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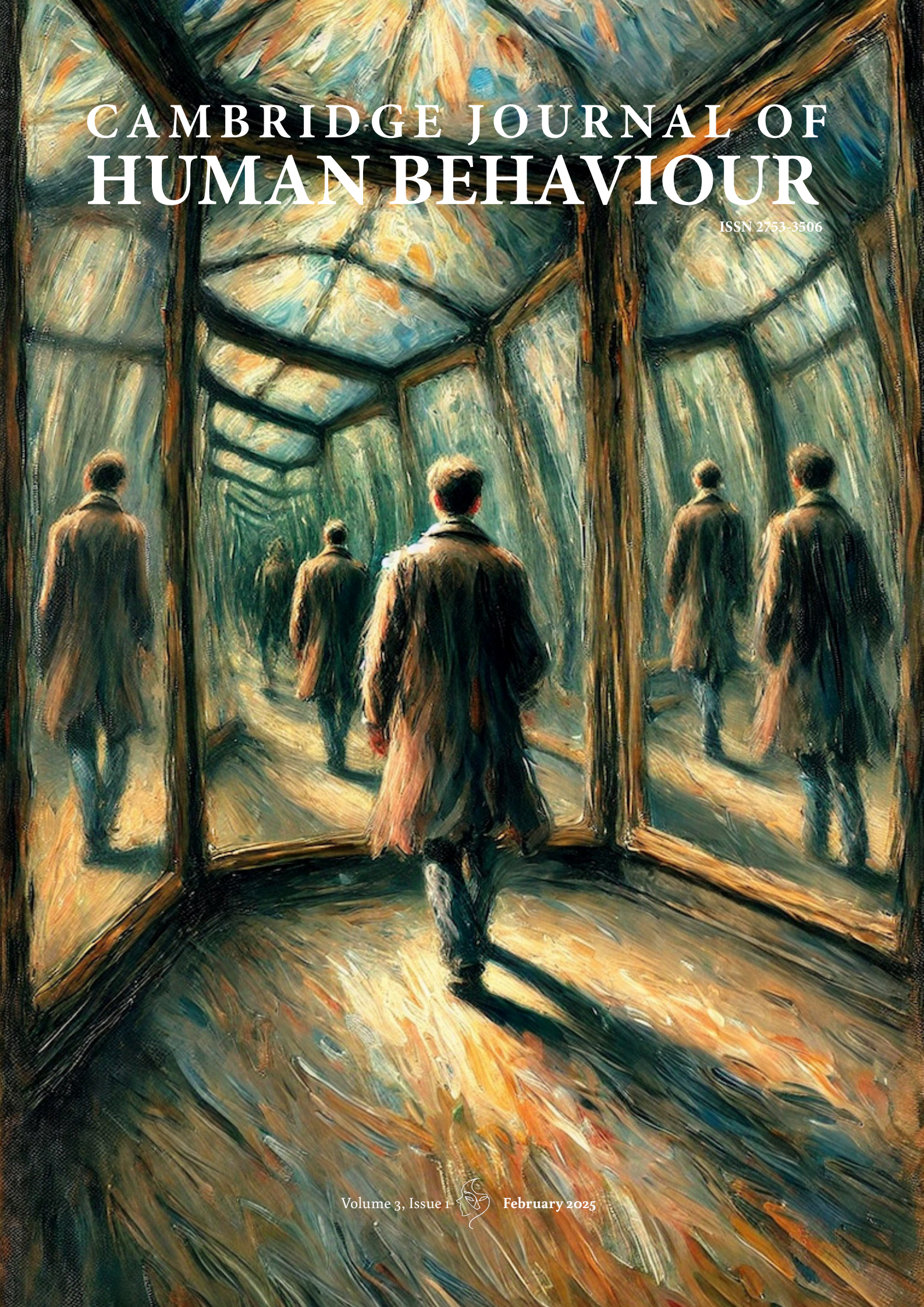

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Contents

Editorial III.iii

Disordered Eating: What are the Potential Roles of Perfectionism and Emotional Reactivity? 1
Cara Houlcroft & Kai Thomas

The Role of Mental Imagery in Rumination and Depressive Symptoms 8
Poppy Webb, Laura Hadwin, Tomás McDowell, and Ryan Horsfall

Book Review: Atmospheres by Herman Schmitz 15
Erin Jones & Pol Salvatella

Editorial

In the first instalment of the third volume of the Cambridge Journal of Human Behaviour, we present an issue dedicated to philosophy and the psychological sciences. Uniting concepts from across fields, this issue offers a truly interdisciplinary understanding of mind and body, and all that lies in between. Alongside two main research articles, we are thrilled to present our first published book review, marking a new critical genre from our authors and another form of scholarly discourse for our readership.

This issue platforms and celebrates the psychological and behavioural sciences as a medium through which to explore human thought and expression. The fact that the human brain can be studied across several different levels of analysis — from the molecular to the behavioural — is a fascinating facet of neuroscience and psychology. This complexity also makes understanding phenomena of the brain particularly challenging. The literature in this issue dissects key debates in the field — such as the subjectivity of consciousness and the role of cognitions in psychopathology — at multiple levels of analysis, using approaches from multiple disciplines.

The issue begins with an observational study by Hadwin & Webb et al., who find that the capabilities for quasi-perceptual internal representations, known as "mental imagery" (p. 8), are indirectly related to depression through rumination. Their article offers a fascinating perspective on the role of the inner world in disorder and psychopathology. Continuing in the clinical vein, Houlcroft & Thomas report an experimental study in preadolescents, which aims to delineate the roles of perfectionism and emotional reactivity in disordered eating. The authors find that socially-prescribed, but not self-oriented, perfectionism significantly explains disordered eating, providing a clear target for behavioural treatments. We end with a book review of Atmospheres, by Hermann Schmitz, which confronts the well-known spectre of mind-body dualism in a new light. Jones and Salvatella underscore the rare clarity of Schmitz's writing, using it as a lens through which to explore his thesis's flaws. The authors conclude by designating Schmitz' collection of essays to the purely phenomenological space, defining it as a work that addresses how humans make sense of subjective experience, without, however, adequately explaining the nuances of its foundational concepts — atmosphere and feelings. Uniting philosophy, with experimental psychology and clinical science, this issue confronts the role of the psyche in both adaptive and maladaptive behaviour.

As ever, this issue would not have made it to press without the dedication of the editorial and review team at the Journal. As we look forward into 2025, we are expanding our team and actively seeking interdisciplinary individuals to take editorial and outreach positions. We are confident that the addition of such individuals will channel and focus our growing momentum, and we encourage students to make an application regardless of institution or background. Thank you, both to our readers and benefactors, for allowing us to platform academic discourse across the behavioural sciences.

Ioanna Fokas

University of Cambridge
Managing Editor, Psychological Sciences

CAMBRIDGE JOURNAL OF HUMAN BEHAVIOUR

PSYCHOLOGY

Disordered Eating: What are the Potential Roles of Perfectionism and Emotional Reactivity?

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Perfectionism and emotional reactivity are identified risk factors for disordered eating (DE) in adults and adolescents, yet research in preadolescents is scarce. Further to this, limited research has explored how these risk factors may act together to influence DE. This study investigated the associations between perfectionism, emotional reactivity, and DE in preadolescents, alongside the mediating role of emotional reactivity between perfectionism and DE. Sixty-seven preadolescents (M age = 10.9 years; 52.2% male) self-reported their levels of DE, and self-oriented and socially prescribed perfectionism. Measures of emotional reactivity were collected by observing participant anxiety expressions in response to a stress-inducing laboratory task. Regression analyses revealed that socially prescribed, but not self-oriented perfectionism, significantly explained variance in DE; however, emotional reactivity was not significantly correlated with either perfectionism dimensions or DE. These findings suggest socially prescribed perfectionism may be more broadly associated with DE, whilst self-oriented perfectionism is less influential on DE during preadolescence. Altogether, these findings highlight the value of investigating associations between common risk factors and DE in younger populations to better understand the emergence of eating psychopathology.

INTRODUCTION

Eating disorders (EDs), such as anorexia nervosa and bulimia nervosa, are disabling mental health conditions that affect over 700,000 individuals in the UK (National Institute for Health and Care Excellence [NICE], 2024; Santomauro et al., 2021). EDs have one of the highest mortality and suicide rates of any psychiatric condition (Galmiche et al., 2019), with suicide accounting for 1 in 5 deaths among people with EDs (Arcelus et al., 2011). Furthermore, ED symptoms can be highly heterogeneous both within and across diagnoses, making treatment and recovery a challenging process (Levinson et al., 2022). Disordered eating (DE) behaviours are described as subclinical eating attitudes or behaviours, and are a prerequisite for developing diagnosable EDs (Smolak & Levine, 2015; Thomas et al., 2021). Most research exploring DE is targeted towards adolescence and adulthood, despite evidence demonstrating that DE can begin during childhood and preadolescence (Herle et al., 2020). DE can persist from childhood into adulthood (Kotler et al., 2001), creating a high risk for future ED development (Pursey et al., 2021). Therefore, it is becoming increasingly important for research to establish preadolescent risk factors in order to facilitate potential interventions that mitigate the progression of eating pathology. Two potential risk factors that are associated with DE include perfectionism and emotional reactivity (Evans et al., 2019; Lilenfeld et al., 2006). The current study aimed to explore the association, and potential interaction, of these variables with DE in a community sample of preadolescents.

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†Author was not an undergraduate student at the time of research.

Perfectionsim is defined as the propensity to seek exceptionally high standards (Chang et al., 2008). Whilst it is considered a typical antecedent of EDs, few studies have assessed perfectionism in relation to DE in preadolescents (Rosewall et al., 2019). In adults, elevated perfectionism is found in individuals with a lifetime history of DE relative to healthy controls (Forbush et al., 2006). Additionally, individuals with EDs, as opposed to other psychiatric disorders, retrospectively report higher levels of perfectionism during childhood (Wade et al., 2016). In adolescents, Ferreiro et al. (2012) found that perfectionism predicted DE in girls over time, and Boone et al. (2011) reported that perfectionism was related to symptom severity in bulimia nervosa. Such perfectionistic tendencies during youth are hypothesised to be maladaptively applied to body shape and weight, resulting in the development of DE (Johnston et al., 2018); however, research is needed in a community sample of preadolescents to determine the presence of perfectionism as a potential early risk factor for DE.

