted over the telephone for similar reasons. Audio from interviews was recorded on a smartphone and transcribed verbatim. The sample size was guided by the concept of information power as outlined in Malterud et al.[41] Interviews were transcribed and analyzed continuously according to the analysis strategy, and adequate sample size and stopping criteria were reached when no new critical findings emerged. The use of clinician recruitment increased the specificity in the sample, i.e., participants with recent and

prominent craving experiences. Furthermore, the study aim was quite specific, using an established theory. i.e., EIT, yielding a constructive dialogue that was relevant for the study purpose.

Instruments

Online survey

The online survey covered demographics, cravings, difficulties in emotion regulation, psychological flexibility, symptoms of problematic alcohol, gambling and drug consumption, problems with inattention, as well as depression and anxiety. Results from the survey are presented in supplementary material.

The CEQ

The Craving Experience Questionnaire (CEQ),[42] which was part of the survey, is a questionnaire containing 22 items for measuring alcohol cravings. The CEQ has been used to measure craving for food, alcohol, and gambling[42,43] and assumes that cravings involve the activation of sensory processes and mental imagery. The CEQ targets vividness of imagery in different sense modalities and intrusiveness of craving cognitions.

The version for gambling, CEQ-G contains 16 items, where items regarding activation of smell and taste sensory processing have been omitted as they are not applicable to gambling. The CEQ and the CEQ-G contains two subscales, *intensity of* a focal craving experience within the past week and *frequency* of past week cravings, both on a 0–10 Likert scale ranging from not at all to extremely/constantly. In addition, participants were also given an added free-text item in the CEQ: "describe a focal craving experience within the past week."

Semi-structured interview

The semi-structured interview guide developed for this study was inspired by the imagery interview by Hales et al.[23] (see supplementary material). After being asked to freely describe a recent, focal experience of craving, the participants were then asked to give details of (1) *type* and *content* of the cognitions related to the craving experience; (2) the *context* of the cravings; and (3) how they *related* to their cravings. Content concerned, e.g., "what thoughts passed through your head when you had cravings?" The participants were then introduced to the concepts of verbal thoughts and mental imagery. They were given examples such as "if you imagine your way from here to your home, what would those thoughts look like?" aiming at giving the participant a notion of mental imagery. Verbal thoughts were described as phrases, sentences and language-like cognitions. Participants were also asked about vividness in their craving and potential sensory activation and then asked to reflect upon the content of their craving after these instructions. The *context* of cravings included, e.g., "describe a typical situation where you frequently experienced cravings." Follow up questions aimed to provide details of the situation, mood states, external and internal triggers. Investigating how the participant related to and coped with craving by asking: "what do you typically do when experience cravings?"

Coding and data analysis

The transcripts were read and re-read, and a coding process was initiated where quotes were summarized with descriptive codes. Subthemes were then organized according to the interview with the overarching domains: (1) modes of thought, (2) content of craving experiences, (3) coping strategies and (4) context of craving. Author V.M. developed the codes and themes and they were reviewed by author A.H.B, following which a reflective dialogue took place. The initial codings were processed in Excel and Word using the method outlined by Ose[44] and all interview transcripts were collapsed into the same analysis. Participants were assigned pseudonyms and tagged with their diagnosis (GD or AUD) and age to ensure anonymity, but to allow for tracking of participant narratives.

Results

Twenty-one participants were recruited for the study; see Table 1 for participant characteristics. The range of days abstinent at the time

Table 1. Participant characteristics.

Variable	AUD (n = 10)	GD (n = 11)
Women	6 (60%)	5 (45.5%)
Men	4 (40%)	6 (54.5%)
Age, mean (range)	49.1 (27–62)	38.5 (27–54)
In a relationship	3 (30%)	9 (81.8%)

Note: AUD = Alcohol Use Disorder, GD = Gambling Disorder.

of interview was between 6 and 240 days and none of the participants were on medications targeting craving (i.e., Naltrexon or Nalmefene). Data on other types of medications were not collected.

The free text answers reported with the CEQ showed that individuals with GD to a larger extent described their cravings in relation to external rather than internal events (see Table 2).

The results are presented according to the domains and themes outlined in Table 3. All transcribed interviews were collapsed into one analysis. Where descriptions between GD and AUD differed significantly, a clear indication is given, such as under the domain *Context of cravings*. Participants were endorsing questions targeting imagery in craving to a larger extent than verbal thoughts, yielding dominance of craving descriptions including imagery. Under the *Modes of thought* domain, participants' reflections are presented on how they think when craving, i.e., verbal thoughts versus imagery.

Table 2. Craving Experience Questionnaire (CEQ).

