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A History of Substance Misuse Predicts Musical Frisson Intensity: How Substance Misuse Shapes Musical Reward Sensitivity

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ABSTRACT

Musical reward is firmly established as therapeutically beneficial to many domains of life. It is thought to operate on the same neural networks as substance misuse; namely, the dopaminergic system and the endogenous opioid system- responsible for reward anticipation and reward enjoyment, respectively. Due to their overlap in neurological foundations, this study questions if the degree of substance misuse an individual has experienced is related to their music reward sensitivity. Previous research provides rationale for the hypothesis that those with a history of substance misuse would report greater music reward sensitivity, including enhanced frisson intensity, which is believed to be a measure of musical pleasure. To test the hypothesis, data was collected through an online survey and explored using correlational analyses. Results showed that severity of substance misuse history was significantly and positively associated with frisson intensity but not overall music reward sensitivity. Therefore, the study's findings demonstrate that the degree of an individual's substance misuse history can predict the musical pleasure aspect of musical reward, but not necessarily musical anticipation. This study holds useful implications, as the first study to assess music reward sensitivity in those with a history of substance misuse, for the future of substance misuse treatment.

1. INTRODUCTION

The effect of music on human neurobiology has been a topic that has enthralled researchers since the mid-twentieth century. Otolaryngologist, Tomatis, was the first to recognise that the ear and the nervous system are interconnected; his medical approach was based upon the idea that through the nervous system, sound could enhance many facets of human existence, from education to language development (Tomatis, 1963). In the late twentieth century, research using new measures, such as fMRI scans, confirmed that sound can alter neurobiology to produce advantageous behavioural outcomes. As such, Tomatis's publications were expanded upon more extensively, with cumulative studies implicating that music is beneficial to nearly all paradigms of life, extending to social, psychological, and even physiological domains (Chanda & Levitin, 2013).

Musical Reward. Musical reward is thought to be one cognitive process responsible for music's longstanding success at enhancing wellbeing (Bhandarkar, Salvi & Shende, 2023). Musical reward is defined as the combination of hedonic and motivational responses to music; that is, both the enjoyment and anticipation of musical features (Gebauer, Kringelbach & Vuust, 2012). Frisson is thought to be one measure of musical reward, and refers to 'pleasurable aesthetic chills' that are caused by listening to music that the listener deems to be emotional (Colver & El-Alayli, 2016). Musical reward has been demonstrated to reduce the necessity for opiate drugs when in physical pain (Cepeda et al, 2006) due activation of the midbrain nuclei, which is rich in endogenous opioids and opioid receptors (Chanda & Levitin, 2013). Furthermore, musical reward, as used in music therapy, has successfully relieved many symptoms of mental health conditions (Golden et al, 2021) thus reiterating the significance of musical reward on overall wellbeing.

Musical Reward and Substance Misuse. Substance misuse (SM) refers to a condition in which a legal or illegal psychoactive substance is consistently consumed despite patterns of detrimental effects, such as withdrawal symptoms (McNeely & Adam, 2020). It is one condition that is believed to share neural underpinnings- namely, the dopaminergic mesolimbic system and endogenous opioid system- with reward and musical reward (Valenzuela & Russell, 2014; Zald & Zatorre, 2011). Furthermore, reward seeking behaviour, specifically the motivational component, is associated with addictive tendencies (Diaz et al, 2014). Due to this, alongside the wealth of evidence that supports music-based rehabilitation, it seems natural to assess how a history of SM shapes musical reward sensitivity (MRS) - an area that appears to be uncharted amongst previous psychological research.

Dopaminergic System. Dopamine- the neurotransmitter responsible for learning, pleasure and motivation- is at the heart of musical reward, and is therefore invaluable to music-induced rehabilitation (Stegemoller, 2014). In some cases, dopamine replacement therapy in Parkinson's patients has caused compulsive singing (Chanda & Levitin, 2013), demonstrating a link between musical reward and dopamine. Ferreri et al (2019) illustrated this link at a neurological level, finding that dopamine antagonist, risperidone, diminished pleasurable and motivational responses to music, both of which are essential for musical reward processes. The same study found that dopamine production increased neuroplasticity in the brain- critical for creating new neural pathways to modify behavioural patterns.