Perfectionism in children and adolescents can be conceptualised as self-oriented (i.e., having extremely high standards for oneself) or socially prescribed (i.e., perceiving others as demanding perfection from oneself) perfectionism (Flett et al., 2016). Self-oriented perfectionism (SOP) is denoted as adaptive, and is generally related to positive psychological wellbeing and high self-esteem (Haynos et al. 2018; Oros et al., 2017). Socially prescribed perfectionism (SPP) is found to predict psychopathology across age groups (Malivoire et al., 2019; Lozano et al., 2015). In regard to DE, SPP is evidenced as more broadly associated with ED symptoms and attitudes than SOP in children, adolescents, and adults (Flett et al., 2016; Hewitt et al., 1995). However, both perfectionism dimensions are found to be independently linked to ED symptoms

(Sherry et al., 2003). Therefore, such mixed findings highlight a need for research to detangle how the dimensions of perfectionism correlate with DE, to establish which aspects are potential risk factors in preadolescents.

Emotional reactivity is described as a sensitivity to experiencing emotions, including how intensely, frequently, or persistently they are experienced (Nock et al., 2008). Elevated emotional reactivity in response to experimentally induced interpersonal stress, such as presenting participants with a mock job interview, is reported in women with EDs (Monteleone et al., 2020). There is also evidence that emotional reactivity is related to emotional under or overeating in preschool children (Messerli-Burgy et al., 2018) and the development of DE over time in adolescents (Juarascio et al., 2016). Furthermore, Goldschmidt et al. (2014) found that women with bulimia nervosa engaged in DE behaviours in response to daily stressors, suggesting a link between increased emotional reactivity and DE; however, there is limited research which examines emotional reactivity and DE in preadolescents, despite the changes in emotional reactivity that occur at the onset of puberty (Dahl & Gunnar, 2009). Vulnerability during this period may lead preadolescents who are emotionally reactive to utilise DE behaviours as an emotion regulation strategy (Bodell et al., 2022). Hence, research is required to identify emotional reactivity as a potential correlate of DE in preadolescents.

Furthermore, emotional reactivity and perfectionism may jointly influence DE. Individuals with perfectionistic standards may perceive failure and rejection more frequently, and with higher appraised significance or detriment (Hewitt et al., 2002). Therefore, preadolescents with increased emotional reactivity may experience failures more intensely. In turn, this may lead to DE behaviours that function to alleviate the negative affect associated with not meeting their own or other's high expectations (Asl et al., 2021; Evans et al., 2019). Accordingly, high emotional reactivity may mediate the association between perfectionism and DE, such that high emotional reactivity may underlie the association between elevated perfectionism and DE. One study by Donahue et al. (2018) found that the relation between SPP and DE was moderated by a lack of adaptive emotion regulation strategies, but emotional reactivity was not considered in this model. Past this, seemingly no research has investigated emotional reactivity as a mediator in the association between perfectionism and DE.

The present study aimed to build upon the current literature by examining the associations between perfectionism, emotional reactivity, and DE in a community sample of preadolescents. In addition, it examined the potential mediating role of emotional reactivity in the association between perfectionism and DE. This study employed measures validated for a preadolescent sample: the Children's Eating Attitudes Test (ChEAT; Maloney et al., 1989), the Child-Adolescent Perfectionism Scale (CAPS; Flett et al., 2016), and the child-adapted version of the Trier Social Stress Test (TSST-C; Buske-Kirschbaum et al., 1997). Our first hypothesis was that preadolescents with higher levels of SOP, SPP, and emotional reactivity would also report elevated levels of DE. In relation to theoretical proposals, this study secondly hypothesised that higher levels of emotional reactivity in preadolescents would mediate associations between the dimensions of perfectionism and DE.

METHODS

Ethics

The wider research (Thomas, 2022) and this study, were approved by the Cardiff University School of Psychology Ethics Committee (EC.19.02.12.5566GR3A3; EC.19.02.12.5566GR6A7). Prior to participation, parents/guardians and children received information regarding the study. Parents/guardians gave informed opt-in consent, while children gave assent. After study participation, children and parents/guardians were appropriately debriefed and provided with the contact details of the researchers and support organisations for whom they could contact if they deemed necessary.

Participants

Seventy-four participants' data were collected for this study from a community sample as part of a larger project. This project recruited participants across two stages, between August 2019 and September 2021 in south Wales (specific details can be found in Thomas, 2022). For the first stage of recruitment, children who had participated in the prior school-based study were invited to participate in the current laboratory study. Participants recruited in the second stage were invited to participate through social media posts and a Cardiff University recruitment database.

Study recruitment had the following exclusion criteria: premature birth, uncorrected vision, serious developmental delays, and neurological difficulties related to serious head trauma (N = 0). In accordance with the task exclusion criteria, seven children were removed for task incompletion and wearing face masks. The latter impaired the ability of the coders to assess the children's expression during the TSST-C. Demographic data of the final sample were collected for participant age, gender, and ethnicity, alongside parent age and socioeconomic status. Details of the final demographics are shown in **Table 1.**

Table 1

Final Sample Demographics.

Participant	M (Range)
Age (years)	10.91 (10.00-11.83)
Gender (male %)	52.20
Ethnicity (%)	
White	
Mixed of Multiple Ethnic Groups	80.60
Asian or Asian British	3.00
Other Ethnic Group	4.50
Black, African, Caribbean, or Black British	7.50
Missing Data	4.50
Parent Demographics (N=67)	**M (Range)**
SES (WIMD) Quartile (%)	
1st (most deprived)	20.90
2nd	19.40
3rd	13.40
4th (least deprived)	46.30

Note. SES: Socioeconomic status, WIMD: Welsh Index of Multiple Deprivation

Materials

Children's Eating Attitudes Test (ChEAT)

The ChEAT (Maloney et al., 1989) is a 26-item self-report measure of child DE attitudes and behaviours. It was adapted from the 26-item Eating Attitude Test (EAT-26; Garner & Garfinkel, 1979) and assesses worries about being overweight, bingeing and purging, food preoccupation, and dieting in 8 to 13-year-olds. Children rate items on the measure using a 6-point response scale to illustrate the frequency they display the behaviour or attitude. Traditional scoring methods of the ChEAT are found to restrict and positively skew the variability within the data (Thomas, 2022; Smolak & Levine, 1994). Therefore, the present study utilised an alternate procedure that scores item responses from 1–6 (Never–Always), with total scores ranging from 26 to 156 (Anton et al., 2006). Greater total ChEAT scores represent higher levels of DE.

Items on the scale were reworded or simplified to increase understanding (Thomas, 2022). Item 4, "I have gone on eating binges where I feel that I might not be able to stop" was adjusted to "I have started to eat and then felt like I cannot stop" after Coombs et al. (2011) recommended that children struggled to comprehend the word 'binge'. Furthermore, items that specified "vomit" (9 and 26) were presented alongside the words "am/be sick", and item 21 was amended to "I spend too much time thinking about food" from the initial "I give too much time and thought to food". The altered wording and adjusted scoring had an acceptable Cronbach's alpha (α = .73)

Child-Adolescent Perfectionism Scale (CAPS)

The CAPS (Flett et al., 2016) is a 22-item self-report measure of SOP and SPP in children, developed from the Multidimensional Perfectionism Scale (Hewitt & Flett, 1991). The SOP subscale has 12 items, while the SPP subscale has 10 items. Children rate items on a 5-point scale to demonstrate how much they identify with the perfectionistic beliefs or tendencies: 1 – false-not at all true of me, 2 – mostly false, 3 – neither true nor false, 4 – mostly true, and 5 – very true of me. Items 3, 9 and 18 were reverse-scored. Total scores were summed and range from 22 to 110, with greater scores representing higher levels of perfectionism. CAPS demonstrates good internal consistency (SOP α = .81; SPP α = .84) and suitable test-retest reliability at 1 year (SOP α = .65; SPP α = .59) (Flett et al., 2016). The current study found an acceptable Cronbach's alpha for both SOP (α = .76) and SPP (α = .78).

Trier Social Stress Test for Children (TSST-C)

The TSST-C (Buske-Kirschbaum et al., 1997) is a behavioural task adapted from the adult TSST (Kirschbaum et al. 1993), which is considered to be a gold standard procedure in experimentally induced stress research (Allen et al., 2017). It is designed to induce psychosocial stress in children and its outcomes can be used to measure emotional reactivity (Allen et al., 2017). In this test, children are typically asked to finish the ending of a given story in an exciting manner and better than their peers, followed by a surprise mental arithmetic test in front of a camera and a panel of adults; however, children in the present study only completed the mental arithmetic task due to time constraints. All other details remained the same.

Video recordings of the TSST-C were coded using the Child and Adolescent Stress and Emotion Scale (CASES; Burkholder et al., 2016), which measures verbal, facial and bodily anxiety expressions made by children. This coding scheme scores children using a 4-point Likert scale (0 – no observed anxiety expressions, 1 – mild expressions, 2 – moderate expressions, and 3 – severe expressions). Anxiety expressions were coded in 10 second windows using EUDICO Linguistic Annotator (ELAN; Version 6.4; The Language Archive, 2022), with two coders who were not involved in data collection and blind to the participants' other results. Total scores for each anxiety expression type were summed, with higher scores reflecting greater anxiety expressions. The current study demonstrated good inter-rater reliability across 6 videos (α = .95).

Statistical Analyses

Data were analysed using SPSS (Version 27.0; IBM, 2020). Two-tailed analyses were implemented and a p-value of 0.05 defined statistically significant results. Data were screened and plotted to identify potential floor or ceiling effects, and to examine data distribution. CASES, SPP and ChEAT data all violated normality assumptions according to the Shapiro-Wilk test. Successful Log transformations were performed to correct ChEAT and SPP data; however, CASES normality remained violated after transformations. Visual inspection of the untransformed data on the CASES' histogram deemed the normality to be allowable; however, non-parametric tests (Spearman's rank correlation) were also performed and were comparable to parametric test results unless reported otherwise.

