

Measuring Preference for Supernormal Over Natural Rewards: A Two-Dimensional Anticipatory Pleasure Scale

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Abstract

Supernormal (SN) stimuli are artificial products that activate reward pathways and approach behavior more so than naturally occurring stimuli for which these systems were intended. Many modern consumer products (e.g., snack foods, alcohol, and pornography) appear to incorporate SN features, leading to excessive consumption, in preference to naturally occurring alternatives. No measure currently exists for the self-report assessment of individual differences or changes in susceptibility to such stimuli. Therefore, an anticipatory pleasure scale was modified to include items that represented both SN and natural (N) classes of rewarding stimuli. Exploratory factor analysis yielded a two-factor solution, and as predicted, N and SN items reliably loaded on separate dimensions. Internal reliability for the two scales was high, $\rho = .93$ and $\rho = .90$, respectively. The two-dimensional measure was evaluated via regression using the N and SN scale means as predictors and self-reports of daily consumption of 21 products with SN features as outcomes. As expected, SN pleasure ratings were related to higher SN product consumption, while N pleasure ratings had either negative or neutral associations to consumption of these products. We conclude that the resulting two-dimensional measure is a potentially reliable and valid self-report measure of differential preference for SN stimuli. While further evaluation is needed (e.g., using experimental measures), the proposed scale may play a useful role in the study of both trait- and state-based variation in human susceptibility to SN stimuli.

Keywords

anticipatory pleasure scale, supernormal stimuli, natural stimuli, reward

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Introduction

Processed foods, psychoactive substances, some retail goods, and various social media and gaming products are readily over-consumed, presenting numerous population health challenges (Roberts, van Vught, & Dunbar, 2012). Evolutionary psychology provides a persuasive explanation of excessive consumption. Animals, including humans, tend to approach (i.e., gather, acquire, and consume) stimuli that provide the highest relative reward for their efforts, thereby optimizing their utility (Chakravarthy & Booth, 2004; Kacelnik & Bateson, 1996). Neurological reward mechanisms evolved to promote adaptive behavior by reinforcing stimuli that send signals of promoting fitness, such as providing nutrients or reproductive opportunities. Tinbergen (1948) coined the term “Supernormal Stimulus” upon finding that animals tend to exhibit heightened responses to exaggerated versions of natural stimuli. This “selection asymmetry” (Staddon, 1975; Ward, 2013) is not

maladaptive in natural environments in which exaggerated versions of the stimulus are rare—but presents problems when artificial and exaggerated alternatives exist. For example, the newly hatched herring gull prefers to peck at a fabricated thin red rod with white bands at its tip, rather than its mother’s naturally red spotted thin beak (Tinbergen & Perdeck, 1951). In the context of resource selection, the outcome is a behavioral heuristic of “get all you can”: an adaptive strategy in natural environments where resource supply is scarce or unreliable. In

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the modern human environment, many highly rewarding experiences exist in the form of artificial consumer products that have been designed or refined to be supernormal. That is, they stimulate an evolved reward system to a degree not found in natural stimuli (Barrett, 2010). For example, psychoactive substances (Nesse & Berridge, 1997), commercial fast-food products (Barrett, 2007), gambling products (Rockloff, 2014), television shows (Barrett, 2010; Derrick, Gabriel, & Hugenberg, 2009), digital social networking and the Internet (Rocci, 2013; Ward, 2013), and various retail products, such as expensive cars (Erk, Spitzer, Wunderlich, Galley, & Walter, 2002), high-heeled shoes (Morris, White, Morrison, & Fisher, 2013), cosmetics (Etcoff, Stock, Haley, Vickery, & House, 2011), and children's toys (Morris, Reddy, & Bunting, 1995) have all been discussed as forms of modern day supernormal stimuli. For some of these stimuli, neurological evidence has shown that they tend to activate dopamine pathways intensely, hijacking the reward response designed for natural rewards, thereby promoting excess consumption and in some cases, addiction (Barrett, 2010; Blumenthal & Gold, 2010; Wang et al., 2001).

To varying degrees, supernormal stimuli tend to be unhealthy. The ready availability of high-calorie takeaway meals and snacks, the toxicity of alcohol and other substances, the sedentary activity involved in watching television, using digital media and gaming products, and the expense of retail items or gambling, all serve to provide an environment that fosters unhealthy behavioral choices, leading to harms (Barrett, 2007, 2010; Birch, 1999; Hantula, 2003; Ward, 2013). This makes the study of susceptibility of modern humans to supernormal stimuli of practical significance. In the current report, we use the term supernormal stimuli to refer to modern human products and experiences that are characterized by asymmetric selectivity (uncontrolled approach to more intense variants) and being made artificially abundant in the modern world. These products are often processed, refined, or synthesized consumer goods including snack foods or substances. Less obvious examples include messages received via social media. Although at times less stimulating than a face-to-face conversation, this communication method provides prolonged enhanced visual, speed, and delivery characteristics. Similarly, most modern day clothing and other retail products exhibit similar enhanced signifiers of rarity or desirability, with attendant implications for sexual or social status. Consumption or acquisition of these products is theorized to provide immediate reward due to being interpreted as fitness enhancing.