	AUD (n = 10)	**GD** (n = 11)
CEQ Frequency mean (sd), scale 0–10	3.41 (2.0)	4.61 (2.1)
CEQ Intensity, mean (sd), scale 0–10	4.84 (1.83)	6.20 (2.42)
Descriptions from free text answer to: "*Describe a focal craving experience within the last week*," number of times theme mentioned.		
Internal (total)	8	5
Frustration	2	
Sad	1	
Tired	1	
Stress and anxiety	4	1
Imagining jackpot		1
Giving in to craving		1
Imagining sound and lights		1
Need to relax		1
External (total)	1	8
Commercial/ads	1	1
Sport events		4
Financial (receiving money, bills)		2
Self-exclusion expires		1
Situational (total)	5	1
Being in a typical drinking/gambling situation	2	1
Social (friend reminds of drinking/gambling)	2	
Passing by a liquor store	1	

Thematic analysis

Domain: Content of cravings

Rituals, anticipation and sensory activation. The participants described that the content of their craving imagery involved the *preparative rituals* that would enable drinking or gambling, such as the acquisition of alcohol or accessing money for gambling. Imagining the preparation phase was described by Emma (50 years, AUD) as "thrilling" and "exciting" and commonly accompanied imagining the different steps of the preparative routine: "It is more like images, seeing myself go to the same liquor store, buying my wine, taking it to the car. Coming home. Hiding it in a particular place. Drinking it at a particular timepoint."

Emma's preparative imagery was initially experienced as brief flashes: "You know, it just pops up like this … yes, I could drink then, when my husband is not at home. like these, brief flashes coming to me." Her preparative descriptions involved several steps and detailed planning:

> At a certain time, I drive to the liquor store. I follow a certain pattern. It is like a routine. Me driving to the liquor store, always buying the same brand … same beverage … same producer … and I drink at the exact same time … and. Yeah. A bit compulsive I would say.

Participants with AUD's common preparations involving buying wine or liquor and the rituals leading up to consumption. Steven (59 years, AUD) described his habits surrounding drinking a particular kind of whiskey as "a ritual." For participants with GD, the preparative craving involved money management and, for sports betting, inspecting odds and planning how to place the bets. Participants with AUD described cravings more as letting go of control and experiencing relief. In contrast, craving descriptions among participants with GD involved taking control, as Margaret (50 years, GD) describes:

> It also involves planning how much money to spend gambling or the self-deceptive preparation by observing a chance game such as Black Jack in order to make more "knowledgeable" bets. All the time I am an active observer … keeping track of what others have, when they win just to have an overview of how the game is played. So, you are fully concentrated.

Table 3. Domains, themes, subthemes and quotes.

Domain	Theme	Subtheme	AUD/GD	Brief example quote[a]
Content of cravings	*Rituals, anticipation, and sensory activation*	Preparative rituals	AUD	"Imagining myself go to the liquor store, buying my wine."
		Entering a casino	GD	"Entering those big casinos and all the lights flashing … that feeling, wow, I am standing here."
		Anticipation	GD	"An image is also when you are really close to a big win."
		Sound	GD	"Foremost it is the sound of the (casino) chips."
		Visual	GD	"Wheels are spinning just right and I hit the jackpot, the big win."
		Visual	AUD	"I see the box wine shows up, the kind I want to buy."
		Taste	AUD	"You imagine a cold beer, almost feel the taste of it."
	Me, there and then	Gambling at home	GD	"Me in the sofa, a glass of wine, a smile and it keeps on rolling, money is rolling in."
		Drinking at the pub	AUD	"I see myself at a very cozy place … with a good beer I pour."
		Strategic gambling	GD	"I stop below a certain limit, I strategically plan my gambling"
		Gambling at casino	GD	"I am in a buzz, simply happy for being there and gambling , regardless if I win or not, but I am there."
	"Something good will come out of it"	Spending on others	GD	"You want to give to other people."
		Identity	GD	"You gamble to feel complete."
		Escape and relief	AUD	"I wanted to dampen. Not think anymore, I wanted to get away."
		Solving financial depths through gambling	GD	"Solving depths. Happy faces somehow. For my relatives."
Modes of thought	*The conflict between imagery and verbal thoughts*	Cravings as mental imagery	AUD	"It is more imagery"
		Inhibitory self-talk	AUD	"Tried to talk sense to myself."
		Verbal thoughts as elaborations	GD	"Discussing with myself how to access money"
		Inner conflict	AUD	"It becomes like a conflict."
Coping with cravings	*Cravings as a symptom of sickness*	Compulsions	AUD	"The last 10 years it has been more like a uncontrolled compulsion"
		Anxiety	AUD	"It is anxiety and depression when craving emerge and been … genuine. Now I really want."
		Nausea	AUD	"It is almost figuratively, I get nausea when I think about it now."
	Cravings attractive	Good feeling	GD	"I want to ride on that feeling"
		Craving imagery cozy	AUD	"I find it a bit cozy"
	Coping through distraction, self-punishment and sensory control	Distraction	AUD	"I go and do something completely different."
		Reducing sensory input (visual)	AUD	"I walk on the other side of the street (from liquor store)."
		Reducing sensory input (auditory)	GD	"I gamble with sounds off. I had sounds in the beginning, then you react strongly."
		Imagining negative consequences	AUD	"What can happen if I relapse? I could lose my husband, it can affect my children very negatively and so on."
Context of craving	*Here and now as a reminder*	Typical gambling situation	GD	"At night, about 6 pm. Home."
		Social contexts	AUD	"It is Christmas smorgasbord, that is connected to a craving."
		Low stimuli and alone	GD	"Those calm moments are very stressful."
		External triggers	GD	"When you have been fed with commercials."
		Social contexts inhibits	AUD	"Everyone around was happy and drinking beer. Then I thought, alcohol, I cannot handle it."
	Emotions sets the stage	Negative emotions	AUD	"The feelings of hopelessness, powerlessness and giving up."
		Positive emotions	GD	"You afford yourself to gamble, your feel you are such a good person."