Preliminary analyses were conducted to determine whether age, gender, ethnicity, parental age, and socioeconomic status were covariates of DE. These analyses were non-significant (see **Appendix**), and demographic variables were therefore not included in the following analyses.

Pearson's *r* correlations were used to test the primary hypotheses for associations between the perfectionism dimensions, emotional reactivity, and DE. Linear regressions were employed for the significant associations. To examine the secondary hypothesis, hierarchical regressions were used to explore significant associations between all variables. This allowed for the associations between perfectionism dimensions and DE to be examined whilst controlling for emotional reactivity. This was followed by mediational analyses, which were used to investigate whether emotional reactivity was a mediator in the association between perfectionism dimensions and DE. Variance inflation factor was used to examine multicollinearity and was found to be at an acceptable level.

Procedure

All children attended the laboratory session with a parent or guardian present. Children who participated in the first stage of the larger project completed the ChEAT questionnaire at school, whereas children recruited through the second stage of the project completed the ChEAT at the laboratory. All children completed the CAPS questionnaire at the laboratory. Children then participated in several neurocognitive tasks that were not part of the current study, including a Go/NoGo task, set shifting task, and a central coherence task. Afterwards, each child was guided to a second room to sit in front of two researchers, a camera, and a one-way mirror that their parent stood behind, unbeknownst to the child. Once the child was settled in the room and in front of the camera, instructions for the mental arithmetic TSST-C began.

Firstly, children were told they were going to be recorded completing a maths test. In the mental arithmetic task of the TSST-C, participants were asked to subtract the number 7 from 758 as accurately and fast as they could. If the child made an error, they were told to restart at 758 with the phrase "Not quite, please start again". If five consecutive errors were made or the child had difficulty continuing after fewer errors, the experimenter altered the task to subtracting 3s from 307. The task lasted for 5 minutes, after which the child rated how stressful the task was from 1–10 as a manipulation check. They then received feedback and were told the true nature of the task. Following the TSST-C, children completed a frustration task as part of the larger project before being fully debriefed alongside their parents, receiving a prize as compensation for their time.

RESULTS

Whole sample descriptive statistics for all study variables are presented in **Figure 2**. ChEAT, CAPS and CASES scores demonstrated some variability.

Figure 2

Whole sample descriptive statistics for untransformed study variables.

	M (SD)	Min - Max
ChEAT	59.25 (12.17)	35-90
CAPS – Self-Oriented	32.76 (8.53)	15-54
CAPS – Socially Prescribed	19.55 (7.15)	9-37
CASES – Total Observed Anxiety Expression	23.39 (14.61)	1-58

Note. ChEAT: Children's Eating Attitude Test. CAPS: Child-Adolescent Perfectionism Scale. CASES: Child and Adolescent Stress and Emotion Scale.

Correlations were performed to test the associations between DE, SOP, SPP and emotional reactivity (**Figure 3**). There were significant positive correlations between ChEAT and SOP scores, ChEAT and SPP scores, and SOP and SPP scores. Non-significant correlations were found between ChEAT and CASES scores, SOP and CASES scores, and SPP and CASES scores.

The significant associations between DE, SOP and SPP were further examined using the CAPS dimension scores and ChEAT scores in a multiple linear regression. Although the model was significant ($F(2, 64) = 5.48$, $p = .006$, $R^2 = .146$), only SPP scores significantly explained the variance in the ChEAT scores ($B = .168$, SE $B = .073$, $p = .025$). SOP was non-significant in the model (B = .001, SE B = .001, p = .406). Since the associations between all three variables were non-significant, follow-up hierarchical regressions and mediation analyses were not employed.

Exploratory analyses were conducted to determine whether the subcomponent scores of the CASES were correlated with the ChEAT scores. The subcomponent scores all violated normality based on the Shapiro-Wilk test, and corrective Log transformations were unsuccessful. Spearman's rank correlations found that the intensity of facial anxiety

Figure 3

Pearson's correlations between questionnaire measures

	ChEAT	CAPS – Self-Oriented	CAPS – Socially-Prescribed	CASES – Total Observed Anxiety Expressions
ChEAT	1			
CAPS – Self-Oriented	0.275*	1		
CAPS- Socially-Prescribed	0.370**	0.521**	1	
CASES – Total Observed Anxiety Expressions	0.116	-0.165	-0.115	1

*** Correlation is significant at p < 0.01*
** Correlation is significant at p < 0.05*

expressions were positively correlated with ChEAT scores (rs(65) = .25, p = .040); however, the intensity of bodily anxiety expressions (rs(65) = -.02, p = .887) and vocal anxiety expressions (rs(65) = .11, p = .372) were not correlated with ChEAT scores.

DISCUSSION

Past research has linked multidimensional perfectionism and emotional reactivity to DE in adolescents (Evans et al., 2019) and adults (Lilenfeld et al., 2006), yet there are few studies that investigate these associations in preadolescents (Rosewall et al., 2019). The results of the current study revealed that preadolescents with higher levels of SOP and SPP experienced higher levels of DE; however, whilst SPP significantly explained the variance in DE, SOP did not significantly contribute to the model. This partially supports our hypothesis that dimensions of perfectionism would be associated with DE in preadolescents. Inconsistent with our hypotheses, emotional reactivity was not significantly associated with DE or the perfectionism dimensions, potentially suggesting that emotional reactivity is not a risk factor for DE, nor a mediator between perfectionism and DE, in preadolescents.

The finding that SPP significantly explains variance in DE is consistent with literature arguing that SPP is a maladaptive form of perfectionism that is more broadly related to DE outcomes (Flett et al., 2016; Hewitt et al., 1995; Malivoire et al., 2019). If DE relates to placing excessive worth on one's weight and shape, partly due to an awareness of how Western society values "thinness" (Warren et al., 2005, p. 241), those who feel an external pressure to be perfect may adhere to socially prescribed body ideals (Donahue et al., 2018). Indeed, the perpetuation of unrealistic cultural body ideals communicated by parents, peers, or mass media has been linked to DE outcomes (Levine & Murnen, 2009), with boys and girls as young as 8–10 years demonstrating an awareness of such ideals (Shapiro et al., 1997). Therefore, preadolescents with heightened levels of SPP may perceive a greater pressure to strive towards these standards, thus fostering DE attitudes and behaviours (Donahue et al., 2018). This may be particularly true if preadolescents with increased SPP believe they will receive social approval for satisfying the perceived expectations of those around them, reinforcing their attitudes and perhaps increasing DE further (Flett et al., 1991; Lieberman et al., 2001). Altogether, our findings indicate that SPP is associated with DE in preadolescents, perhaps due to the application of maladaptive perfectionism to socially set body ideals.

The present study also revealed that although SOP was positively correlated with DE, SOP did not significantly explain the variance in DE after SPP was accounted for. These findings contradict literature that argues SOP is an independent risk factor for DE (Sherry et al., 2003) and suggests SOP is either less influential in the development of DE in preadolescents or is indirectly associated with DE through another factor. Sociocultural theories of eating pathology propose that a perceived social pressure to be thin can facilitate a cognitive and affective internalisation of thinness body ideals, leading to body dissatisfaction and DE (Stice, 2002). This concept can be applied to the dimensions of perfectionism, whereby body ideals related to SPP are converted into an inflexible intrapersonal standard that is then akin to SOP (Soares et al., 2009). Whilst perfectionism is prospectively related to thin ideal internalisation and thus ED symptoms in adolescents (Boone et al., 2011), a community sample of preadolescents may be too young to have internalised body ideals within their self-oriented standards of perfectionism. In other words, preadolescents may experience the social pressure of a body ideal, but are perhaps too young to turn body ideals into an internalised and self-oriented pressure. Therefore, SOP's association with DE may have been rendered non-significant in the present study after accounting for SPP, as preadolescents are potentially too young to adopt SOP towards eating behaviours.

The present study's results demonstrated that emotional reactivity was not significantly associated with DE in preadolescents, opposing the proposed mediation model, and the view that emotional reactivity is a risk factor for DE (Evans et al., 2019). This finding contrasts prior research that identified a link between emotional reactivity and DE, and theories which suggest DE may develop as a coping mechanism to regulate heightened emotions (Evans et al., 2019; Messerli-Burgy et al., 2018; Monteleone et al., 2020). However, research that considers emotional reactivity as a risk factor for DE is in its relatively early stages, with the studies available mainly relying on cross-sectional data in adults with diagnosed EDs (Monteleone et al., 2020). Therefore, such results may instead communicate that emotional reactivity is a potential symptom of EDs that can originate from more long-term clinical impairment, rather than a correlate of subclinical DE in preadolescents. For example, women with anorexia nervosa can demonstrate disrupted physiology due to malnutrition, potentially leading to the abnormal emotional reactivity observed in prior studies (Chami et al., 2019; Diaz-Marsa et al., 2021). Furthermore, our findings are inconsistent with research that has used alternative measures of emotional reactivity. Juarascio et al. (2016) found heightened emotional reactivity predicted DE across time in adolescents when using a measure that captured a variety of negative emotions following a distress-inducing task. This measure may enable us to capture a more comprehensive measure of emotional reactivity and identify more nuanced associations with DE. Altogether, whilst the cross-sectional limitations of past studies may impact interpretations of the association between emotional reactivity and DE, non-significant results in the current study may be due to the relatively narrow measurement of emotional reactivity.