Individual Differences in Reward Preferences

Evolved reward mechanisms are generally regarded as species wide (De Jong & Van der Steen, 1998). However, this does not entail that all humans are "hard wired" to respond equally intensely to stimuli with exaggerated reward properties. That is, even highly species-typical behavioral phenotypes vary among individuals (Buss, 2009), and despite the general attractiveness of supernormal stimuli, not everybody regularly consumes to excess or succumbs to addiction (Sussman, Lisha, &

Griffiths, 2010). Pleasure is experienced from a variety of sources that do not involve consumption of supernormal stimuli, including exploring scenic landscapes, enjoying the company of family and friends, and engaging in favored hobbies or pastimes (Gard, Gard, Kring, & John, 2006; Snaith et al., 1995). An important question for health research and the enquiry of this study is: Do some people experience more intense reward from supernormal stimuli than by natural forms of stimuli?

It has been suggested that people do vary in their tendency to overconsume rewarding stimuli and that underlying psychological traits may help explain this individual variance (Faber, Christenson, de Zwaan, & Mitchell, 1995; Villeda et al., 2011; Weed, Butcher, McKenna, & Ben-Porath, 1992; Zeinali & Vahdat, 2011). Recent empirical findings using factor analysis support this assertion, demonstrating that a common underlying factor explains a meaningful proportion of covariance among immediately gratifying, hedonic products including alcohol, drug, cigarette, fast food, snack, salt, meat, caffeine, gambling, Internet, and television consumption (Goodwin, Browne, Rockloff, & Donaldson, 2015). Similarly, materialist economic behavior has been related to individual differences in orientation toward acquisition, suggesting that some individuals are particularly motivated toward rewards involving purchases, monetary gain, and consumption (Richins & Dawson, 1992). Both psychological and physiological literature (Davis et al., 2007; Dawe, Gullo, & Loxton, 2004; Moreno-López, Soriano-Mas, Delgado-Rico, Rio-Valle, & Verdejo-García, 2012; Volkow, Fowler, & Wang, 2002) suggest that these findings may reflect individual differences in orientation toward a general class of rewards with a common supernormal property.

The Current Study

To date, although scales measuring anticipated pleasure responses to rewarding experiences exist, no work has been done to distinguish responses to different types of reward. The Snaith-Hamilton Pleasure Scale (SHPS) was developed primarily to detect anhedonia in depressed patients (Snaith et al., 1995). Items for the scale were suggested by members of the general public ($n = 55$), each providing a list of five situations which provided them with pleasure. Items that were unlikely to be applicable to most people (e.g., specific alcoholic drinks or dietary preferences) were excluded. The majority of items in the final scale reflected examples of rewarding experiences that, by our definition, are natural (i.e., not supernormal; e.g., "I would enjoy other people's smiling faces" or "I would enjoy a warm bath or refreshing shower").

Although little is known regarding preferences for natural and supernormal stimuli, personality and neurological theory predicts that individuals may vary in their orientation toward different types of reward. Ideas from the literature on supernormal stimuli provide a framework to organize rewards into a two-dimensional natural/supernormal scheme. Using the SHPS

as a basis, the current study aims to create a measure of anticipated pleasure that included items clearly representing both supernormal and natural experiences. A scale that measures supernormal versus natural preference should predict above-average consumption of a broad class of modern artificial and enhanced products and should help improve our understanding of trait and state-based variation in unhealthy lifestyle choices.

We expected that modified SHPS would form a clear two-factor structure based on natural and supernormal items. Furthermore, we expected that higher anticipated pleasure ratings for supernormal experiences would predict higher frequency of actual consumption of a wide range of supernormal stimuli, and this list includes alcohol, drugs, caffeine, digital media products, high calorie foods, and luxury or otherwise nonessential retail products.

Material and Method

Supernormal Scale Development

A list of supernormal items was developed based on qualitative interviews with undergraduate university students, whereby participants ($n = 26$, 85% female, 18–46 years old) were asked to think about the things they enjoyed in life and list those things that they tended to do, or have, too much of. This technique was chosen in order to mirror the procedure used to develop the SHPS. Questions were administered using a semi-structured interview and were designed to tap perceptions of excessive or uncontrolled approach behavior, reflecting the asymmetric selectivity property of supernormal items (for full script, see Appendix A). Each unique response was allocated a node, and frequencies of nodes were tabulated. Responses describing specific illicit or restricted substances were removed, and nodes were combined in order to yield items that were as general as possible. For example, reference to general or specific savory snack foods were combined into a single node labeled “Eating a savory snack, such as cheese, crackers, chips or nuts.” From this, all nodes mentioned by 13 or more participants (>50% of the sample) were retained for the scale. These included high-calorie foods in the form of sweets and snacks, discretionary retail products, social media, and television.