The interaction between SM history and general reward sensitivity (GRS) is one that has been explored in great depth, and can perhaps offer indications of the relationship between SM and MRS, due to GRS being a strong predictor of frisson (Mori & Iwanga, 2015). There are two proposed theories connecting dopaminergic reward with SM. The first theory posits those who have SM are hyperresponsive to reward, an increased dopamine release, caused by natural stimuli. Dopamine receptor availability quickly decreases to equalise dopamine levels, building a dopamine tolerance. This can lead to the pursuit of exceedingly rewarding substances, some of which emit tenfold the amount of dopamine elicited by natural rewards (Yale Medicine, 2020). A contrasting theory, known as the reward deficiency hypothesis (Joyner et al, 2019), suggests that SM is the result of hyporesponsiveness to natural stimuli, resulting in substance use to override reward deficiency. Previous research provides evidence for both positions, finding higher GRS (Diaz et al, 2014), and lower GRS (Volkow et al, 2010) in those with a history of SM, however Volkow et al (2001) also finds that dopamine receptors can regenerate after SM, provided abstinence is sustained. At a dopaminergic level, it seems that MRS will be different in those with histories of SM, but whether it would be lower or higher remains ambiguous.

Endogenous Opioid System. Endogenous opioids are peptides in the brain and nervous system which help to regulate pain relief, emotion, and reward (Abrimian, Kraft & Pan, 2021). Opioid production shares neural correlates with dopamine production in the ventral tegmental area and nucleus accumbens and is also thought to stimulate dopamine release (Stinus, Cador & Le Moal, 1992). Endogenous opioids are believed to be accountable for the hedonic element of reward, whereas dopamine is implicated in both anticipatory and hedonic processes (Chanda & Levitin, 2013). Goldstein (1980) found that opioid antagonist, naxolone, inhibited frisson, implying that frisson is rooted in endogenous opioid release. It would thus make sense for frisson to be an embodiment of musical pleasure, but not anticipation.

The association of stimuli with pleasure is a conditioned response. If some individuals are more susceptible to forming strong pleasurable associations due to their GRS, it would make sense that those with a history of SM might also form strong pleasurable associations with music- another exogenous stimulus. Equally, because frisson (alongside sex and food) activates the endogenous opioid system in a similar way to substance use (Mallik, Chanda & Levitin, 2017), those with a history of SM may be more sensitive to pleasure from particularly arousing stimuli, such as music, relative to other stimuli. In support of this, Culler (2015) found that individuals with a history of SM preferred listening to exciting, rather than calm, music as to 'emulate' substance-induced pleasure and arousal. It therefore seems likely that those with a history of SM will experience frisson more intensely than those without, as a result of exaggerated MRS.

Study Rationale. Due to the lack of longitudinal research in this field, research regarding neurological theories of reward in those with a history of SM typically lack causality. For example, hyporesponsivity could be a result of SM- particularly dopaminergic substances- downregulating the sensitivity of dopamine receptors (Volkow et al, 2010) as opposed to the source of SM. The issue of causality, alongside disparity in research, muddies the waters regarding the relationship between GRS and SM. This study aims to explore how MRS presents in individuals with SM whilst eluding the issue of causality by focusing on GRS and MRS as potential rehabilitative tools instead of causes or symptoms of SM.

The dopaminergic system underlies reward processing, and thereby also underlies SM and MRS. Research appears to be divided on which dopaminergic theory best explains SM. Assuming support for the hyporeactive theory of SM, perhaps those with a history of SM will not find 'natural' stimuli, like music, as rewarding as those without a history of SM do. As prior research surrounding hyporeactivity and SM has not determined a direction of cause-and-effect, if hyporeactivity is merely due to SM, there is evidence to suggest that the dopaminergic system can be repaired (Volkow et al, 2001). If so, perhaps those with a history of SM will not differ in their MRS and frisson intensity ratings compared with those with less history of SM. Alternatively, through the lens of the dopaminergic hyperreactivity model, those with a history of SM will be more reactive to musical reward and will experience frisson at a greater intensity.