Furthermore, the non-significant association between emotional reactivity and DE may also be due to the present study's observational measurement of emotional reactivity. Although the CASES was used in prior research to investigate emotional reactivity in children and adolescents (Burkholder et al., 2016), the CASES measures external expressions of anxiety rather than individuals' internal feelings. This may be particularly important as emotional expression suppression is associated with DE, indicating that individuals with elevated levels of DE may demonstrate less behavioural signs of emotionality despite possibly experiencing increased emotional intensity (Ortiz et al., 2019). Hence, the present findings perhaps contrasted previous studies as the latter utilised self-report measurements of affect, which potentially assessed emotional reactivity more insightfully after the experimental induction of stress (Juarascio et al., 2016; Monteleone et al., 2020). This could be due to participants being more willing to report their internal emotional states, rather than express them outwardly; however, self-report measures can also introduce respondent bias, as participants could additionally experience trouble with reporting specific internal feelings (Evans et al., 2019). Furthermore, emotional expression is deemed as prevalent in preadolescence due to the onset of puberty (Rapee et al., 2019). Therefore, whilst the measurement of emotional reactivity may have influenced the present study's results, it is uncertain as to whether emotional reactivity is related to DE in preadolescents.

Non-significant associations were also found between emotional reactivity and the dimensions of perfectionism, further contradicting the hypothesised mediation model, and contrasting previous research which suggests elevated levels of perfectionism lead to heightened emotional reactivity (Dunkley et al., 2014; Hewitt et al., 2002). These inconsistent findings may be attributed to differences in methodologies. For instance, Dunkley et al. (2014) asked participants to use daily diaries to report

on various stressors they experienced throughout their day over several days, whereas the present study experimentally induced one specific stressor. Since emotional reactivity is a multifaceted construct (Nock et al., 2008), the day-to-day nature of Dunkley and colleagues' study may have captured the frequency and duration of emotional reactions, while the present study predominantly measured their behavioural intensity. Therefore, there are possible associations between emotional reactivity and the dimensions of perfectionism in preadolescents; however, the methodology of the present study may have limited the finding of such associations.

Limitations and Future Directions

The present study was subject to various limitations. Firstly, this study did not measure preadolescent awareness and internalisation of body ideals. Therefore, it cannot be confirmed that the awareness of socially prescribed body ideals was responsible for the association between SPP and DE, and lack of body ideal internalisation rendered SOP non-significant in the DE regression model. Conversely, some literature has identified an association between body ideal internalisation and DE in preadolescent girls (Blowers et al., 2003; Evans et al., 2013), which suggests that preadolescents are potentially old enough to cognitively and affectively incorporate such societal standards into their self-concept (Jankauskiene & Baceviciene, 2022); however, seemingly no research has specifically investigated SOP in relation to body ideal internalisation and DE in preadolescents. Therefore, future research should include measures of ideal internalisation, such as the revised Sociocultural Attitudes Towards Appearance Questionnaire (Schaefer et al., 2016), to develop a more comprehensive understanding of perfectionism and DE in preadolescents.

Another limitation of the present study may explain the lack of significant association between emotional reactivity and DE. Exploratory analyses with CASES scores revealed that DE was associated with the intensity of facial expressions of anxiety, but not bodily or vocal expressions. This finding perhaps reflects that coders may find facial expressions of anxiety as less ambiguous to interpret (Zhang et al., 2018). For instance, a fearful face is potentially easier to deduce as an anxiety expression, whereas nervous fidgeting could be misconstrued for hyperactivity. These challenges plausibly led to decreased precision in identifying anxiety expressions, thus suggesting that the measurement of emotional reactivity was not maximally accurate. Such suggestions should be considered tentatively due to the exploratory nature of these analyses, but future research could combine different emotional reactivity methodologies to address this limitation. Such methodologies could include both behavioural and self-report scales in order to combat each measures' individual limitations, and thus clarify the potential association between emotional reactivity and DE in preadolescents.

Thirdly, the present study did not include nor measure child weight status as a covariate of DE. This is potentially important as research demonstrates preadolescents with higher body mass index (BMI) are more likely to engage in DE behaviours (Murray et al., 2022); however, defining weight status according to BMI percentiles is controversial as BMI is an inaccurate measure of fat mass in children (Agbaje, 2024). Therefore, it is unclear how weight status influences DE in preadolescents, and whether it would affect the present study's findings. Future research should use alternate measures of weight status, such as waist-circumference-to-height-ratio (Agbaje, 2024), to identify how weight status may influence DE in relation to perfectionism and emotional reactivity.

Lastly, it is important to highlight the cross-sectional approach used in the current study, which may restrict conclusions that can be drawn regarding the causality of SPP as a risk factor in the development of DE. Future studies should thereby follow preadolescents into adolescence or adulthood to establish the influence of perfectionism as a risk factor in the trajectory of DE; however, establishing temporal precedence of either perfectionism or emotional reactivity in the development of DE does not always guarantee causality, as other unmeasured variables could be responsible for both the risk factor and DE (Jansen, 2016). Therefore, future research could also consider experimental psychopathology studies that examine whether the minor activation of a proposed risk factor in healthy preadolescents leads to short-term DE attitudes (Jansen, 2016). For example, Shafran et al. (2006) found that when adult participants were asked to pursue high levels of perfectionism for 24 hours, they demonstrated decreased food intake compared to participants who were told to set minimal standards for themselves. Such research might be highly valuable to determine preadolescent risk factors; however, comprehensive ethical considerations would need to be made to ensure the protection of participants from potential psychological distress. Altogether, future research should consider a variety of study designs to further understand the complex aetiology of DE in preadolescents.

Implications

While the presence of DE in preadolescents is not a novel finding (Herle et al., 2020), it remains concerning that such harmful attitudes and behaviours were reported by this community sample (Thomas et al., 2021). This highlights a need for early screening tools (Thomas et al., 2021), and emphasises the importance of interventions that prevent DE from progressing into diagnosable EDs (Pursey et al., 2021).

Furthermore, research has shown that current interventions demonstrate limited effectiveness in preventing and treating DE development (Pennesi & Wade, 2016). This may be because a one-size-fits-all approach is likely unattainable due to the heterogeneous nature of DE (Pennesi & Wade, 2016). Instead, extensive research that informs targeted interventions may be the best route for improving the wellbeing of children at risk for developing DE. After future research is conducted, the association between SPP and DE in the present study may suggest a point of intervention for preadolescents. Therefore, an intervention which targets perfectionism in preadolescents, whilst additionally addressing the harmful nature of sociocultural body ideals, may be a valuable programme for preventing or reducing DE in this age group.

CONCLUSION

Overall, the present study provides evidence for the association between SPP and DE in preadolescence. While high levels of SPP were associated with higher levels of DE, SOP did not significantly explain the variance in DE after accounting for SPP. Furthermore, emotional reactivity was not significantly associated with DE or the perfectionism dimensions, thus failing to support the proposed mediation model between variables. Although these results draw attention to the potential influence of SPP and SOP in preadolescent development of DE, they also highlight the importance of employing various methodological designs to capture complex constructs. Given the influence of DE on later ED development and the presence of such attitudes and behaviours in the current study, early screening tools and interventions that target SPP are potentially crucial for preventing later ED pathology. Therefore, once further longitudinal and experimental research is conducted to better understand the roles of perfectionism and emotional reactivity in DE, the higher probability there is of delivering evidence-based interventions that positively impact the wellbeing of children.

SUPPLEMENTARY MATERIAL

Appendix

PSYCHOLOGY

Article references

Agbaje, A. O. (2024). Waist-circumference-to-height-ratio had better longitudinal agreement with DEXA-measured fat mass than BMI in 7237 children. *Pediatric Research*, *96*, 1369–1380. https://doi.org/10.1038/s41390-024-03112-8

Allen, A. P., Kennedy, P. J., Dockray, S., Cryan, J. F., Dinan, T. G., & Clarke, G. (2017). The Trier Social Stress test: Principles and practice. *Neurobiology of Stress*, *6*, 113–126. https://doi.org/10.1016/j.ynstr.2016.11.001

Anton, S. D., Han, H., Newton, R. L., Martin, C. K., York-Crowe, E., Stewart, T. M., & Williamson, D. A. (2006). Reformulation of the children's eating attitudes test (cheat): Factor structure and scoring method in a non-clinical population. Eating and Weight Disorders - Studies on Anorexia, *Bulimia and Obesity*, *11*(4), 201–210. https://doi.org/10.1007/bf03327572

Arcelus, J., Mitchell, A. J., Wales, J., & Nielsen, S. (2011). Mortality rates in patients with anorexia nervosa and other eating disorders: a meta-analysis of 36 studies. *Archives of general psychiatry, 68*(7), 724-731. https://doi.org/10.1001/archgenpsychiatry.2011.74

Asl, E. M., Abdi, L., Sadegh, A. M., & Behrouzian, F. (2021). The mediating role of self-compassion in the relationship between positive reactivity, negative reactivity, and perfectionism with disordered eating. *Journal of Education and Health Promotion, 10*(1). https://doi.org/10.4103/jehp.jehp_1485_20

Blowers, L. C., Loxton, N. J., Grady-Flesser, M., Occhipinti, S., & Dawe, S. (2003). The relationship between sociocultural pressure to be thin and body dissatisfaction in preadolescent girls. *Eating Behaviors, 4*(3), 229–244. https://doi.org/10.1016/s1471-0153(03)00018-7

Bodell, L. P., Egbert, A. H., Anaya, C., & Wildes, J. E. (2022). Associations between emotion reactivity and eating disorder symptoms in a transdiagnostic treatment seeking sample. *International Journal of Eating Disorders, 55*(10), 1390–1396. https://doi.org/10.1002/eat.23808

Boone, L., Soenens, B., & Braet, C. (2011). Perfectionism, body dissatisfaction, and bulimic symptoms: The intervening role of perceived pressure to be thin and thin ideal internalization. *Journal of Social and Clinical Psychology, 30*(10), 1043–1068. https://doi.org/10.1521/jscp.2011.30.10.1043

Burkholder, A. R., Koss, K. J., Hostinar, C. E., Johnson, A. E., & Gunnar, M. R. (2016). Early life stress: Effects on the regulation of anxiety expression in children and adolescents. *Social Development, 25*(4), 777–793. https://doi.org/10.1111/sode.12170

Buske-Kirschbaum, A., Jobst, S., Wustmans, A., Kirschbaum, C., Rauh, W., & Hellhammer, D. (1997). Attenuated free cortisol response to psychosocial stress in children with atopic dermatitis. *Psychosomatic Medicine, 59*(4), 419–426. https://doi.org/10.1097/00006842-199707000-00012