Survey Participants and Procedure

Participants ($n = 5391$, 51% female) were members of an online survey panel maintained by an agency specializing in the recruitment of survey participants (myopinions.com.au). E-mails were sent to panel members inviting them to participate in the online survey for which they could earn points that could be accumulated and exchanged with the agency for cash. The full survey took approximately 20 min to complete. Ages ranged from 18 to 87 years old ($M = 49.01$, $SD = 16.50$). The majority of participants were born in Australia (74%), with the remainder born in the United Kingdom (8.4%), New Zealand (2.7%), or other (14.9%).

Measures

Supernormal Pleasure Scale. As described earlier, a set of 5 supernormal items were created for the purpose of this study (e.g., “Purchasing a new item such as clothing or an appliance for your house” or “Receiving a personal message via email, SMS or social networking site”). Respondents were asked how much pleasure they would expect to feel from each experience. Answers were recorded on a 5-point Likert scale ranging from (1 = none at all or neutral) to (5 = there is nothing I would enjoy more). The Spearman-Brown split half reliability for these items was high ($\rho = .90$).

Natural Pleasure Scale (NPS). The SHPS (Snaith et al., 1995) consists of 14 items measuring how much pleasure a participant would anticipate feeling in response to a variety of experiences. One item “Watching my favorite television show” was redundant as it was identical to an item from the Supernormal Pleasure Scale (SNPS), and 5 items from the SHPS did not clearly describe either supernormal or natural experiences (e.g., “My favorite meal”). Only the 8 remaining items that clearly described natural stimuli (e.g., “Having a refreshing bath or shower” and “The scent of flowers or a sea breeze”) were retained. Respondents answered on a 5-point Likert-type scale ranging from (1 = “none at all or neutral”) to (5 = “there is nothing I would enjoy more”). The Spearman-Brown split half reliability for these items was high ($\rho = .93$).

Behavioral items. Twenty-one variables representing the consumption of a range of foods, substances, entertainment, and retail products were aggregated from a set of 58 questions asking participants to record typical time spent on or frequency of various types of consumption (e.g., “On a typical weekday or working day how much time do you spend gaming on a desktop computer, game console, portable gaming system, mobile phone or tablet” or “On average how often do you drink caffeinated soft drinks such as Coke or Pepsi”). Participants responded on a Likert-type scale between 7 and 9 categories for most items, whereby the middle category represented an approximate average based on, where available, population norms. For example, responses regarding various forms of entertainment consumed on a typical day included “1 = none, 2 = less than 10, 3 = 10 to 30 min, 4 = 30 min to 1 hr, 5 = 1 to 3 hr, 6 = 3 to 5 hr, 7 = 5 to 7 hr, and 8 = over 7 hr.” Items that represented the same activity or product were aggregated. For example, all items regarding caffeinated drinks were summed to create a *caffeine* variable. Where possible, established scales were utilized such as the brief Alcohol Use Disorders Identification Test (AUDIT C; Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998) for alcohol consumption and the Consumption Scale for Problem Gambling (Rockloff, 2011). See Appendix B for the full questionnaire. The continuous behavioral variables calculated from each scale or measure were characterized by a range of distributions, some markedly nonnormal. They were converted into binary indicators of “above typical consumption” based on a median split. This allowed a consistent analysis method (logistic regression) to be used on all behavioral responses and aided interpretation and presentation of results.

Statistical Analyses

The 13 selected anticipatory pleasure items were entered into an exploratory factor analysis (EFA) using the Mplus statistical software package. After reliability checks on subscales in two-factor solution, mean pleasure ratings were calculated for supernormal pleasure (SNP) and natural pleasure (NP) item sets and normalized. Binary logistic regression models were run in R statistical software for each of the median split behavioral variables, simultaneously predicted by SNP and NP.

Results

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy approximated the proportion of variance caused by an underlying factor to be .897 and Bartlett's test of sphericity was $\chi^2(78) = 29,895.431$, $p < .001$, warranting factor analysis. Table 1 shows the results of the factor analysis exploring one- and two-factor models. As expected, items in the two-factor solution showed no cross-loadings. All items loaded positively on their corresponding factor with no cross-loading. Spearman-Brown reliabilities for the supernormal and natural scale were $\rho = .91$ and $\rho = .93$, respectively.