Despite a lacking consensus concerning dopamine sensitivity and SM, and ambiguity surrounding the relationship between SM and MRS, links between SM and MRS/frisson intensity can be drawn more easily when considering the endogenous opioid system. As the endogenous opioid system responds to musical pleasure in a similar way to substance-induced pleasure (Culler et al, 2015; Mallik, Chanda & Levitin, 2017), and those with histories of SM are sensitive to substance-induced pleasure, it would make sense that they would also be sensitive to musical pleasure, or frisson. Whilst this only implicates frisson as opposed to broad MRS, frisson is positively associated with GRS (Mori & Iwanga, 2015) so likely also positively correlates with MRS. Moreover, biomarkers of frisson (opioids) and MRS (dopamine) appear to be positively correlated with one another (Stinus, Cador & Le Moal, 1992). Therefore, this study predicts that frisson intensity and MRS will be higher in those with a history of SM compared to those without. If confirmed, this study could provide invaluable contributions to the field of SM rehabilitation by highlighting the importance of musical reward within SM rehabilitation therapies.

2. METHOD

Participants. Participants were notified about the study and provided with a link to participate through Facebook groups pertaining to substance misuse, as well as being sent to acquaintances of the research team. Due to the lack of previous similar studies, an effect size could not be calculated to determine the minimum number of participants needed for the current study. The initial participant pool consisted of 49 people, but the data were cleaned to remove participants whose scores were classified as outliers (n = 2).

The cohort of participants (n = 47, 32 females) fell between the age range of 18 to 60 years old (M = 36.2, SD = 15.8). Participants were required to be at least 18 years of age to participate in the study due to the sensitive nature of the study. Provided that participants met this criterion, there were no other inclusion or exclusion criteria. A history of substance misuse was not a requirement for participation as to capture data from participants with varying degrees of substance misuse history, ranging from no history to a history of severe substance misuse.

Design. This observational study was conducted with an online survey to gather self-report quantitative data from participants. Three predictor variables; music reward sensitivity, frisson intensity, and substance misuse history, were observed and none of these were manipulated. Age was also included in analysis. The same survey was administered to all participants making this a repeated measures design.

Materials. An information sheet, consent form and debrief sheet were included in the study (see Appendix A).

Barcelona Music Reward Questionnaire. To assess participants' music reward sensitivity scores, the Barcelona Music Reward Questionnaire (BMRQ; Mas-Herrero et al, 2013) was administered. This questionnaire consists of 20 statements (Appendix A), asking subjects to select how much they identify with the statement on a scale from 1= 'completely disagree' to 5= 'completely agree'. Items two and five were reverse coded to account for negatively-phrased statements. Scores from each question are then totalled to reflect subjects' overall music reward scores.

Frisson Intensity Scale. An 11 point scale was issued for participants to rate the average intensity of frisson they experience, with one indicating a low intensity and ten indicating a high intensity. If participants had never experienced frisson, they were instructed to select zero.

Drug Abuse Screening Test – 10. A revised version of the 28 item drug abuse screening test (DAST) was used to assess severity of substance misuse with 10 items (DAST-10; Skinner, 1982). Whilst it can be used in clinical settings as a diagnostic tool, it can also be applied to non-clinical populations to provide an overview of the severity of an individual's symptoms related to substance misuse. It does not include alcohol misuse, as the DAST was developed as an extension of the Michigan Alcohol Screening Test (MAST) (Selzer, 1971). Whereas in the original DAST- 10, certain outdated terms are used, the present study modified phrasing to avoid the use of language that may hold stigma (see Appendix A).

Participants are instructed to select either 'yes' or 'no' to each question. Total 'yes' selections equate to the overall DAST- 10 score. Question three is reverse coded to account for negative phrasing. Substance misuse severity is measured on a zero-to-ten scale, with zero indicating no previous or current symptoms of substance misuse, and 10 indicating an abundance of symptoms.

Each DAST- 10 score corresponds to a diagnostic category related to substance misuse; for example, a score between three and five can be categorised as a 'moderate level'. In this study, scores were considered

independently of diagnostic categorisation so that symptomatology of substance misuse could be treated as a continuous spectrum. This decision was made as an attempt to destigmatise social perceptions of substance misuse as well as to enrich the dataset by including each datapoint, which would not have been possible with a categorical approach to the DAST- 10.