[a]Quotes are abbreviated to fit the table while keeping its primary aim.

Fatima (43 years, GD) described *anticipation* in the craving experience as being about to approach something good: "It becomes like a heat, … like happiness, when you feel: 'damn, it is close to things going very well'." Sara, (48 years, GD) who played mainly online casino slots detailed her craving imagery as the symbols signaling a big win and remembering the reaction of: "when you see these big wins, it is like a heart attack. You get happy at the same time, but the heart is pounding." The sensations associated with anticipation were mainly physical, e.g., "heat," "fever" but also the being "highly goal-oriented" and "highly expectant" (Emily, 50 years, AUD).

Sensory activations during a craving were both visual and auditory and could involve imagining the taste of alcohol. Participants with GD visual descriptions included online casinos, e.g., lights,

the sounds from an online slot and images related to receiving a free-spin or a bonus. Maria (31 years, GD), who played mainly online slots, had a recurring image:

> 'I see myself in front of the computer and the wheels end up just right, so I hit the jackpot, the big win. I see it [the image] quite often. And everything is ringing and blinking.'

Ian (42 years, GD) returned often to the image of receiving a free-spin within a casino-slot and approaching a win:

> Some [images] are more significant than others, when you win a large amount of a bonus, that you get … within these free-spins you get more free-spins within the freespins. It becomes a strong image and … a significant imagery is also when you are very close … that is, close to a larger win.

The sound and lights from an Electronic Gaming Machine was also mentioned and the clicking sound of Blackjack markers. For participants with AUD, it could involve the taste sensory, "taste of wine" (Henry, 48 years, AUD) and being absorbed by a "sweet feeling" and visual description of a particular brand of alcohol.

Me, there and then-imagery

A common theme among the imagery descriptions were portraying oneself in a situation carrying out the addictive behavior in a positive manner. These imagery involved *gambling* or *drinking* and had components of *being in control* (for gambling), being "in the bubble"; in your favorite place in a mindset of complete focus and engagement while at the same time being relaxed. Fatima (43 years, GD) described an imagery: "it is the image of me in the sofa, with a glass of wine and this happy smile, and things are going all right, money rolls in." Sara (48 years, GD) further highlighted the memory of absorption and focus on the game:

> I had no thoughts at all. … my thoughts are like stopped while I am playing. My full concentration is in the game. In front of the game (…) when someone calls me to leave, I do not want to leave. … I want to stay.

Carol (62 years, AUD) often returned to the imagery of her drinking at the pub, which did not involve negative associations: "The one [image] of me at the pub, I find it a bit cozy… I like it … definitely." Carlos (30 years, GD) mentioned that craving imagery often involved being focused and in control:

> Letting go of everything on the outside, everything that is happening just now and just gamble and be the one I am when I gamble. If you ignore the negative parts, I still think I … want to control my gambling again.

'Something good will come out of it'

Expected outcomes of drinking or gambling formed an essential part of the craving experience. Participants with GD experienced imagery relating to winning money and using the money, e.g., solving debts or buying things for friends and family, seeing "happy faces." In contrast, participants with AUD descriptions involved *escape and relief* descriptions, aiming for a relief through drinking, as William (42 years, AUD) mentioned: "I drink to that. To return to the calmness. To calm these feelings." or to resolve rumination or panicking over a problem for Steven (59 years, AUD) "I use the word panic … the insight that I cannot solve this problem here and now. I have to do something else."

Gambling cravings involved descriptions of *hope* and were mentioned in connection to *identity*, i.e., regaining dignity or being "oneself" through gambling. Carlos' described how he would *spend on others* with a gambling win: "Buy a house, travel. Spoil my wife. In my thoughts I want to show others that I have won. I want to give to others."

Domain: Modes of thought

The conflict between imagery and verbal thoughts. The participants described their craving initially dominated by *mental imagery* rather than verbal thoughts. Mental imagery could, however, set off verbal thoughts and a conflict between different motives, as Eric (34 years, GD) describes it:

> It is first a movie, then it becomes verbal thoughts (…) the good angel on the one shoulder and the evil angel on the other fighting each other. Most often when I get that big thought about a big win … as a

> consequence there is like a counterreaction, because it is improbable.

Mental imagery was more emotionally laden and accompanied with less reasoning of consequences and could reduce the possibility of preventing a relapse. Emma (50 years, AUD) detailed her cravings as mostly containing mental imagery and that imagery did not involve any contemplation:

> My problem is that I do not think enough. If I had thought and reasoned a bit more, maybe I would not have bought alcohol at all … so it is more imagery.

Verbal thoughts were depicted as *inhibitory self-talk* and a conflict between oppositional motives for and against gambling or drinking. These thoughts were commonly reactions to a prior craving imagery and involved reasoning about consequences, planning, and evaluating actions. Margaret (50 years, GD) highlighted the function of verbal thoughts as:

> I have had conferences with myself, tried to talk sense to myself, I have cursed, I have praised, and I have cautioned. I think I have had conversations in different ways with myself, both from a positive and negative angle.

Verbal thoughts were mentioned as "counter-thoughts" (Eric, 34 years, GD) experienced when craving, and as Margaret mentioned: "accounts of what the consequences might be if I don't stop gambling now."

On the other hand, verbal thoughts could also serve as *elaborations* and planning to seek out opportunities to drink or gamble, as Eric described in relation to his cravings: "I am discussing with myself, how to get hold of money … I will find a way to get money, to borrow money."