SNP and NP were correlated, $r = .497$, $p < .001$. This was expected as they are conceptualized subdomains of a more general construct of overall anticipatory pleasure or inversely, as the SHPS was originally intended, anhedonia. Simultaneous entry of both SNP and NP in the regression analyses allowed each independent variable (IV) to act as the other's control, and increases the degree to which the beta coefficients reflected the unique contribution of SNP/NP, rather than general anticipatory pleasure. Table 2 displays the results of 21 binary logistic regression models predicting above-typical consumption of various products using normalized SNPs and NPS means. Where the dependent variable matched one of the items in the supernormal scale, this item was removed from the scale for this analysis. For example, when predicting TV consumption, the item "Watching my favorite television program" was not included in the aggregated supernormal scale. All 21 supernormal behavioral variables were predicted by SNP. Many behaviors shared moderate to large associations (Cohen, 1988) with SNP ratings. For example, eating snacks, $\beta = .460$, standard error (SE) = .050, $p < .001$; sweets, $\beta = .425$, $SE = .038$, $p < .001$; dessert, $\beta = .375$, $SE = .051$, $p < .001$; take away food, $\beta = .372$, $SE = .037$, $p < .001$; social networking, $\beta = .424$, $SE = .034$, $p < .001$; buying packaged food, $\beta = .366$, $SE = .037$, $p < .001$; browsing online, $\beta = .332$, $SE = .036$, $p < .001$; and playing video games, $\beta = .302$, $SE = .034$, $p < .001$. The remainder of items shared small to medium associations with SNP ratings. Furthermore, all but two behaviors (junk mail and magazines) were negatively predicted, or not predicted, by NP after controlling for SNP. Finally, the binarized behavioral variables were aggregated using a simple count, yielding a variable that described the number of behaviors (of 21) that individuals undertook at above-median levels. The resulting count was approximately

Table 1. Comparing Fit Statistics and Factor Loadings for One- and Two-Factor Models, With Final Set of Items and Spearman-Brown Statistics for Items in Each Factor.

	One-Factor Model		Two-Factor Model	
	1	1	1	2
Natural				
Being with close family or friends	.542*		.529*	
Engaging in hobbies or pastimes	.473*		.421*	
Having a warm bath or refreshing shower	.642*		.523*	
The scent of flowers or a sea breeze ^a	.747*		.740*	
Seeing other peoples smiling faces	.787*		.808*	
Small things (e.g., a bright sunny day or a phone call from a friend)	.823*		.819*	
A beautiful landscape or view	.781*		.810*	
Helping others	.718*		.757*	
Supernormal				
Watching my favorite television program ^a	.393*			.306*
Purchasing a new item such as clothing or and appliance for the house ^b	.492*			.426*
Receiving a personal message via e-mail, SMS, or social networking website ^b	.483*			.484*
Eating a dessert such as cake, ice-cream or cookies ^b	.448*			.856*
Eating a savory snack, such as cheese, crackers, chips, or nuts ^b	.483*			.785*
Spearman-Brown ρ	.89		.93	.90
Correlation with factor 1	—			.497*
Chi-square	6,851.594			2,818.408
df	65			53
RMSEA	.139			.098
SRMR	.082			.042
AIC	161,741.659			157,732.473
BIC	161,998.766			158,068.690
χ^2 difference (two factor vs. one factor)	—			4,033.186*

Note. RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual; AIC = Akaike information criterion; BIC = Bayesian information criterion.

^aOriginal item edited by author. ^bAuthor additions.

*Significant at the $p < .05$, loadings $< .25$ suppressed

normally distributed, and we employed ordinary least squares to regress it on NP and SNP. It was negatively predicted by NP, $\beta = -.746$, $SE = .051$, $p < .001$, and positively predicted by SNP, $\beta = 1.116$, $SE = .051$, $p < .001$.

Discussion

The current study aimed to develop and validate a pleasure scale that could distinguish between preferences for SNP and NP experiences. We used the following two-step process: (1)

Table 2. Logistic Regression Results Predicting Above/Below Median Split for Each Supernormal Behavioral Variable From Mean Natural and Supernormal Pleasure Ratings.