Chami, R., Monteleone, A. M., Treasure, J., & Monteleone, P. (2019). Stress hormones and eating disorders. *Molecular and Cellular Endocrinology, 497*, 110349. https://doi.org/10.1016/j.mce.2018.12.009

Chang, E. C., Ivezaj, V., Downey, C. A., Kashima, Y., & Morady, A. R. (2008). Complexities of measuring perfectionism: Three popular perfectionism measures and their relations with eating disturbances and health behaviors in a female college student sample. *Eating Behaviors, 9*(1), 102–110. https://doi.org/10.1016/j.eatbeh.2007.06.003

Coombs, E., Brosnan, M., Bryant-Waugh, R., & Skevington, S. M. (2011). An investigation into the relationship between eating disorder psychopathology and autistic symptomatology in a non-clinical sample. *British Journal of Clinical Psychology, 50*(3), 326–338. https://doi.org/10.1348/014466510x524408

Dahl, R. E., & Gunnar, M. R. (2009). Heightened stress responsiveness and emotional reactivity during pubertal maturation: Implications for psychopathology. *Development and Psychopathology, 21*(1), 1–6. https://doi.org/10.1017/s0954579409000017

DiazMarsa, M., MacDowell, K., de la TorreLuque, A., Caso, J. R., Faya, M., Gutierrez, S., Soto, M., Pemau, A., DiazCarracedo, P., CarrascoDiaz, A., Leza, J. C., Graell, M., & Carrasco, J. L. (2021). Inflammatory dysregulation in women with an eating disorder: Relationships with altered emotional reactivity. *International Journal of Eating Disorders, 54*(10), 1843–1854. https://doi.org/10.1002/eat.23598

Donahue, J. M., Reilly, E. E., Anderson, L. M., Scharmer, C., & Anderson, D. A. (2018). Evaluating associations between perfectionism, emotion regulation, and eating disorder symptoms in a mixed-gender sample. *Journal of Nervous & Mental Disease, 206*(11), 900–904. https://doi.org/10.1097/nmd.0000000000000895

Dunkley, D. M., Mandel, T., & Ma, D. (2014). Perfectionism, neuroticism, and daily stress reactivity and coping effectiveness 6 months and 3 years later. *Journal of Counseling Psychology, 61*(4), 616–633. https://doi.org/10.1037/cou0000036

Evans, B. C., Felton, J. W., Lagacey, M. A., Manasse, S. M., Lejuez, C. W., & Juarascio, A. S. (2019). Impulsivity and affect reactivity prospectively predict disordered eating attitudes in adolescents: A 6-year Longitudinal Study. *European Child & Adolescent Psychiatry, 28*(9), 1193–1202. https://doi.org/10.1007/s00787-018-01267-4

Evans, E. H., Tovée, M. J., Boothroyd, L. G., & Drewett, R. F. (2013). Body dissatisfaction and disordered eating attitudes in 7- to 11-year-old girls: Testing a sociocultural model. *Body Image, 10*(1), 8–15. https://doi.org/10.1016/j.bodyim.2012.10.001

Ferreiro, F., Seoane, G., & Senra, C. (2012). Gender-related risk and protective factors for depressive symptoms and disordered eating in adolescence: A 4-year Longitudinal Study. *Journal of Youth and Adolescence, 41*(5), 607–622. https://doi.org/10.1007/s10964-011-9718-7

Flett, G. L., Hewitt, P. L., Besser, A., Su, C., Vaillancourt, T., Boucher, D., Munro, Y., Davidson, L. A., & Gale, O. (2016). The child–adolescent perfectionism scale. *Journal of Psychoeducational Assessment, 34*(7), 634–652. https://doi.org/10.1177/0734282916651381

Flett, G. L., Hewitt, P. L., Blankstein, K. R., & Koledin, S. (1991). Dimensions of perfectionism and irrational thinking. *Journal of Rational-Emotive and Cognitive-Behavior Therapy, 9*(3), 185–201. https://doi.org/10.1007/bf01061229

Forbush, K., Heatherton, T. F., & Keel, P. K. (2006). Relationships between perfectionism and specific disordered eating behaviors. *International Journal of Eating Disorders, 40*(1), 37–41. https://doi.org/10.1002/eat.20310

Galmiche, M., Déchelotte, P., Lambert, G., & Tavolacci, M. P. (2019). Prevalence of eating disorders over the 2000–2018 period: a systematic literature review. *The American journal of clinical nutrition, 109*(5), 1402-1413.

Garner, D. M., & Garfinkel, P. E. (1979). The eating attitudes test: An index of the symptoms of anorexia nervosa. *Psychological Medicine, 9*(2), 273–279. https://doi.org/10.1017/s0033291700030762

Goldschmidt, A. B., Wonderlich, S. A., Crosby, R. D., Engel, S. G., Lavender, J. M., Peterson, C. B., Crow, S. J., Cao, L., & Mitchell, J. E. (2014). Ecological momentary assessment of stressful events and negative affect in bulimia nervosa. *Journal of Consulting and Clinical Psychology, 82*(1), 30–39. https://doi.org/10.1037/a0034974

Haynos, A. F., Utzinger, L. M., Lavender, J. M., Crosby, R. D., Cao, L., Peterson, C. B., Crow, S. J., Wonderlich, S. A., Engel, S. G., Mitchell, J. E., Le Grange, D., & Goldschmidt, A. B. (2018). Subtypes of adaptive and maladaptive perfectionism in anorexia nervosa: Associations with eating disorder and affective symptoms. *Journal of Psychopathology and Behavioral Assessment, 40*(4), 691–700. https://doi.org/10.1007/s10862-018-9672-8

Herle, M., Stavola, B. D., Hübel, C., Abdulkadir, M., Ferreira, D. S., Loos, R. J., Bryant-Waugh, R., Bulik, C. M., & Micali, N. (2020). A longitudinal study of eating behaviours in childhood and later eating disorder behaviours and diagnoses. *The British Journal of Psychiatry, 216*(2), 113–119. https://doi.org/10.1192/bjp.2019.174

Hewitt, P. L., & Flett, G. L. (1991). Perfectionism in the self and social contexts: Conceptualization, assessment, and association with psychopathology. *Journal of Personality and Social Psychology, 60*(3), 456–470. https://doi.org/10.1037/0022-3514.60.3.456

Hewitt, P. L., Caelian, C. F., Flett, G. L., Sherry, S. B., Collins, L., & Flynn, C. A. (2002). Perfectionism in children: Associations with depression, anxiety, and anger. *Personality and Individual Differences, 32*(6), 1049–1061. https://doi.org/10.1016/s0191-8869(01)00109-x

Hewitt, P. L., Flett, G. L., & Ediger, E. (1995). Perfectionism traits and perfectionistic self-presentation in eating disorder attitudes, characteristics, and symptoms. *International Journal of Eating Disorders, 18*(4), 317–326. https://doi.org/10.1002/1098-108x(199512)18:4<317::aid-eat2260180404>3.0.co;2-2

IBM. (2020). IBM Statistics for MacBook (Version 27.0) [Computer software]. IBM. https://www.ibm.com/support/pages/downloading-ibm-spss-statistics-27010

Jankauskiene, R., & Baceviciene, M. (2022). Media pressures, internalization of appearance ideals and disordered eating among adolescent girls and boys: Testing the moderating role of body appreciation. *Nutrients, 14*(11). https://doi.org/10.3390/nu14112227

Jansen, A. (2016). Eating disorders need more experimental psychopathology. *Behaviour Research and Therapy, 86*, 2–10. https://doi.org/10.1016/j.brat.2016.08.004

Johnston, J., Shu, C. Y., Hoiles, K. J., Clarke, P. J. F., Watson, H. J., Dunlop, P. D., & Egan, S. J. (2018). Perfectionism is associated with higher eating disorder symptoms and lower remission in children and adolescents diagnosed with eating disorders. *Eating Behaviors, 30*, 55–60. https://doi.org/10.1016/j.eatbeh.2018.05.008

Juarascio, A. S., Felton, J. W., Borges, A. M., Manasse, S. M., Murray, H. B., & Lejuez, C. W. (2016). An investigation of negative affect, reactivity, and distress tolerance as predictors of disordered eating attitudes across adolescence. *Journal of Adolescence, 49*(1), 91–98. https://doi.org/10.1016/j.adolescence.2016.02.005

Kirschbaum, C., Pirke, K.-M., & Hellhammer, D. H. (1993). The 'Trier Social Stress Test' – a tool for investigating psychobiological stress responses in a laboratory setting. *Neuropsychobiology, 28*(1-2), 76–81. https://doi.org/10.1159/000119004

Kotler, L. A., Cohen, P., Davies, M., Pine, D. S., & Walsh, B. T. (2001). Longitudinal relationships between childhood, adolescent, and adult eating disorders. *Journal of the American Academy of Child & Adolescent Psychiatry, 40*(12), 1434–1440. https://doi.org/10.1097/00004583-200112000-00014

Levine, M. P., & Murnen, S. K. (2009). "Everybody knows that mass media are/are not [pick one] a cause of eating disorders": A critical review of evidence for a causal link between media, negative body image, and disordered eating in females. *Journal of Social and Clinical Psychology, 28*(1), 9–42. https://doi.org/10.1521/jscp.2009.28.1.9

Levinson, C. A., Cusack, C., Brown, M. L., & Smith, A. R. (2022). A network approach can improve eating disorder conceptualization and treatment. *Nature Reviews Psychology, 1*(7), 419–430. https://doi.org/10.1038/s44159-022-00062-y

Lieberman, M., Gauvin, L., Bukowski, W. M., & White, D. R. (2001). Interpersonal influence and disordered eating behaviors in adolescent girls. *Eating Behaviors, 2*(3), 215–236. https://doi.org/10.1016/s1471-0153(01)00030-7

Lilenfeld, L. R. R., Wonderlich, S., Riso, L. P., Crosby, R., & Mitchell, J. (2006). Eating disorders and personality: A methodological and Empirical Review. *Clinical Psychology Review, 26*(3), 299–320. https://doi.org/10.1016/j.cpr.2005.10.003