This conflict between "opposite systems" and a deficiency of a logical decision process was outlined by Emma (50 years, AUD): "It is the struggle, the conscious, logical, I am not, at least I do not see myself as a stupid person, it is two different … it becomes like a conflict."

When hindering oneself from drinking or gambling, oppositional motives were at stake. The motivations to gamble or drink fueled by imagery of anticipation and desired outcomes, and the motivations to refrain were for the most part driven by verbal reasoning. When in the process of quitting participants described the cravings as less frequent, but more intense since the craving was not "satisfied" by placing a bet (Carlos, 27 years, GD).

Domain: Coping with craving

Cravings as a symptom of sickness. In contrast to the appetitive descriptions, cravings could be experienced as a symptom of sickness and evoke reactions of *nausea* and be associated with *anxiety*, *stress* and *compulsion*. A common description was that the cravings changed after experienced severe negative consequences from gambling or drinking. Fatima's (43 years, GD) image of online slot-wheels spinning invoked consecutive self-criticism: "I do not even want to think about it (the imagery). When it pops up, I just get mad. I get really pissed [laughing], because I do not want to have it at all. I become mad because I still even think about it."

Coping through distraction, self-punishment, and sensory control. Not all participants had an explicit strategy to cope with cravings or simply waited for the cravings to dissolve. Those who described strategies, active *distraction* and avoidance was most common, such as engaging in another, competing activity such as writing, talking to a friend. When craving emerged, Maria (31 years, GD) got busy with other activities: "most often it is about some form of household work, leave the situation, cleaning or doing the dishes, having a shower. Go away, simply do something else."

Another strategy, although not commonly applied, was *reducing sensory inputs* described by two participants, such as turning off sounds at the online casino, or taking a different route home to not be exposed to the signs of the liquor store.

Imagining negative consequences from gambling or drinking was also mentioned, such as "facing reality," by thinking about previous outcomes from drinking relapses for participants with AUD or the actual probabilities of winning money for participants with GD, as Maria (31 years, GD) described:

> More in line with reality. If I think about wins, I try instead to think about losses. So that I know this dream image is not accurate. I try to convince myself

> that this image (negative outcome) is what actually happens 99 times out of 100.

The participants related to their craving experience in diverse ways. The craving experiences were described both as "painful" or "dangerous" but also as attractive, positive, and for some, cozy. Eric (34 years, GD) wanted to embrace the feeling: "… damn. This will be very good. Then I do not want to let go of it, instead I want to ride on that feeling, because it feels good in my whole body."

Domain: Context of cravings

Here and now as a reminder. Being in *a situation* where the participants previously had been gambling or drinking were a common context for craving occurrence, where "the stupid learned behavior took over" as Emma (50 years, AUD) portrayed it. For participants with AUD, it could involve passing a pub or an alcohol store or a friend reminding them of drinking. Other common situations described were "at home" or "in the sofa," during different times of the day depending on gambling or drinking habits.

Participants with GD more commonly described *external stimuli* associated with craving such as an upcoming sports event, gambling commercials, or even sensory inputs from children's toys resembling the sound of an online casino slot. Margaret (50 years, GD) described how she has practiced becoming aware of her craving triggers:

> The cravings were most often triggered by something. At the beginning, it was TV or radio commercials, the ads outdoor that were really hard. You were attacked with commercials everywhere ... And sometimes I know I could just be cooking or occupied at the computer or something else, and I felt how it started to crawl in my body and I became restless.

Other external triggers presented more commonly among participants with GD were financial triggers such as receiving a bill, getting access to money, or being preoccupied with personal finances. Ian (42 years, GD) explains his reaction to receiving salary: "you receive your paycheck to your bank account at 12 pm, wake up and start gambling."

Being alone and situations of low stimuli were often preceding cravings, mainly for participants with GD. Eric (34 years, GD) thought that cravings most often emerged when he was alone:

> Most often it is a situation when I am alone, for example when I am driving from work. When you have a chance to think freely for a while. Or if I am working by myself with something monotonous, then [craving] might show up.

Emotions sets the stage. Participants with AUD described internal stimuli associated with craving, such as feelings of stress, anxiety and depression and a desire to regulate these experiences. Emily (50 years, AUD) described her antecedents to cravings as "the feelings of hopelessness, powerlessness and giving up. I become so tired and my body hurts. I can't find a way." Participants with AUD descriptions commonly involved an aim to reduce the effect of sensory input. Samuel (52 years, AUD) described: "it happens more often in situations where things are getting stressful. Many things at the same time. (…) It becomes like … I need some support here."

Discussion

The purpose of the present study was to investigate detailed accounts of craving experiences, in terms of mode of thought, content and contexts of craving. The results add first person perspectives on craving during abstinence in a period when trying to regain control over an addictive behavior. A common theme was experiencing craving as initially dominated by mental imagery; verbal thoughts were described as a consecutive, contemplative phase of the craving, often reasoning about the possible consequences. For some, verbal thoughts did also have a function of seeking out opportunities to drink or gamble. Common themes were positively framed imagery related to experiences with gambling and drinking, imagery of the preparative routines and anticipated outcomes. There were differences between GD and AUD in terms of the context of craving and that individuals AUD related craving to internal states to a larger extent.