	Natural						Super						
	Range (Median)	n > med	B (SE)	Wald	Lower CI	Upper CI	OR	Lower CI	Upper CI	B (SE)	Wald	Lower CI	Upper CI
Snacks ^a	1-7 (2)	2,618	-0.200 (0.033)	-6.096	1.141	1.180	1.180	1.141	1.220	0.460 (0.050)	9.229	1.508	1.666
Sweets	1-7 (3)	1,451	-0.231 (0.038)	-6.125	0.950	0.982	0.982	0.950	1.014	0.425 (0.038)	11.123	1.473	1.590
Social networking	3-25 (10)	2,548	-0.176 (0.033)	-5.295	0.811	0.838	0.838	0.811	0.867	0.424 (0.034)	12.467	1.477	1.581
Dessert ^c	1-7 (2)	2,494	-0.088 (0.033)	-2.646	0.886	0.916	0.916	0.886	0.947	0.375 (0.051)	7.343	1.383	1.531
Take away	2-14 (4)	1,576	-0.309 (0.037)	-8.429	0.708	0.734	0.734	0.708	0.762	0.372 (0.037)	10.014	1.397	1.450
Trolley	2-14 (2)	1,682	-0.547 (0.037)	-14.739	0.557	0.578	0.578	0.557	0.600	0.366 (0.037)	9.863	1.389	1.442
Browse online	1-6 (3)	1,676	-0.087 (0.036)	-2.441	0.884	0.916	0.916	0.884	0.950	0.332 (0.036)	9.204	1.344	1.444
Video gaming	2-16 (2)	2,466	-0.350 (0.034)	-10.385	0.670	0.693	0.693	0.670	0.717	0.302 (0.034)	8.994	1.308	1.399
Soft drink	2-12 (4)	2,271	-0.367 (0.034)	-10.790	0.670	0.693	0.693	0.670	0.717	0.284 (0.034)	8.380	1.284	1.374
Internet	2-16 (10)	1,632	-0.268 (0.036)	-7.459	0.738	0.765	0.765	0.738	0.793	0.280 (0.036)	7.724	1.276	1.371
Shopping ^a	2-14 (4)	2,088	-0.016 (0.033)	-0.473	0.953	0.985	0.985	0.953	1.017	0.238 (0.048)	4.988	1.210	1.331
Meat product	1-7 (3)	943	-0.302 (0.043)	-7.075	1.110	1.147	1.147	1.110	1.186	0.233 (0.044)	5.342	1.208	1.318
Junk mail	1-6 (3)	2,615	0.137 (0.033)	4.155	1.110	1.147	1.147	1.110	1.186	0.221 (0.033)	6.687	1.207	1.289
Pornography	2-16 (2)	1,371	-0.424 (0.038)	-11.171	0.630	0.654	0.654	0.630	0.679	0.210 (0.038)	5.483	1.188	1.234
Drugs	1-6 (1)	348	-0.343 (0.064)	-5.325	0.665	0.709	0.709	0.665	0.757	0.207 (0.067)	3.098	1.151	1.230
TV ^a	2-16 (10)	2,542	-0.009 (0.032)	-0.267	0.960	0.992	0.992	0.960	1.024	0.191 (0.044)	4.373	1.159	1.211
Magazines	1-7 (1)	2,288	0.210 (0.034)	6.208	1.192	1.233	1.233	1.192	1.276	0.165 (0.033)	4.970	1.141	1.180
Salt	2-8 (5)	2,115	-0.015 (0.033)	-0.454	0.953	0.985	0.985	0.953	1.018	0.158 (0.033)	4.740	1.133	1.172
Caffeine	8-47 (20)	2,450	-0.018 (0.033)	-0.559	0.950	0.982	0.982	0.950	1.014	0.138 (0.033)	4.230	1.111	1.148
Gambling	0-13 (1)	1,681	-0.068 (0.035)	-1.947	0.902	0.934	0.934	0.902	0.967	0.127 (0.035)	3.602	1.096	1.176
Alcohol	0-12 (3)	2,385	-0.101 (0.033)	-3.085	0.875	0.904	0.904	0.875	0.934	0.078 (0.033)	2.387	1.046	1.117

Note. OR = odds ratio; CI = confidence interval.

^aSupernormal pleasure rating mean calculated without item regarding this specific behavior.

***p < .001. **p < .01. *p < .05.

exploring the factor structure of a list of items designed to reflect either supernormal or natural reward properties and (2) regressing a broad range of behavioral variables measuring relative quantity/frequency of supernormal product consumption onto the newly formed subscales. EFA results revealed a two-factor solution that fit the data well and clearly distinguished between two types of reward. That is, natural items loaded positively on the first factor (NP), and items designed to represent supernormal stimuli loaded positively on the second factor (SNP) and with no cross loadings. The two factors were positively correlated ($r = .497$) reflecting the fact that both SNP and NP are conceptually subfactors of general anticipatory pleasure—contraindicative of anhedonia, the construct that the original SHPS was intended to measure. However, concordance of item content with the subfactor loadings, and the absence of cross loadings between subfactors, supports the idea that SNP and NP are meaningful subconstructs of general anticipated pleasure.

Multiple regression results added criterion validity to our interpretation of the two-factor solution. SNP and NP display consistent and contrasting relationships with a broad range of supernormal stimuli. When controlling for NP, those scoring higher on SNP were significantly more likely to consume above the median amount of supernormal products. This finding still applied when items describing the dependent variable were removed from the predictor variable. (e.g., When social networking was the dependent variable, the item “Receiving a personal message via email, SMS or social networking website” was removed from the SNPS). Effect sizes, although small to moderate for all items, were substantial, considering that it is recognized as generally difficult to directly predict specific behavioral outcomes based on general attitudes or personality traits (Ajzen & Timko, 1986). Anticipated pleasure responses to supernormal stimuli are not likely to predict a large proportion of variance in any one consumption behavior but rather a small to moderate amount of variance across a wide range of consumption behaviors.

The items “junk mail” and “magazines” did not conform to expectations. Both were predicted positively by SNP and NP ratings, and in the case of magazines, natural pleasure was a stronger predictor. This could be due to the fact that digital media has somewhat replaced print media in terms of supernormal status (delivering greater speed and accessibility) and that products in print media are an indirect form of supernormal stimuli in that they are only images. When SNP is taken into account, those scoring higher on NP were more likely to fall under the median amount of consumption of supernormal stimuli with the exception of “shopping” and “salt” intake, which were not significantly affected by NP.