Procedure. Participants were acquired through the study advertisement which provided a link directly to the survey, hosted on Qualtrics. An information sheet was presented to participants that provided an overview of the study and included a content warning for the topic of substance misuse. A consent form was then issued, where participants had to select 'yes' before progressing. Next, they were asked to create a pseudonymised code consisting of the last two letters of their surname, the last two letters of their mum's name, and the date of their birthday. The purpose of this code allows the researcher to withdraw participant data on request, even after study completion, without compromising anonymity. Following this, participants were prompted to enter their gender and age into free text boxes so that demographic information could be collected.

The BMRQ was the first questionnaire that participants completed. This was followed by the frisson intensity rating scale. Another content warning then prefaced the DAST- 10 before this was completed. Upon completion of the DAST- 10, participants were provided with helpline contact details for both immediate and long-term support should they have found themselves affected by the contents of the survey. Participants were also thanked for their time spent partaking in the study. Finally, a debrief sheet summarised the aims of the study in further detail, alongside contact information for the withdrawal of data.

3. RESULTS

To test the hypothesis that individuals with a history of substance misuse would have a higher music reward sensitivity, including intensified frisson, all data were screened to check that assumptions for a correlational analysis were met. No outliers existed in the dataset after data cleaning (n = 57). Of all the variables, only the MRS variable met the assumption of normal distribution of residuals (see Table 1). The assumption of linearity was also violated. As such, a Spearman's rank-order correlation was conducted as a non-parametric equivalent to a correlation.

Table 1. Tests of Normality

Tests of Normality

	Mean	Std. Deviation	Shapiro-Wilk	Shapiro-Wilk *p*
Age	36.213	15.796	0.805	< .001
Music reward score	78.723	8.402	0.968	0.22
Frisson (1-10)	6.83	2.014	0.927	0.006
DAST1O Score	3.128	3.693	0.785	< .001

Frisson intensity score and DAST- 10 score had a positive, but weak, curvilinear relationship, and this relationship was significant (rs=.26, p =.04) (see Figure 1). On average, as DAST- 10 scores increased, frisson intensity scores also increased.

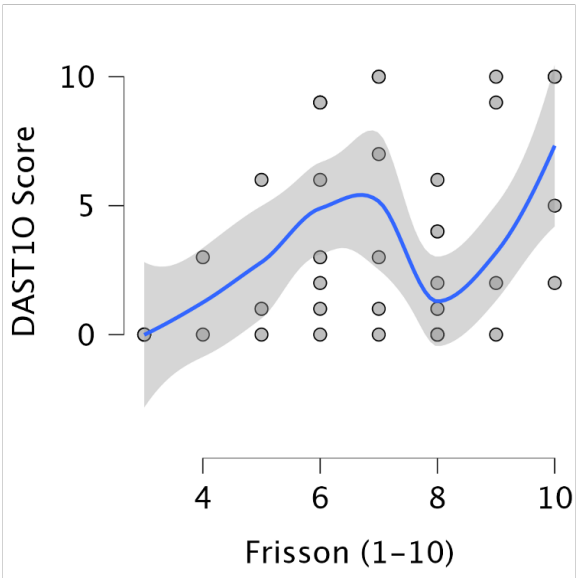

Figure 1. Scatterplot showing correlation between DAST- 10 and frisson intensity.

Correlations between all other variables were non-significant (see Table 2), however frisson intensity score was somewhat positively correlated with age, but its *p*-value marginally exceeded that needed to assume statistical significance (*rs*=.24, *p*=.052) (see Figure 2). MRS was non-significantly, negatively and weakly correlated with DAST- 10 scores (*r*s= -.06, *p* =.66), and interestingly, was also weakly and non-significantly correlated with frisson intensity scores (*rs*=.14, *p*=.17). Age had no significant bearing on MRS or DAST- 10 score.

Table 2. Spearman's Correlations between each variable

Spearman's Correlations

Variable pairings		Spearman's Rho	*p*
Frisson (1-10) -	DAST10 Score	0.258	0.04*
Frisson (1-10) -	Music reward score	0.141	0.173
Frisson (1-10) -	Age	0.24	0.052
DAST10 Score -	Music reward score	-0.063	0.662
DAST10 Score -	Age	-0.418	0.998
Music reward score -	Age	-0.257	0.959

Note. All tests one-tailed, for positive correlation.