The finding that the craving experience is characterized by mental imagery is in line with one previous study in a non-clinical population, showing that mental imagery was more common

than thoughts.[37] In this sample, 74% reported that mental imagery formed a part of the craving experience, as compared to 65% reporting "thoughts." Positive affect was the most common trigger reported among non-clinical gamblers in contrast to the current sample where negative mood states were more common.

The participants' descriptions of verbal thoughts resembled self-talk, often serving the purpose of inhibiting addictive impulses through awareness of long-term negative consequences. This strategy can be found in many CBT-treatments, shifting focus from the immediate to long-term consequences. In addition, using this type of deliberate inner speech has been associated with generating robust verbal representations, perhaps reinforcing abstinence, but has also been hypothesized as secondary to visual thinking, given its order in evolution.[45]

The preparative rituals described, such as getting access to alcohol or preparing to gamble, resemble the "drug-seeking behavior" reported in animal studies.[46] This anticipatory seeking out behavior might be intrinsically rewarding and the dopaminergic system stimulates foraging or the incentive motivation—the memory of past reward and the expectation of future reward.[47] Noteworthy is that the preparative routines themselves were reported as craving imagery. This can indicate the highly reinforcing effect of anticipation, i.e., for some, the phase of anticipating drinking or gambling becomes essential to the craving experience. One might speculate that the distorted expectancy might peak during this phase, when the actual effects are unknown. In accordance, the anticipatory dopamine response without intake of substances and the reward prediction error has been suggested to be a common feature across addictions.[48]

At the time of the interview, the participants were at least five days abstinent. This state of abstinence, according to learning theory, can enhance reward signals.[49] Aversive states prepare the individual for enhanced acquisition of the reinforcing value of stimuli, in this study described under the theme e*motions set the stage*. The negative mood states, or even situations of low stimuli, mentioned in relation to craving can function as an establishing operation and increase the anticipatory effects.

There were some differences in craving contexts and anticipated outcomes related to the addictive disorder. Participants with GD described external stimuli associated with craving to a larger extent, and anticipated effects involved gaining financial assets and through them restored identity and even hope. This is in contrast to participants with AUD, whose descriptions commonly involved internal stimuli associated with craving and anticipation of short-term emotional outcomes such as experiencing relief or stress reduction: some of the participants with AUD specifically mentioned an anticipated and rather immediate dampening effect of sensory activation, resembling short-term stress reduction. This could be viewed such that gambling craving to a larger extent involves positive expectation, or reward, while alcohol craving leans more toward relief. Even though relief cravings have been reported in GD, and incorporated in measures of gambling craving, such as the Gambling Craving Scale,[50] they might be more prominent in alcohol cravings. Some have argued that gambling cravings do not emerge from wanting relief from negative emotions, but rather from a lack of positive experiences.[51] In accordance, participants with GD in the present study reported that cravings could emerge in low stimuli situations, with the expectancy of heightened arousal and focus through gambling.

So what are the lessons learned and their implications for clinical practice?

First, a *conscious scrutinization* of addictive imagery and its function might provide better opportunities for increasing self-control. Another strategy stemming from this line of research is to develop *competing positive abstinence imagery,* i.e., to strengthen the emotional connection to these goals.[52,53] Preferably, this imagery must compete with the addictive behavior and be of value for the individual. Noteworthy is that this strategy was not mentioned by the participants in the present study and long-term consequences were mentioned mostly with a deterrent purpose. Active distraction, however, such as engaging in competing cognitive tasks was mentioned. Similar strategies have shown promise in reducing vividness and intrusiveness of trauma-related imagery.[54] As for craving, a guided imagery task and

brief body scans have shown to be superior at least to no intervention to prevent food cravings.[55] Additionally, research into mindfulness and acceptance strategies for alcohol, cigarettes and food craving has shown promising results.[56]

Experimental studies have shown that mental imagery tasks can be used to promote *satiation* and *habituation* to the desired stimulus. In a laboratory setting, repeated exposure to food intake-imagery (chocolate balls or cheese cubes) significantly decreased subsequent consumption, discussed to reduce the hedonistic value, the *liking* of the stimuli.[57] Similar tests have been conducted with a gambling task, among those imagining playing a slot machine 30 times played significantly fewer trials than those who did so only 3 times prior to the lab test.[58] However, one must note that these hypotheses have been tested predominantly among healthy individuals and not in clinical samples. In addition, subsequent studies have failed to replicate these results for food craving and consumption[59,60] and no effects were found for alcohol craving among individuals with AUD, but a significant decrease for alcohol craving among healthy controls.[61] The authors argued that abstinent individuals with AUD might have an aberrant ability to habituate to alcohol-related stimuli and that habituation might be primarily applicable to aversive stimuli. Nevertheless, it is unclear whether these effects promote a long term clinically significant change, and it is not possible to control to what extent subjects engage in a private event such as an imagery task.