Lozano, L. M., Valor-Segura, I., & Lozano, L. (2015). Could a perfectionism context produce unhappy children? *Personality and Individual Differences, 80*, 12–17. https://doi.org/10.1016/j.paid.2015.01.022

Malivoire, B. L., Kuo, J. R., & Antony, M. M. (2019). An examination of emotion dysregulation in maladaptive perfectionism. *Clinical Psychology Review, 71*, 39–50. https://doi.org/10.1016/j.cpr.2019.04.006

Maloney, M. J., McGuire, J., Daniels, S. R., & Specker, B. (1989). Dieting behavior and eating attitudes in children. *Pediatrics, 84*(3), 482–489. https://doi.org/10.1542/peds.84.3.482

Messerli-Bürgy, N., Stülb, K., Kakebeeke, T. H., Arhab, A., Zysset, A. E., Leeger-Aschmann, C. S., Schmutz, E. A., Meyer, A. H., Ehlert, U., Garcia-Burgos, D., Kriemler, S., Jenni, O. G., Puder, J. J., & Munsch, S. (2018). Emotional eating is related with temperament but not with stress biomarkers in preschool children. *Appetite, 120*, 256–264. https://doi.org/10.1016/j.appet.2017.08.032

Monteleone, A. M., Ruzzi, V., Patriciello, G., Cascino, G., Pellegrino, F., Vece, A., Monteleone, P., & Maj, M. (2020). Emotional reactivity and eating disorder related attitudes in response to the Trier Social Stress test: An experimental study in people with anorexia nervosa and with bulimia nervosa. *Journal of Affective Disorders, 274*, 23–30. https://doi.org/10.1016/j.jad.2020.05.051

Murray, S. B., Blashill, A. J., & Calzo, J. P. (2022). Prevalence of disordered eating and associations with sex, pubertal maturation, and weight in children in the US. *JAMA* Pediatrics, 176(10), 1039. https://doi.org/10.1001/jamapediatrics.2022.2490

National Institute for Health and Care Excellence. (2024, July). Eating Disorders: How common is it?. https://cks.nice.org.uk/topics/eating-disorders/background-information/prevalence/

Nock, M. K., Wedig, M. M., Holmberg, E. B., & Hooley, J. M. (2008). The emotion reactivity scale: Development, evaluation, and relation to self-injurious thoughts and behaviors. Behavior Therapy, 39(2), 107–116. https://doi.org/10.1016/j.beth.2007.05.005

Oros, L. B., Iuorno, O., & Serppe, M. (2017). Child perfectionism and its relationship with personality, excessive parental demands, depressive symptoms and experience of positive emotions. The Spanish Journal of Psychology, 20. https://doi.org/10.1017/sjp.2017.9

Ortiz, S., Knauft, K., Smith, A., & Kalia, V. (2019). Expressive suppression mediates the relation between disordered eating and suicidal ideation. Journal of Clinical Psychology, 75(10), 1943–1958. https://doi.org/10.1002/jclp.22830

Pennesi, J.-L., & Wade, T. D. (2016). A systematic review of the existing models of disordered eating: Do they inform the development of effective interventions? Clinical Psychology Review, 43, 175–192. https://doi.org/10.1016/j.cpr.2015.12.004

Pursey, K. M., Burrows, T. L., Barker, D., Hart, M., & Paxton, S. J. (2021). Disordered eating, body image concerns, and weight control behaviors in primary school aged children: A systematic review and metaanalysis of Universal–Selective Prevention Interventions. International Journal of Eating Disorders, 54(10), 1730–1765. https://doi.org/10.1002/eat.23571

Rapee, R. M., Oar, E. L., Johnco, C. J., Forbes, M. K., Fardouly, J., Magson, N. R., & Richardson, C. E. (2019). Adolescent development and risk for the onset of social-emotional disorders: A review and conceptual model. Behaviour Research and Therapy, 123. https://doi.org/10.1016/j.brat.2019.103501

Rosewall, J. K., Gleaves, D. H., & Latner, J. D. (2019). Moderators of the relationship between body dissatisfaction and eating pathology in preadolescent girls. The Journal of Early Adolescence, 40(3), 328–353. https://doi.org/10.1177/0272431619837385

Santomauro, D. F., Melen, S., Mitchison, D., Vos, T., Whiteford, H., & Ferrari, A. J. (2021). The hidden burden of eating disorders: An extension of estimates from the global burden of disease study 2019. The Lancet Psychiatry, 8(4), 320–328. https://doi.org/10.1016/s2215-0366(21)00040-7

Schaefer, L. M., Harriger, J. A., Heinberg, L. J., Soderberg, T., & Kevin Thompson, J. (2016). Development and validation of the sociocultural attitudes towards appearance questionnaire-4-revised (SATAQ-4R). International Journal of Eating Disorders, 50(2), 104–117. https://doi.org/10.1002/eat.22590

Shafran, R., Lee, M., Payne, E., & Fairburn, C. G. (2006). The impact of manipulating personal standards on eating attitudes and behaviour. Behaviour Research and Therapy, 44(6), 897–906. https://doi.org/10.1016/j.brat.2005.08.009

Shapiro, S., Newcomb, M., & Burns Loeb, T. (1997). Fear of fat, disregulated-restrained eating, and body-esteem: Prevalence and gender differences among eight- to ten-year-old children. Journal of Clinical Child Psychology, 26(4), 358–365. https://doi.org/10.1207/s15374424jccp2604_4

Sherry, S. B., Hewitt, P. L., Besser, A., McGee, B. J., & Flett, G. L. (2003). Self-oriented and socially prescribed perfectionism in the eating disorder inventory perfectionism subscale. International Journal of Eating Disorders, 35(1), 69–79. https://doi.org/10.1002/eat.10237

Smolak, L., & Levine, M. P. (1994). Psychometric Properties of the Children's Eating Attitudes Test. International Journal of Eating Disorders, 16(3), 275–282. https://doi.org/10.1002/1098-108x(199411)16:3<275::aid-eat2260160308>3.0.co;2-u

Smolak, L., & Levine, M. P. (2015). Body Image, Disordered Eating, and Eating Disorders. In The Wiley Handbook of Eating Disorders, Assessment, Prevention, Treatment, Policy, and Future Directions (pp. 4–10). John Wiley & Sons, Ltd.

Soares, M. J., Macedo, A., Bos, S. C., Marques, M., Maia, B., Pereira, A. T., Gomes, A., Valente, J., Pato, M., & Azevedo, M. H. (2009). Perfectionism and eating attitudes in Portuguese students: A longitudinal study. European Eating Disorders Review, 17(5), 390–398. https://doi.org/10.1002/erv.926

Stice, E. (2002). Risk and maintenance factors for eating pathology: A meta-analytic review. Psychological Bulletin, 128(5), 825–848. https://doi.org/10.1037/0033-2909.128.5.825

Thomas, K. S. (2022). The role of cognitive control in the co-occurrence of disordered eating and internalizing symptoms in preadolescence [Unpublished doctoral thesis]. Cardiff University.

Thomas, K. S., Williams, M. O., & Vanderwert, R. E. (2021). Disordered eating and internalizing symptoms in preadolescence. Brain and Behaviour, 11(1). https://doi.org/10.1002/brb3.1904

Wade, T. D., O'Shea, A., & Shafran, R. (2016). Perfectionism and Eating Disorders. In F. M., Sirois & D. S., Molnar (Eds.), Perfectionism, Health, and Well-Being (pp. 205–222). Springer.

Warren, C. S., Gleaves, D. H., Cepeda-Benito, A., Fernandez, M. del, & Rodriguez-Ruiz, S. (2005). Ethnicity as a protective factor against internalization of a thin ideal and body dissatisfaction. International Journal of Eating Disorders, 37(3), 241–249. https://doi.org/10.1002/eat.20102

Zhang, H., Chen, X., Chen, S., Li, Y., Chen, C., Long, Q., & Yuan, J. (2018). Facial expression enhances emotion perception compared to vocal prosody: Behavioral and Fmri Studies. Neuroscience Bulletin, 34(5), 801–815. https://doi.org/10.1007/s12264-018-0231-9

CAMBRIDGE JOURNAL OF HUMAN BEHAVIOUR

PSYCHOLOGY

The Role of Mental Imagery in Rumination and Depressive Symptoms

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Mental imagery refers to quasi-perceptual internal representations, which are experienced in the absence of corresponding external stimuli. Despite its central function across a range of cognitive processes, recent research has highlighted the role of visual and auditory mental imagery in ruminations, which are typically maladaptive thoughts that have been shown to perpetuate depressive symptoms. Some individuals are unable to experience visual or auditory mental imagery, due to conditions named aphantasia and anauralia, respectively. The current study is the first to assess whether rumination mediates the relationship between mental imagery capabilities and depressive symptoms, in a targeted sample including individuals who do not experience mental imagery. One hundred thirty-two participants, comprising a sample of self-diagnosed aphantasic individuals and students from the University of Sheffield, were recruited in the current study. In an online experiment, participants completed a modified IRQ as well as the RRS and BDI-II, measuring their visual and auditory mental imagery capabilities, ruminative thought, and depressive symptoms, respectively. A mediation regression analysis was used to investigate whether rumination mediated an association between mental imagery capabilities and depressive symptoms. The results revealed a significant indirect effect of combined visual and auditory mental imagery capabilities on depressive symptoms through rumination, with reduced mental imagery capabilities associated with lower levels of rumination which, in turn, were associated with lower depressive symptoms; however, the total and direct effects of mental imagery on depression were non-significant, thereby indicating an inconsistent mediation. These findings progress the understanding of the role of mental imagery in rumination and psychopathology.

INTRODUCTION

Mental imagery (MI) is a high-level cognitive function that has been important in theories of mental function since at least Plato (Galton, 1880). MI is theorised to be a quasi-perceptual experience without a corresponding external stimulus (Kosslyn, 1980, 1994) that can be experienced across different modalities, including visual, auditory, olfactory, gustatory, tactile, and movement (Arcangeli, 2023; Baddeley & Logie, 1992; Floridou et al., 2021). For the purpose of this paper, the authors will focus solely on visual and auditory MI.