* p < .05, ** p < .01, *** p < .001, one-tailed

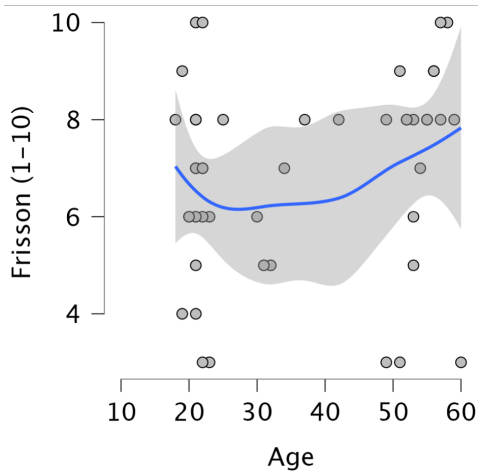

Figure 2. Scatterplot showing correlation between frisson intensity and age

4. DISCUSSION

This study hypothesised that an individual's MRS and frisson intensity could be predicted by their history of SM, with those with scoring highly on DAST- 10 also scoring highly on MRS and frisson intensity. The significant correlation between frisson and DAST- 10 score certainly aligns with part of the hypothesis. In light of research that covers the role of the endogenous opioid system in SM and frisson (Mallik, Chanda & Levitin, 2017), it is not surprising that on average, participants with a history of severe SM reported higher frisson intensity. Based on studies evidencing frisson as a marker of endogenous opioid release and musical pleasure (Culler et al, 2015; Goldstein, 1980), the finding from the present study indicated that as the degree of SM history increased, musical pleasure increased. Since musical pleasure is one of two components of musical reward (Gebauer, Kringelbach & Vuust, 2012), this finding could have been explained if those with higher degrees of SM history were also particularly receptive to musical reward. Instead, the findings from the correlation between DAST- 10 and MRS demonstrated that this relationship was non-significant, thus failing to support this part of the hypothesis. These antithetical findings, that frisson, but not MRS, was enhanced in those with histories of SM, reflect a dissociation between pleasurable and motivational processes within musical reward, where perhaps the motivational or 'wanting' element of musical reward is unaffected by a history of SM, but musical 'liking' is intensified. Because frisson intensity was higher in those with a SM history, it seems more likely that 'wanting' rather than 'liking' processes were accountable for the lack of significant difference in MRS.

*Substance Misuse on Music Reward Sensitivity***.** One explanation for the non-significance of SM history on MRS is that 'wanting' of a reward is variable in those with SM history due to neuroadaptive differences in response to immediate versus delayed reward gratification. Individuals who misused substances in ways that provided instant gratification- such as substance inhalation- may have impaired motivational reward responses; immediate reward gratification has been shown to have a negative correlation with dopamine receptor availability, and dopamine receptor availability has been demonstrated to increase as a function of 'waiting time' for rewards (Gao et al, 2021). Perhaps then, dopamine receptor availability, or 'wanting' of a natural reward, varies within those with a history of SM and depends upon whether an individual is accustomed to immediate or delayed gratification. This would explain the non-significant finding of MRS between levels of SM history.

Alternatively, the lack of significance could be a consequence of different rehabilitative statuses within the sample. For example, an individual who has been abstinent from SM for an extended period of time may have higher MRS as a consequence of dopamine receptor regeneration (Volkow et al, 2001) compared with those with recent SM history. Differences in both substance and consumption type, and rehabilitation status, therefore offer plausible explanations for the lack of significance between MRS and SM. This leaves room for the possibility that elements of SM history could still predict MRS, but only when rehabilitative status and substance type/method of consumption are controlled for.