Loss of control is a central feature of addictive disorders, outlined in the diagnostic taxonomies as repeated unsuccessful attempts to quit. In the craving descriptions there were some discrepancies, the participants with GD expressed a desire for increased control through gambling, in contrast to those with AUD. To put it differently, some craved gambling to regain control and some craved a drink to let go of control. Some responses might reflect the phenomenon of *illusion of control,* a common cognitive distortion among individuals with GD, which refers to the belief that one can exercise control over an entirely random event, such as a casino slot.[62]

Strengths and limitations and future directions

One strength of the study is the purposive sampling from addiction care, aiming at increasing the transferability of the findings to help seeking contexts for individuals with addictive disorders. Moreover, it is highly unlikely that the participants have reflected upon craving imagery previously and can be assumed to be naïve to the topic. The web survey prior to the interview did however include items measuring intensity and frequency of cravings and could potentially influence reports or at least a heightened awareness of one's craving. The role of subjectively reported craving within addiction treatment and research is yet to be fully understood. Future studies should investigate the link between the ability to switch between modes of thoughts and its relation to relapses both for individuals suffering from GD and AUD.

In summary, thematic analysis showed that abstinent individuals with AUD and GD describe mental imagery as a central feature of their craving experience and verbal thoughts as subsequent inhibitory self-talk. Craving imagery involves objects associated with the addiction, preparing and carrying out the behavior and anticipated effects of consumption. There is a need for research and clinical practice to take modes of thought and craving content into account.

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References

1. GBD 2016 Alcohol and Drug Use Collaborators. The global burden of disease attributable to alcohol and drug use in 195 countries and territories, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. Lancet Psychiat. 2018;5(12):987–1012. doi:10.1016/s2215-0366(18)30337-7.
2. Hodgins DC, Stea JN, Grant JE. Gambling disorders. Lancet. 2011;378(9806):1874–1884. doi:10.1016/S0140-6736(10)62185-X.
3. Black DW, Coryell W, Crowe R, McCormick B, Shaw M, Allen J. Suicide ideations, suicide attempts, and completed suicide in persons with pathological gambling and their first-degree relatives. Suicide Life-Threat Behav. 2015;45(6):700–9. doi:10.1111/sltb.12162.
4. Moghaddam JF, Yoon G, Dickerson DL, Kim SW, Westermeyer J. Suicidal ideation and suicide attempts in five groups with different severities of gambling: findings from the National Epidemiologic Survey on Alcohol and Related Conditions. Am J Addict. 2015;24(4):292–298. doi:10.1111/ajad.12197.
5. Edlund MJ, Booth BM, Han X. Who seeks care where? Utilization of mental health and substance use disorder treatment in two national samples of individuals with alcohol use disorders. J Stud Alcohol Drugs. 2012;73(4):635–646. doi:10.15288/jsad.2012.73.635.
6. Kohn R, Saxena S, Levav I, Saraceno B. The treatment gap in mental health care. Bull World Health Organ. 2004;82(11):858–866.
7. Public Health Agency of Sweden. Swedish longitudinal gambling study, Swelogs findings from wave one and wave two. 2016. https://www.folkhalsomyndigheten.se/contentassets/a8798390011b4b3e9caa09fd36c354b2/gambling-and-gambling-problems-in-sweden-2009-2010.pdf.
8. Suurvali H, Hodgins DC, Toneatto T, Cunningham JA. Motivators for seeking gambling-related treatment among Ontario problem gamblers. J Gambl Stud. 2012;28(2):273–296. doi:10.1007/s10899-011-9268-7.
9. Cowlishaw S, Merkouris S, Dowling N, Anderson C, Jackson A, Thomas S. Psychological therapies for pathological and problem gambling. Cochrane Database Syst Rev. 2012;11:CD008937. doi:10.1002/14651858.CD008937.pub2.
10. Knox J, Hasin DS, Larson FRR, Kranzler HR. Prevention, screening, and treatment for heavy drinking and alcohol use disorder. Lancet Psychiat. 2019;6(12):1054–1067. doi:10.1016/S2215-0366(19)30213-5.
11. Witkiewitz K, Finney JW, Harris AH, Kivlahan DR, Kranzler HR. Recommendations for the design and analysis of treatment trials for alcohol use disorders. Alcohol Clin Exp Res. 2015;39(9):1557–1570. doi:10.1111/acer.12800.
12. Drummond DC. Theories of drug craving, ancient and modern. Addiction. 2001;96(1):33–46. doi:10.1080/09652140020016941.
13. Kavanagh DJ, Statham DJ, Feeney GFX, Young RM, May J, Andrade J, Connor JP. Measurement of alcohol craving. Addict Behav. 2013;38(2):1572–1584. doi:10.1016/j.addbeh.2012.08.004.
14. Limbrick-Oldfield EH, Mick I, Cocks RE, McGonigle J, Sharman SP, Goldstone AP, Stokes PR, Waldman A, Erritzoe D, Bowden-Jones H, et al. Neural substrates of cue reactivity and craving in gambling disorder. Transl Psychiatry. 2017;7(1):e992. doi:10.1038/tp.2016.256.
15. Cavicchioli M, Vassena G, Movalli M, Maffei C. Is craving a risk factor for substance use among treatment-seeking individuals with alcohol and other drugs use disorders? A meta-analytic review. Drug Alcohol Depend. 2020;212:108002. doi:10.1016/j.drugalcdep.2020.108002.
16. Hodgins DC, el-Guebaly N. Retrospective and prospective reports of precipitants to relapse in pathological gambling. J Consult Clin Psychol. 2004;72(1):72–80. doi:10.1037/0022-006X.72.1.72.
17. Canale N, Cornil A, Giroux I, Bouchard S, Billieux J. Probing gambling urge as a state construct: evidence from a sample of community gamblers. Psychol Addict Behav. 2019. doi:10.1037/adb0000438.
18. Skinner MD, Aubin H-J. Craving's place in addiction theory: contributions of the major models. Neurosci Biobehav Rev. 2010;34(4):606–623. doi:10.1016/j.neubiorev.2009.11.024.
19. Ashrafioun L, Rosenberg H. Methods of assessing craving to gamble: a narrative review. Psychol Addict Behav. 2012;26(3):536–49.
20. American Psychiatric Association, D. S., & American Psychiatric Association. 2013. Diagnostic and statistical manual of mental disorders: DSM-5 (Vol. 5). Washington, DC: American psychiatric association.
21. Di Simplicio M, Renner F, Blackwell SE, Mitchell H, Stratford HJ, Watson P, Myers N, Nobre AC, Lau-Zhu