The Mechanism Underlying Mental Imagery

It is believed that MI is generated in sensory regions of the brain (for a review, see Kosslyn et al., 2001), and therefore "functions like a weak form of perception" (Pearson et al., 2015, p. 590). In the case of visual MI, top-down signals from the prefrontal cortex activate neurons in early visual areas in the ventral stream (Dentico et al., 2014; Ganis & Schendan, 2008; Koenig-Robert & Pearson, 2020), thereby resulting in a perception-like experience. Auditory MI is believed to be generated by overlapping neural mechanisms that generate overt speech that is audible to others (Jack et al., 2019; Whitford et al., 2017), with neuroimaging research highlighting associated activity in the auditory regions (Yao, 2021), and more vivid inner speech resulting in higher auditory cortex activation (Yao & Scheepers, 2011).

The Role Of Mental Imagery In Cognitive Processes, Emotions, And Psychopathology

MI has received considerable interest in research due to its role in a variety of cognitive functions (Pearson et al., 2008), such as self-regulation (Tullett & Inzlicht, 2010), working memory (Baddeley & Logie, 1992), problem-solving (Baldo et al., 2010), and reading (Alexander & Nygaard, 2008; Yao, 2021). According to Holmes and Mathews (2010) and Lang (1979), MI also influences emotions through sensory-sensitive emotional systems. Importantly, it has also been argued that altered or maladaptive MI, such as involuntary flashbacks, is experienced in those

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with psychopathological conditions (Cavedon-Taylor, 2022; Weßlau & Steil, 2014), including post-traumatic stress disorder (PTSD; American Psychiatric Association, 2013), schizophrenia (McGuire et al., 1996), anxiety disorders, and depression (Holmes et al., 2016).

THE SPECTRUM OF VISUAL AND AUDITORY MENTAL IMAGERY

The experience of MI is highly variable (Milton et al., 2021), as visual MI vividness is experienced on a spectrum, ranging from severely reduced, or completely absent (Hinwar & Lambert, 2021; Zeman et al., 2015), to photo-like strength (Pearson, 2019; Zeman et al., 2020). Coined by Zeman et al. (2015), the term "aphantasia" (p. 2) refers to the spectrum condition of reduced, or absent, voluntary visual MI. While recent research has identified that those with aphantasia experience reduced MI in other sensory modalities (Hinwar & Lambert, 2021; Dawes et al., 2020), the current paper defines aphantasia as weakened or absent visual MI, in line with the majority of related research (e.g. Keogh & Pearson, 2018; Zeman et al., 2015). This condition is a very poorly understood phenomenon (Takahashi & Gyoba, 2021), which has an estimated prevalence rate of 2–5% in the general population (Faw, 2009), and is believed to be driven by the inability to produce visual MI, rather than by impoverished metacognitive awareness or introspective capabilities (Keogh & Pearson, 2018). More recently, a lack of auditory MI, termed anauralia, has been identified in individuals, with a reportedly very high co-occurrence rate between aphantasia and anauralia (Hinwar & Lambert, 2021). Consistent with aphantasia, auditory imagery in anauralia, including the capacity to consciously experience an "inner voice", ranges from weakened to completely absent (Hinwar & Lambert, 2021). Research so far has primarily focused on aphantasia over anauralia (e.g., Keogh & Pearson, 2018), whereby the comparison of aphantasic individuals to those with typical MI has revealed functional differences in memory (Bainbridge et al., 2021; Jacobs et al., 2018), and face recognition (Milton et al., 2021).

The Role of Mental Imagery in Rumination

MI can evoke strong emotional responses (Holmes & Mathews, 2010), and is a hallmark in many psychopathological conditions (Cavedon-Taylor, 2022; Weßlau & Steil, 2014), such as post-traumatic stress disorder (PTSD; American Psychiatric Association, 2013), anxiety disorders, and depression (Holmes et al., 2016). One maladaptive response style often experienced after distress, seen in many psychopathological conditions, is rumination (Nolen-Hoeksema, 1998, 2000). It reportedly holds primarily verbal features (Fresco et al., 2002; Moffatt et al., 2020; Nolen-Hoeksema, 1998) but can hold visual features as well (Moritz et al., 2013; Patel et al., 2007). Rumination is defined as the frequent and repeated activation of negatively valenced cognitive representations, whereby negative information processing biases and executive control deficits contribute to an increased tendency to ruminate (Watkins & Roberts, 2020). Cognitive representations associated with rumination are characterised by increased negativity and self-criticism, reduced optimism and self-confidence (Lyubomirsky et al., 1999), and increased negative future thinking (Lavender & Watkins, 2004), amongst others (Lyubomirsky et al., 1998). Importantly, these cognitive representations can occur as visual images (Lawrence et al., 2018; McLaughlin et al., 2007; Newby & Moulds, 2011b) and verbal thoughts (Calvete et al., 2005; Fresco et al., 2002; Moffatt et al., 2020; Nolen-Hoeksema, 1998). While the majority of research in this area has been on auditory-verbal-based cognitions, visual ruminations are reportedly common, with over half of a sample of 127 participants reporting to experience either visual, or visual and verbal cognitive representations when ruminating (Lawrence et al., 2018).

The Role Of Rumination And Mental Imagery In Depression

Major Depressive Disorder is one of the most common mental disorders worldwide with a 15–18% lifetime risk (Kessler et al., 2003; Malhi & Mann, 2018; Steffen et al., 2020). The role of rumination in depression has been widely studied, and it has been shown to predict the onset of, exacerbate, and prolong depressive symptoms (Ehring, 2021; Nolen-Hoeksema, 1991, 2004; Watkins & Roberts, 2020); recent research has therefore

Malhi & Mann, 2018; Steffen et al., 2020). The role of rumination in depression has been widely studied, and it has been shown to predict the onset of, exacerbate, and prolong depressive symptoms (Ehring, 2021; Nolen-Hoeksema, 1991, 2004; Watkins & Roberts, 2020); recent research has therefore focused on reducing depressive symptoms through interventions aimed at reducing rumination (Li et al., 2022).

MI appears to play an important role in depression, as 27–42% of depressed individuals report the presence of visual MI in depressive cognitions (Lawrence et al., 2018; Moritz et al., 2013; Patel et al., 2007) and 87–96% report visual MI in flashbacks to negative and 87–96% report visual MI in flashbacks to negative life events (Brewin et al., 1996; Newby & Moulds, 2011a). It is thought that imagery significantly impacts emotion because (1) it directly influences emotional systems that are responsive to sensory inputs (Holmes & Mathews, 2010; Lang, 1979), (2) the processes underlying MI and perception overlap, resulting in a response consistent with that induced by real emotionally-arousing events (Baddeley & Andrade, 2000; Holmes & Mathews, 2010; Segal & Fusella, 1969), and (3) imagery has the capacity to activate memories of past emotional episodes (Conway, 2001; Holmes & Mathews, 2010). Supporting the notion that MI has significant clinical implications, Moritz et al. (2013) found participants with sensory-rich depressive thoughts had more severe depressive symptomatology, increased numbers of depressive episodes and were more frequently hospitalised than those without sensory-rich depressive thoughts. Thus, the existing body of research suggests MI plays a notable role in psychopathological conditions.

The evidence base contrasting the role of visual- and verbal-imagery-based ruminations in depressive cognitions is currently mixed, with research highlighting a stronger association between rumination and depressive symptoms for visual-image-based ruminations, as opposed to verbal-thought-based ruminations (Lawrence et al., 2018; Lawrence et al., 2022); however, other research has highlighted more abstract-level ruminations in depressed individuals (Cribb et al., 2006; Watkins & Moulds, 2007), and verbal-based rumination, which occurs at this abstract level, can be more difficult to resolve through problem solving and self-regulation, as opposed to more concrete visual-based rumination (Stöber, 1998; Watkins, 2008).

GAPS IN THE LITERATURE AND THE CURRENT STUDY

As verbal thought and visual imagery are argued to play important roles in rumination (Fresco et al., 2002; Moritz et al., 2013), the current paper aimed to investigate whether rumination mediates a relationship between MI and depressive symptoms, in a sample made up of aphantasic and non-aphantasic individuals. To the best of the author's knowledge, this forms the first research assessing the role of rumination in depressive symptoms in an aphantasic sample. As aphantasia and anauralia have only recently emerged in the literature (e.g., Arcangeli, 2023; Dance et al., 2022), it is currently unknown whether this lack of inner imagery can impact depressive symptoms. If MI plays a significant role in rumination (Fresco et al., 2002; Patel et al., 2007) and psychopathology (Lawrence et al., 2018; Moritz et al., 2013), then it might be expected that those who lack this MI would be less susceptible to rumination, thereby acting as a protective factor to depressive symptoms; however, it must be noted that self-report data from Newby and Moulds (2011a) revealed some individuals experience rumination simply as a "feeling" (p. 237), rather than through MI. As there is evidence that individuals with aphantasia employ cognitive strategies to compensate, at least partially, for a lack of MI (Jacobs et al., 2018), it may be possible that this "feeling" form of rumination counteracts any impairments in visual- and auditory-based rumination.It was hypothesised that rumination would mediate the relationship between MI and depressive symptoms, with reduced MI predicting lower depressive symptoms.