These results suggest that items measuring anticipated reward from natural and supernormal stimuli can be successfully classified into two correlated but distinct scales. Current findings demonstrate criterion validity and internal reliability, supporting their use for measuring individual differences in susceptibility to supernormal reinforcement. It appears that the SNPS and NPS reflect the way in which individuals respond

differently to experiences involving fabricated products with enhanced reward properties (e.g., sweet foods and retail products), when compared to more natural forms of reward (e.g., being close to friends and family or viewing an attractive landscape). The relationship of SNP and NP with actual behavior is in line with theoretical expectations. These findings are also consistent with recent findings regarding a latent behavioral factor that explains positive covariance among the consumption of alcohol, drugs, cigarettes, fast food, snacks, TV, Internet, gambling products, caffeine, salt, and meat products (Goodwin et al., 2015). SNP preference is a plausible trait-based description of individual differences in this tendency to overconsume.

It has been suggested a preference for supernormal reward could be the result of differences in dopamine functioning. Dopamine deficiency has been found to be related to various forms of excess consumption including alcohol abuse, binge eating, problem gambling, and Internet addiction (Bergh, Eklund, Södersten, & Nordin, 1997; Blum, Cull, Braverman, & Comings, 1996; Johnson & Kenny, 2010; Kim et al., 2011). The concept of supernormal susceptibility is consistent with an interpretation in terms of individual variability in the dopamine functioning. Dopaminergic pathways, evolved to prioritize resource acquisition and consumption in a resource-scarce environment, are likely to be particularly sensitive to psychoactive substances, energy-dense food, and other modern day consumer products exhibiting exaggerated reward properties (Barrett, 2010; Nesse & Berridge, 1997; Wang et al., 2001). If this is the case, then the two-dimensional NPS/SNPS described here would be expected to discriminate individuals with dopamine dysfunction. Future research might profitably employ neurophysiological techniques in conjunction with self-report measures, in order to confirm the correspondences between these two levels of description.

A self-report measure of NP/SNP may help inform the way in which evolved biological reward drives can vary among individuals. Although all mammals appear to share species wide adaptations for survival, strategies and preferences employed to achieve survival differ greatly between individuals (Lund, Tamnes, Moestue, Buss, & Vollrath, 2007; Marsh, Boag, & Hicks, 2010). A recent movement to integrate research into individual differences and evolutionary psychology provides several plausible accounts of how species wide adaptations are expressed differently within individuals (Marsh et al., 2010). Buss (2009) presents several arguments for this, including the effect of heritable genetic predispositions combined with differing environmental and developmental contexts. Therefore, future research might benefit from consideration of the influence of personality trait differences on expression of evolved reward mechanisms. For example, rash impulsivity is often associated with dysfunctional behaviors such as substance use, gambling, excessive retail shopping, and binge eating (Benson, Norman, & Griffiths, 2011; Black, Shaw, McCormick, Bayless, & Allen, 2012; Dawe et al., 2004; Kane, Loxton, Staiger, & Dawe, 2004; McDaniel & Zuckerman, 2003; Petry, 2001), whereas reward sensitivity tends to predict approach to all rewarding experiences (not just illicit or

unhealthy substance such as drugs of abuse or highly appetitive foods; Carver & White, 1994; Clark, Loxton, & Tobin, 2015; Gullo, Ward, Dawe, Powell, & Jackson, 2011; Harnett, Loxton, & Jackson, 2013; Loxton et al., 2008). It may be that these two personality constructs, among others, predict ones' preference toward supernormal stimuli. The current scale provides a tool for measuring this supernormal preference.

Supernormal experiences are inherently unhealthy and amenable to excess consumption due to their processed characteristics (e.g., snacks and take away foods) and encouraging prolonged sedentary behavior (e.g., social networking and gaming). Therefore, the ability to identify individuals who prefer these types of reward provides a valuable contribution to those researching, treating, and preventing population health problems caused by over consumption.

Limitations

A desire to provide socially acceptable answers is inherent in self-report measures, particularly when items reflect health and lifestyle choices (Arnold & Feldman, 1981; Hebert, Clemow, Pbert, Ockene, & Ockene, 1995). It is important to recognize that covariance between pleasure preferences and consumption behavior may in part be due to individual differences in perceptions of health or the desire to appear healthy. Though less convenient, future research might utilize implicit measures of reward preference using experimental methods and/or objective third party measures of behavior. This would further strengthen evidence for the construct validity of the scale. It is also acknowledged that some construct overlap may exist between SNP ratings and materialism as measured, for instance, by the Values-Oriented Materialism Scale (Richin & Dawson, 1992), since items regarding purchases and acquisition appear in both measures. Inclusion of this scale in future research might provide discriminate validity of the SNPS. Finally, using cross sectional methods, we are unable to provide evidence of test-retest reliability in either the pleasure scale or behavioral measures. Future research should address the stability of such measures using longitudinal research designs.

Conclusion

The current study provides an initial step creating a method of distinguishing between supernormal and natural anticipated pleasure items. Findings inform the fields of evolutionary psychology and personality research, highlighting the way in which biological reward mechanisms may be expressed differently between individuals.