A, Holmes EA. An investigation of mental imagery in bipolar disorder: exploring "the mind's eye". Bipolar Disord. 2016;18(8):669–683. doi:10.1111/bdi.12453.
22. Ji JL, Kavanagh DJ, Holmes EA, MacLeod C, Di Simplicio M. Mental imagery in psychiatry: conceptual & clinical implications. CNS Spectr. 2019;24(1):114–126. doi:10.1017/S1092852918001487.
23. Hales SA, Deeprose C, Goodwin GM, Holmes EA. Cognitions in bipolar affective disorder and unipolar depression: imagining suicide. Bipolar Disord. 2011;13(7–8):651–661. doi:10.1111/j.1399-5618.2011.00954.x.
24. Holmes EA, Crane C, Fennell MJV, Williams JMG. Imagery about suicide in depression-"Flash-forwards"? J Behav Ther Exp Psychiatry. 2007;38(4):423–434. doi:10.1016/j.jbtep.2007.10.004.
25. Holmes EA, Mathews A. Mental imagery and emotion: a special relationship? Emotion. 2005;5(4):489–497. doi:10.1037/1528-3542.5.4.489.
26. Libby LK, Shaeffer EM, Eibach RP, Slemmer JA. Picture yourself at the polls: visual perspective in mental imagery affects self-perception and behavior. Psychol Sci. 2007;18(3):199–203. doi:10.1111/j.1467-9280.2007.01872.x.
27. Vygotsky LS. Thought and language. Cambridge, Massachusetts: MIT Press; 2012.
28. Amit E, Hoeflin C, Hamzah N, Fedorenko E. An asymmetrical relationship between verbal and visual thinking: converging evidence from behavior and fMRI. Neuroimage. 2017;152:619–27. doi:10.1016/j.neuroimage.2017.03.029.
29. Amit E, Gottlieb S, Greene JD. Visual versus verbal thinking and dual-process moral cognition. In: Dual-process theories of the social mind. New York: Guilford Publications. 2014. p. 340–54.
30. Arcan K, Karanci AN. Adaptation, validity, and reliability study of the five-factor gambling motives scale. Anadolu Psikiyatri Derg. 2014;15(3):248–56. doi:10.5455/apd.48431.
31. Goodie AS, Fortune EE. Measuring cognitive distortions in pathological gambling: review and meta-analyses. Psychol Addict Behav. 2013;27(3):730–743. doi:10.1037/a0031892.
32. Kavanagh. Imaginary relish and exquisite torture: the Elaborated Intrusion Theory of desire. 2005.
33. May J, Kavanagh DJ, Andrade J. The Elaborated Intrusion Theory of desire: a 10-year retrospective and implications for addiction treatments. Addict Behav. 2015;44:29–34. doi:10.1016/j.addbeh.2014.09.016.
34. Antons S, Brand M, Potenza MN. Neurobiology of cue-reactivity, craving, and inhibitory control in non-substance addictive behaviors. J Neurol Sci. 2020;415:116952. doi:10.1016/j.jns.2020.116952.
35. Childress AR, Ehrman RN, Wang Z, Li Y, Sciortino N, Hakun J, Jens W, Suh J, Listerud J, Marquez K, et al. Prelude to passion: limbic activation by "unseen" drug and sexual cues. PLoS One. 2008;3(1):e1506. doi:10.1371/journal.pone.0001506.
36. Kavanagh DJ, May J, Andrade J. Tests of the elaborated intrusion theory of craving and desire: features of alcohol craving during treatment for an alcohol disorder. Br J Clin Psychol. 2009;48(Pt 3):241–254. doi:10.1348/014466508X387071.
37. Cornil A, Lopez-Fernandez O, Devos G, de Timary P, Goudriaan AE, Billieux J. Exploring gambling craving through the elaborated intrusion theory of desire: a mixed methods approach. Int Gambl Stud. 2018;18(1):1–21. doi:10.1080/14459795.2017.1368686.
38. Caselli G, Spada MM. The Desire Thinking Questionnaire: development and psychometric properties. Addict Behav. 2011;36(11):1061–7. doi:10.1016/j.addbeh.2011.06.013.
39. Braun V, Clarke V. Successful qualitative research: a practical guide for beginners. Sage; 2013.
40. Braun V, Clarke V. One size fits all? What counts as quality practice in (reflexive) thematic analysis? Qual Res Psychol. 2021;18(3):328–52. doi:10.1080/14780887.2020.1769238.
41. Malterud K, Siersma VD, Guassora AD . Sample size in qualitative interview studies: guided by information power. Qual Health Res. 2016;26(13):1753–1760. doi:10.1177/1049732315617444.
42. May J, Andrade J, Kavanagh DJ, Feeney GF, Gullo MJ, Statham DJ, Skorka-Brown J, Connolly JM, Cassimatis M, Young RM, et al. The craving experience questionnaire: a brief, theory-based measure of consummatory desire and craving. Addiction. 2014;109(5):728–735. doi:10.1111/add.12472.
43. Cornil A, Long J, Rothen S, Perales JC, de Timary P, Billieux J. The gambling craving experience questionnaire: psychometric properties of a new scale based on the elaborated intrusion theory of desire. Addict Behav. 2019;95:110–117. doi:10.1016/j.addbeh.2019.02.023.
44. Ose SO. Using excel and word to structure qualitative data. J Appl Soc Sci. 2016;10(2):147–162. doi:10.1177/1936724416664948.
45. Amit E, Greene JD. You see, the ends don't justify the means: visual imagery and moral judgment. Psychol Sci. 2012;23(8):861–8. doi:10.1177/0956797611434965.
46. Perry CJ, Zbukvic I, Kim JH, Lawrence AJ . Role of cues and contexts on drug-seeking behaviour. Br J Pharmacol. 2014;171(20):4636–4672. doi:10.1111/bph.12735.
47. Arias-Carrión O, Stamelou M, Murillo-Rodríguez E, Menéndez-González M, Pöppel E. Dopaminergic reward system: a short integrative review. Int Arch Med. 2010;3:24. doi:10.1186/1755-7682-3-24.
48. Linnet J. The anticipatory dopamine response in addiction: a common neurobiological underpinning of gambling disorder and substance use disorder? Prog Neuropsychopharmacol Biol Psychiat. 2020;98:109802. doi:10.1016/j.pnpbp.2019.109802.
49. Hutcheson DM, Everitt BJ, Robbins TW, Dickinson A. The role of withdrawal in heroin addiction: enhances