Substance Misuse on Frisson Intensity. The significant positive correlation between frisson intensity and SM illustrates that, in general, musical pleasure increased with severity of SM history. The relationship between the

two variables shows that individuals who fall on the lower end of the SM history spectrum experienced frisson intensity at every level, whereas individuals scoring over seven on the DAST- 10 also reported experiencing frisson intensity levels of six or above. The relationship was curvilinear, however, depicting that no one who reported a frisson intensity score of eight had a DAST- 10 score of higher than six. This is likely the result of the sample having a heavy weighting of participants with less severe SM history, compared to those with a more severe SM history; the majority of the sample had a DAST- 10 score of below five, so perhaps participants with a DAST- 10 score of under five skewed the data when reported frisson intensity was at eight. This could be rectified with the inclusion of more people with a history of SM, or by splitting the sample into 'low' DAST- 10 score and 'high' DAST- 10 score and analysing the difference in mean frisson intensity ratings, but this would compromise the depth of data as well as reducing participants to 'low' or 'high' levels of SM.

Neurologically, the relationship between SM and frisson intensity could be explained by similarities in the activity of the endogenous opioid system between both SM and musical pleasure (Mallik, Chanda & Levitin, 2017). Because both processes share underpinnings, those with a history of SM may be particularly sensitive to musical pleasure, as supported by research suggesting musical pleasure can imitate the effects of opiate substances (Culler, 2015). Musical pleasure could therefore provide a healthy, non-invasive and inexpensive immediate coping mechanism to alleviate symptoms of substance withdrawal and boost positive affect, but music should be selected with caution as certain pieces of music may act as a cue for SM (Bensimon, 2024) . A long-term approach may involve combatting the underlying issues that perpetuate SM using talking therapies, with the integration of music therapy to increase wellbeing (Reybrouck & Eerola, 2022). Music therapies targeting SM have shown success in reducing substance cravings as well as an abundance of symptoms and causes of SM, such as depressive and anxious symptoms (Fachner et al, 2023). The finding from the current study highlights the importance of music therapies within the treatment of SM due to intense musical pleasure experienced by those with histories of SM, as well as advocating for music therapy for SM to maintain a particular focus on the elicitation of frisson. If those with a history of SM are particularly reactive to musical pleasure then frisson, alongside talking therapy, could have considerably useful implications for the management of SM symptoms and causes.

Age and Frisson. Unexpectedly, age and frisson had a near-significant positive relationship. Burr et al (2021) found that older adults experience more positive affect and less negative affect than younger adults, and because frisson is an expression of pleasure, this could explain why frisson intensity was nearly significantly correlated with age.

Directions for Future Research. Future research may benefit from replicating this study with a sample containing more individuals with histories of SM, and incorporating questionnaires about rehabilitation status, type of substance and method of consumption that participants engaged in, as these factors may have contributed to the non-significant relationship between SM and MRS. Despite frisson being only one component of musical reward, opioid release from frisson triggers dopaminergic activity- the neural basis of musical anticipation (Stinus, Cador & Le Moal, 1992). Theoretically, if these are the only two components to musical reward, MRS should have increased as frisson intensity increased. Therefore it cannot be ruled out that different results would be found when controlling for factors such as rehabilitation status, substance type, and method of consumption. This field of research may also benefit from the employment of a measure of electrodermal activity, such as the Galvanic Skin Response, to objectively measure frisson intensity in those with SM history, instead of using self-reported data. If the significant finding of the current study is replicated, it can be more confidently integrated within SM therapies.

Study Limitations. One shortcoming of the study was its reliance on frisson intensity as a marker of musical pleasure. In light of the dissociation between frisson intensity and MRS, it is plausible that frisson intensity reflects activity of general arousal mechanisms instead of musical enjoyment. Conversely, if frisson does reflect musical pleasure, arguably the degree of musical pleasure an individual experiences is better measured by frisson frequency than intensity, as this provides a more comprehensive view of frisson over time, whereas a high frisson intensity score does not indicate a persistent susceptibility to frisson.

The findings of the study were also somewhat marred by the self-report nature of the design. The results were dependent on subjective interpretations of the questions and answers, and therefore potentially held less validity due to the lack of standardised measurement of each variable. Additionally, due to the assessment of SM, the study was liable to social desirability bias. Even with full anonymity, it is entirely conceivable that participants felt unable to be truthful regarding SM, due to fear of shame, judgement, or even denial.