Excess consumption of artificial, highly attractive "supernormal" products in the developed world contributes to a variety of avoidable diseases, debt, and poor socioemotional well-being. Identifying individuals who are particularly attracted to unhealthy behaviors and vulnerable to overconsumption may play a useful role in the treatment and prevention of various behavioral health problems.

Appendix A: Qualitative Consumption Questionnaire/Script

We are doing some research and we want to find out about the sorts of things people enjoy doing in their lives, but in particular those things they find themselves doing a little too much of. I just want to emphasize that this is all completely anonymous and we're not going to record any personal details whatsoever.

The things we're talking about are virtually anything that you enjoy, find satisfying, or relaxing. Of course everyone has their own tastes and preferences. However, it's important to remember that we're specifically interested in those things that we find hard to control how much we do. So, we'll be talking about things that we find ourselves sometimes doing a little bit too much of – either because we enjoy it, or for some other reason. I'd also like you to think about the kinds of things you have to consciously monitor, to ensure that you don't do too much of it.

Part A

So, let's talk about things you enjoy in your life . . . What sort of things do you enjoy? . . . What kinds of things make you feel relaxed? What activities do you find satisfying?

SUBSCRIPT A (*participant-led discussion, for each activity X*)

Would you say you sometimes had too much/did that too much?/Do you find it hard to cut-down on X?/Is it something you'd prefer to do less of?, etc (*vary to keep it conversational, only record if activity X is nominated as excessive. If activity nominated appears to have extrinsic factors driving the excessive behavior, check that it is something the subject has chosen to do, or been forced to do (e.g. working too much, due to mortgage repayments). Only record if intrinsically motivated*)

What kind of regular habits do you have? What things do you tend to do most days?

SUBSCRIPT A

What are your personal preferences that make you different from most others? Things you think you do more than most other people?

SUBSCRIPT A

Can you think of something that made you think, "I'm doing a little bit too much of this?"

Is there anything that your friends or family have mentioned you should cut down on or stop? Is there anything you do that your friends and family don't approve of?

Is there anything that you tend to keep private, because you'd prefer others didn't know how much you did?

Is there anything that you've thought—gee, I think I might be a little bit addicted to this? . . .

SUBSCRIPT A

Let's talk about things that are tempting or hard for you to resist. What can you think of? When the opportunity arises, what things are hard to say no to? How about things that when you start, you find it difficult to stop?

SUBSCRIPT A

What about things that you've felt bad about afterwards, things that made you think: I really spent too much time doing that? How about things that made you think, I really shouldn't have spent so much money on that? How about things that made you think, doing so much of that isn't doing my health any good?

SUBSCRIPT A

Appendix B: Consumption Behavior Measures

On a typical WEEK DAY or WORKING DAY, how much time do you spend doing each of the following:

- Watching TV
- Browsing the internet on a computer, smart phone or tablet
- Using social networking websites (such as Facebook, Twitter or My Space)
- Viewing erotic or romantic images, videos or books
- Gaming on a desktop computer, game console, portable gaming system, mobile phone or tablet?
- Response scale: 1 = none, 2 = less than 10 min, 3 = 10–30 min, 4 = 30 min to 1 hr, 5 = 1–3 hr, 6 = 3–5 hr, 7 = 5–7 hr, 8 = 7+ hr

On a typical WEEKEND or NON-WORKING DAY, how much time do you spend doing each of the following:

- Watching TV
- Browsing the internet on a computer, smart phone or tablet
- Using social networking websites (such as Facebook, Twitter or My Space)
- Viewing erotic or romantic images, videos or books
- Gaming on a desktop computer, game console, portable gaming system, mobile phone or tablet?
- Response scale: 1 = none, 2 = less than 10 min, 3 = 10–30 min, 4 = 30 min to 1 hr, 5 = 1–3 hr, 6 = 3–5 hr, 7 = 5–7 hr, 8 = 7+ hr

How often do you check your social networking account (e.g., Facebook, Twitter or My Space)

- Response scale: 1 = I do not have . . . , 2 = once a week, 3 = 2–3 times per week, 4 = almost every day, 5 =

once a day, 6 = 2–3 times a day, 7 = 3–5 times a day, 8 = 5–7 times a day, 9 = 7+ times per day.

How often do you send a text message from your phone (not for work or business)?

- Response scale: 1 = never, 2 = less than once a week, 3 = once a day, 4 = 1–10 times per day, 5 = 10–20 times per day, 6 = 30–40 times per day, 7 = 50 + times per day

On average how often do you do the following:

- Purchase foods for a meal or snack from fast food outlets such as KFC, MacDonald's, Hungry Jacks, Red Rooster
- Purchase foods for a meal or snack from other food outlets such as a, bakery, service station, food or pie van, noodle bar, Chinese food, etc
- Eat desserts such as ice-cream, cake and cookies
- Eat meat products? (such as sausages, frankfurter, Devon, fritz, salami, meat pies, bacon or ham)
- Eat chocolates, lollies or other sweets
- Eat chips, crackers or nuts
- Drink NON-CAFFEINATED soft drinks such as lemonade, etc
- Drink CAFFEINATED soft drinks such as Coke or Pepsi
- Drink ENERGY drinks such as Redbull, Mother or V
- Drink TEA
- Drink COFFEE
- Response scale: 1 = never, 2 = less than once a week, 3 = 1–2 per week, 4 = 5–7 per week, 5 = twice a day, 6 = 3 + per day

When you drink TEA, how much would you typically drink in one sitting?