reward or promotes avoidance? Nat Neurosci. 2001;4(9):943–947. doi:10.1038/nn0901-943.
50. Young MM, Wohl MJ. The Gambling Craving Scale: psychometric validation and behavioral outcomes. Psychol Addict Behav. 2009;23(3):512–522. doi:10.1037/a0015043.
51. Castro Vd, Fong T, Rosenthal RJ, Tavares H. A comparison of craving and emotional states between pathological gamblers and alcoholics. Addict Behav. 2007;32(8):1555–64. doi:10.1016/j.addbeh.2006.11.014.
52. Andrade J, Khalil M, Dickson J, May J, Kavanagh DJ. Functional Imagery Training to reduce snacking: testing a novel motivational intervention based on Elaborated Intrusion theory. Appetite. 2016;100:256–62. doi:10.1016/j.appet.2016.02.015.
53. Solbrig L, Whalley B, Kavanagh DJ, May J, Parkin T, Jones R, Andrade J. Functional imagery training versus motivational interviewing for weight loss: a randomised controlled trial of brief individual interventions for overweight and obesity. Int J Obes (Lond). 2019;43(4):883–894. doi:10.1038/s41366-018-0122-1.
54. Iyadurai L, Blackwell SE, Meiser-Stedman R, Watson PC, Bonsall MB, Geddes JR, Nobre AC, Holmes EA. Preventing intrusive memories after trauma via a brief intervention involving Tetris computer game play in the emergency department: a proof-of-concept randomized controlled trial. Mol Psychiatry. 2018;23(3):674–682. doi:10.1038/mp.2017.23.
55. Hamilton J, Fawson S, May J, Andrade J, Kavanagh DJ. Brief guided imagery and body scanning interventions reduce food cravings. Appetite. 2013;71:158–162. doi:10.1016/j.appet.2013.08.005.
56. Tapper K. Mindfulness and craving: effects and mechanisms. Clin Psychol Rev. 2018;59:101–117. doi:10.1016/j.cpr.2017.11.003.
57. Morewedge CK, Huh YE, Vosgerau J. Thought for food: imagined consumption reduces actual consumption. Science. 2010;330(6010):1530–1533. doi:10.1126/science.1195701.
58. Whiting SW, Dixon MR. Effects of mental imagery on gambling behavior. J Gambl Stud. 2013;29(3):525–534. doi:10.1007/s10899-012-9314-0.
59. Haasova S, Elekes B, Missbach B, Florack A. Effects of imagined consumption and simulated eating movements on food intake: thoughts about food are not always of advantage [Original Research]. Front Psychol. 2016;7:1691. doi:10.3389/fpsyg.2016.01691.
60. Zorjan S, Schwab D, Schienle A. The effects of imaginary eating on visual food cue reactivity: an event-related potential study. Appetite. 2020;153:104743. doi:10.1016/j.appet.2020.104743.
61. Geisel O, Behnke J, Schneider M, Wernecke K-D, Müller CA. Effects of repetitive imagination of alcohol consumption on craving in alcohol-dependent patients: a pilot study. Addict Behav Rep. 2016;4:51–57. doi:10.1016/j.abrep.2016.08.001.
62. Fortune EE, Goodie AS. Cognitive distortions as a component and treatment focus of pathological gambling: a review. Psychol Addict Behav. 2012;26(2):298–310. doi:10.1037/a0026422.