Conclusion. This study investigated how SM history shapes MRS and frisson intensity. Correlational analyses were performed on survey-collected data. Whilst MRS was not significantly affected by the level of SM history an individual had, frisson intensity increased as severity of SM history increased. This aligned with part of the

hypothesis. Despite an unexpected disassociation between frisson intensity and MRS, the results suggest that musical pleasure, but not anticipation, is enhanced in those with a history of SM. This leaves the door open for future research to use electrodermal measures of frisson, thereby establishing if this relationship is maintained at an objective level. If this is the case, SM treatment would benefit largely from the incorporation of frisson into both music and talking therapies. Despite certain limitations, this is the first study to explore musical reward in those with a history of SM, and its findings offer promising implications for the treatment of SM.

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APPENDIX

Information sheet

Exploring consumption and perception of music in relation to substance misuse history

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Researcher contact email: lily.bekker@durham.ac.uk Information sheet date: 22/01/24

What is this study about?
This study will explore how music is perceived amongst individuals who have struggled with various levels of substance misuse.

Who can take part?
Anyone 18+ may take part, regardless of whether or not you have struggled with substance misuse in the past.

What will participation in this study involve?
The study consists of two short questionnaires. It should take no longer than 15 minutes to complete.
Due to the sensitive nature of the topic, a trigger warning will preface any questions about substance misuse.

How will the data be used and stored?
The data is being collected for a summative project.
You will be asked to create a pseudonymised code; this will not compromise your anonymity and will at no point be cross referenced. The purpose of this code is to protect your right to withdraw, even after you have completed the study.
Analysis and presentation of results will remain anonymous.
Data collected will be stored securely, on a password-protected laptop, until after a report has been written up; after this, data will be deleted.

What if I change my mind?
You have the right to withdraw from the study at any time.
After you have completed the study, if you would like to withdraw your data, please email your pseudonymised code to lily.bekker@durham.ac.uk and your data will get deleted.

Who can I contact if I have questions or concerns?
If you have any questions regarding this study, please email me at lily.bekker@durham.ac.uk.
If you wish to make a complaint, please contact Kelly Jakubowski at kelly.jakubowski@durham.ac.uk.

Consent form

I confirm that I have read and understand the information sheet dated 22/01/24 for the above project
I have had the opportunity to consider the information and ask any questions
I understand that my participation is voluntary and I am free to withdraw at any point without giving a reason

I agree to take part in the above project
I have been informed about how the data will be used and stored

Debrief

Thank you for completing the study. This study investigated musical reward sensitivity and musical frisson within those with varying levels of substance misuse history. Should you have any concerns regarding this study, please contact Kelly Jakubowski at kelly.jakubowski@durham.ac.uk..If you would like to withdraw your data, please email lily.bekker@durham.ac.uk with your pseudonymised code.

BMRQ Questions

1. When I share music with someone I feel a special connection with that person.

2. In my free time I hardly listen to music.
3. I like listen to music that contains emotion
4. Music keeps me company when I'm alone.

5. I don't like to dance, not even with music I like.
6. Music makes me bond with other people.
7. I inform myself about music I like.

8. I get emotional listening to certain pieces of music.

9. Music calms and relaxes me.

10. Music often makes me dance.

11. I'm always looking for new music.

12. I can become tearful or cry when I listen to a melody that I like very much.

13. I like to sing or play an instrument with other people.
14. Music helps me chill out.
15. I can't help humming or singing along to music that I like.

16. At a concert I feel connected to the performers and the audience.

17. I spend quite a bit of money on music and related items.
18. I sometimes feel chills when I hear a melody that I like.
19. Music comforts me.

20. When I hear a tune I like a lot I can't help tapping or moving to its beat.

DAST- 10 Questions

1.Have you used drugs other than those required for medical reasons?

2. Do you use more than one drug at a time?

3. Are you always able to stop using drugs when you want to? (If never use drugs, answer "Yes.")

4. Have you had "blackouts" or "flashbacks" as a result of drug use?
5. Do you ever feel bad or guilty about your drug use? If never use drugs, choose "No."

6. Does your spouse (or parents) ever complain about your involvement with drugs?

7. Have you neglected your family because of your use of drugs?
8. Have you engaged in illegal activities in order to obtain drugs?

9. Have you ever experienced withdrawal symptoms (felt sick) when you stopped taking drugs?

10. Have you had medical problems as a result of your drug use (e.g., memory loss, hepatitis, convulsions, bleeding, etc.)?