- Response scale: 1 = I don't drink tea, 2 = I regular cup (250 ml), 3 = 12 regular cups, 4 = 3 + regular cups

When you drink COFFEE, how much would you typically drink in one sitting? (1 serve is equal to either one espresso shot, or one teaspoon of instant coffee)

- Response scale: 1 = I don't drink coffee, 2 = I serve, 3 = 2 serves, 4 = 3 + serves

How often do you add salt to your food WHILE cooking or preparing it?

- Response scale: 1 = never, 2 = rarely, 3 = sometimes, 4 = usually

How often do you add salt to your food AFTER cooking or preparing it?

- Response scale: 1 = never, 2 = rarely, 3 = sometimes, 4 = usually

When you drink NON-CAFFINATED soft drink (such as lemonade etc) how much would you typically drink in one sitting?

Response scale: 1 = I don't drink soft drink, 2 = Less than 250 ml (small glass), 3 = 250–400 ml (small can or bottle), 4 = 400 ml–1 liter (mid bottle), 5 = 1 + liters

When you drink CAFFINATED soft drink (such as lemonade etc) how much would you typically drink in one sitting?

Response scale: 1 = I don't drink soft drink, 2 = less than 250 ml (small glass), 3 = 250–400 ml (small can or bottle), 4 = 400 ml–1 liter (mid bottle), 5 = 1 + liters

When you drink ENERGY soft drink (such as lemonade etc) how much would you typically drink in one sitting?

Response scale: 1 = I don't drink soft drink, 2 = less than 250 ml (small glass), 3 = 250–400 ml (small can or bottle), 4 = 400 ml–1 liter (mid bottle), 5 = 1 + liters

Have you used any illicit drugs in the past 12 months? This includes drugs such as cannabis, ecstasy, amphetamines, etc.

Response scale: 1 = never, 2 = once a month or less, 3 = 2–4 times per month, 4 = 2–3 times per week, 5 = 4–5 times per week, 6 = 6+ times per week.

Approximately how many new items of clothing do you purchase for yourself per month? Include things like shoes, tops, pants, jackets, and so on.

Response scale: 1 = none, 2 = less than one item a month, 3 = 1–2 items a month, 4 = 3–5 items a month, 5 = 6–10 items a month, 6 = 11–15 items a month, 7 = 15+ items per month

Approximately how many collectable items do you purchase for yourself per month? Include things like DVDs or Blu-ray movies, CDs, Books, Games or other collectables

Response scale: 1 = none, 2 = less than one item a month, 3 = 1–2 items a month, 4 = 3–5 items a month, 5 = 6–10 items a month, 6 = 11–15 items a month, 7 = 15+ items per month

How often do you do the following:

Browse advertising catalogues that arrive in the mail
Browse or search for retail products on online shopping websites

Response scale: 1 = never, 2 = once a month, 3 = 2–3 times per month, 4 = once a week 5 = 2–3 times per week 6 = almost everyday

When watching TV how often do you mute or fast forward through advertisement breaks when watching TV (reversed)?

Response scale: 1 = all of the time, 2 = most of the time, 3 = sometimes, 4 = rarely, 5 = never.

When grocery shopping, what percentage of your trolley or basket would you estimate is made up of packaged food and bottled drinks?

Response scale: 1 = 0%, 2 = <20%, 3 = 20–40%, 4 = 40–60%, 5 = 60–80%, 6 = 80–100%

AUDIT C (Bush et al., 1998)

During the past 30 days have you had at least one drink of any alcoholic beverage? Yes/No

Out of the past 30 days, how many days did you have at least one drink of any alcoholic beverage?

How many drinks did you have on a typical day when you were drinking in the past year? Consider a "drink" to be a can or bottle of beer, a glass of wine, a wine cooler, or one cocktail or a shot of liquor (like rum, scotch, gin or vodka).

Response: Value entered and recoded according to standard AUDIT C aggregation

CSPG (Rockloff, 2011)

How often did you gamble in the past 12 months?

Response scale: 0 = never, 1 = once a month or less, 2 = 2–4 times per month, 3 = 2–3 times per week, 4 = 4–5 times per week, 5 = 6+ times per week.

How much time did you spend gambling on a typical day in which you gambled in the past 12 months?

Response scale: 0 = never, 1 = less than 30 min, 2 = 30 min to 1 hr, 3 = 1–2 hr, 4 = 2–3 hr, 5 = 3 + hr

How often did you spend more than 2 hr gambling (on a single occasion) in the past 12 months?

Response scale: 0 = never, 1 = less than monthly, 2 = monthly, 3 = weekly, 4 = daily or almost daily

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