METHODS

Participants

132 adult participants (44 male, 84 female, 3 prefer not to say and 1 other, mean age = 29 years, SD = 16.52, age range = 18–78) were recruited

through opportunity sampling and took part in the study. In order to collect a participant sample with a range of visual and auditory MI capabilities, participants were recruited through two different sources: (1) Self-identified aphantasic participants were voluntarily recruited via the online forum Reddit (https://www.reddit.com/r/aphantasia; see **Appendix A**). Those with aphantasia were targeted during the recruitment stage because of the very high co-occurrence rate between aphantasia and anauralia (Hinwar & Lambert, 2021), and because aphantasia is more widely discussed in the media (and thus more widely recognised) than anauralia. (2) Undergraduate students from the University of Sheffield were voluntarily recruited via SONA, an online system used at the University of Sheffield in the Department of Psychology. It was deemed appropriate to use non-aphantasic and aphantasic participants given that MI capabilities and experiences vary across non-clinical samples (Floridou et al., 2021; Gulyás et al., 2022; Isaac & Marks, 1994; Talamini et al., 2023). While recruitment methods were designed to attract individuals with aphantasia, using a forum of self-identified aphantasics, it was not assumed that any specific groups lacked MI. This approach enabled MI to be measured independently of participants' understanding of aphantasia, using the Internal Representations Questionnaire (IRQ; see Design and Materials). Any participants with a diagnosed reading difficulty were excluded, which was relevant to a separate part of a larger experiment. An informed consent form was given to participants, who were then asked to review it before agreeing to participate.

Design and Materials

The current study used a repeated-measures design to examine the relationship between mental imagery, rumination and depressive symptoms. To assess participants' verbal and visual MI, a modified version of the Internal Representations Questionnaire (IRQ; Roebuck & Lupyan, 2020) was used (see **Appendix D**). The modified IRQ Factors used questions only from the "Visual" and "Verbal" representations subscales, resulting in a 22-item self-report questionnaire. Roebuck and Lupyan (2020) confirmed the measure's good test-retest reliability and high internal validity, hence why this measure was chosen for the current study. Participants responded using a 5-point Likert scale, with the following response options: "Strongly Disagree" (1), "Slightly Disagree" (2), "Neither Agree nor Disagree" (3), "Slightly Agree"(4), "Strongly Agree" (5). Item 20 "I rarely vocalise thoughts in my mind" was reverse scored. The minimum score is 22, maximum is 110, where higher scores indicate a higher frequency of visual and verbal MI.

The Ruminative Responses Scale (RRS; Nolen-Hoeksema & Morrow, 1991) was used to assess the degree to which individuals ruminate (see **Appendix B**). The RRS is a 22-item self-report questionnaire, containing three factors: (1) depression, (2) brooding, and (3) reflection. Participants respond to statements such as "How often do you think about a recent situation, wishing it had gone better" using a 4-point Likert scale with the following response options: Almost Never (1), Sometimes (2), Often (3), Almost Always (4). The minimum score is 22, maximum is 88, where higher scores indicate higher degrees of rumination. It has been shown to have adequate internal consistency and good test-retest stability (Roelofs et al., 2006), and to be a reliable and valid measure of ruminative cognition (Erdur-Baker & Bugay, 2010; Treynor, 2003).

To measure the severity of depressive symptoms the Beck Depression Inventory-II (BDI-II; Beck et al., 1996a) was used (see **Appendix C**), due to its high reliability and validity (Beck et al., 1996b; Kühner et al., 2007; Wang & Gorenstein, 2013). There are 21 groups of statements that participants respond to by selecting which statement (rated 0–3) in the group best describes how they have been feeling for the past two weeks: for example, "Sadness: (0) I do not feel sad. (1) I feel sad much of the time. (2) I am sad all the time. (3) I am so sad or unhappy that I can't stand it." For item 16 (Changes in Sleeping Pattern) and item 18 (Changes in Appetite), seven options are available: 0, 1a, 1b, 2a, 2b, 3a, 3b, to indicate an increase or decrease in behaviour/motivation. The maximum score is 63 which indicates severe depression, with 0–13 indicating minimal depression.

Procedure

The University of Sheffield's Ethics Committee reviewed and approved the materials, procedure and protocol for this research. Participants were provided a link to Gorilla (www.Gorilla.sc), where the experiment was conducted. in the study. Participants responded to the IRQ first to assess their visual and verbal MI. The order in which participants completed the BDI-II and RRS was then randomised. One question per screen was presented to participants, with the different response options presented as buttons below the question text, including a "Skip question" button. Participants indicated their chosen response option by clicking with their mouse, or by tapping their chosen option on the touchscreen of their device. Data was collected by Gorilla and analysed using IBM SPSS Statistics PROCESS macros (Hayes, 2018). Upon fulfilment, all participants were provided with a debrief which provided the main objectives, contact details of the main researchers should they require further information, complaints regarding safeguarding and signposts to support services. While no monetary compensation was offered to participants, credits towards passing an undergraduate module were awarded to University of Sheffield students who participated in the project.

RESULTS

Data Analysis

A mediation regression analysis was performed to assess whether rumination mediated a relationship between MI and depressive symptoms. To prepare the data, participants' raw scores were downloaded from Gorilla to Excel. BDI-II scores from items 16 and 18 were re-coded in accordance with BDI-II's scoring guide. Item 20 from IRQ was reversed for each participant. Modality specific responses (visual and verbal responses) from the IRQ were calculated separately, and then added together to get the combined MI score for each participant. Additionally, total scores for the RRS and BDI-II were calculated for each participant. The means and standard deviations of these scores are presented in **Figure 1**. Data were then analysed using IBM SPSS Statistics PROCESS macros (Hayes, 2018). Inspection of the box and whisker plots revealed there were no outliers in the data. Visual inspection of histograms revealed an approximately normal distribution of data, and scatter plots revealed data met homoscedastic assumptions.

Figure 1

Summary of Descriptive Statistics for visual and auditory subcomponents of the IRQ, the combined IRQ, and the RRS and BDI-II Scores (N = 132)

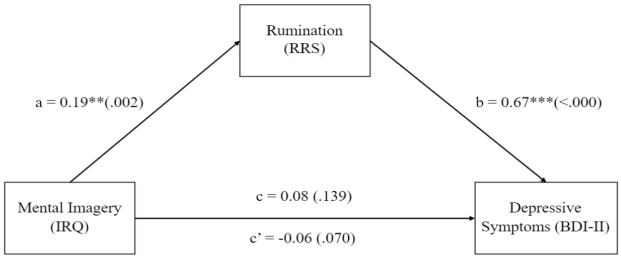
	Mean	SD
IRQ - Visual	28.70	14.31
IRQ - Auditory	38.69	9.51
IRQ - Combined	67.40	19.74
RRS	45.93	14.24

Mediation Analysis

A mediation regression analysis was conducted to test the direct and indirect effects of combined verbal and visual MI (independent variable) on depressive symptoms (dependent variable), via rumination (see Figure 2). The direct effect of combined MI on depressive symptoms (path c') was found to be non-significant, B = -0.06, SE = 0.03, p = .070, 95% CI [-0.12, 0.01]; however, the indirect paths between combined MI and rumination (path a), B = 0.19, SE = 0.06, p = .002, 95% CI [0.07, 0.32], and between rumination and depressive symptoms (path b), B = 0.67, SE = 0.04, p < .001, 95% CI [0.59, 0.75] were both significant (see Figure 1.). Bootstrapping procedures were used to obtain the 95% confidence interval of the indirect effect using 5000 bootstrap samples (Preacher & Hayes, 2008). The total indirect effect was significant, B = 0.13, SE = 0.04, CI = 0.05 to 0.21; however, the total effect (c) was non-significant, B = 0.08, SE = 0.05, p = .14 CI [-0.12, 0.04], indicating an inconsistent mediation model.

Figure 1

Inconsistent Mediation of Rumination (RRS) in the Relationship Between Mental Imagery (IRQ) and Depressive Symptoms (BDI-II)



*Note. Coefficients presented are standardised mediation regression coefficients. ** p < 0.01. *** p < .001*

To assess the influence of visual and verbal subcomponents of MI, separate mediation analyses were conducted for each element on depressive symptoms. For visual MI, the direct effect was found to be non-significant, B = -0.07, SE = 0.04, p = .08, 95% CI [-0.15, 0.01]. The indirect paths between visual MI and rumination (path a; B = 0.23, SE = 0.09, p < .01, 95% CI [0.07, 0.40]) and rumination and depressive symptoms (path b; B = 0.66, SE = 0.04, p < .001, 95% CI [0.58, 0.75]) were both significant, consistent with the combined measure; however, bootstrapping procedures showed the total indirect effect observed for the combined measure was non-significant for visual imagery only, (B = 0.15, SE = 0.06, CI = 0.05 to 0.26) and the total effect (c) was also non-significant (B = 0.08, SE = 0.07, CI = 0.05 to 0.02). A similar pattern of findings was observed for the mediation performed for verbal MI (path a - B = 0.31, SE = 0.13, p < .01, 95% CI [0.05, 0.56], path b - B = 0.66, SE = 0.04, p < .001, 95% CI [0.58, 0.75], direct effect c' - B = -0.09, SE = 0.06, p = .13, 95% CI [-0.21, 0.03], total effect (c) B = 0.11, SE = 0.07, CI = -0.09 to 0.32, total indirect effect, B = 0.21, SE = 0.08, CI = 0.04 to 0.36). In summary, the indirect paths between MI, rumination and depressive symptoms are robust for individual subscales of MI, however, the total indirect effect is only present for a combined score of internal visual and verbal imagery.

DISCUSSION

The current study aimed to investigate the mediational effect of rumination on the relationship between MI and depressive symptoms. While the results showed no significant direct effect of combined MI on depressive symptoms, the total indirect effect was significant. When the visual MI and auditory MI scores were entered into the mediation model separately, the indirect paths between MI (visual or auditory) and rumination, and between rumination and depressive symptoms, were significant, though the total indirect effect, and the total effect were non-significant. It can therefore be concluded from the current study that greater combined MI capabilities predict higher levels of rumination, and that higher levels of rumination predict higher depressive symptoms. As the total indirect effect of the combined MI mediation was significant, but the total effect was non-significant, the hypothesis that rumination will mediate the relationship between MI and depressive symptoms is only partially supported.

The Association Between Mental Imagery, Rumination and Depressive Symptoms

The current findings revealed that auditory, visual and combined MI capabilities were negatively associated with rumination scores, consistent with evidence of the highly sensory nature of ruminative thought (Newby & Moulds, 2011a). Furthermore, the current study also highlighted a significant positive relationship between rumination and depressive symptoms, consistent with past findings (Donaldson & Lam, 2004; Just & Alloy, 1997; Kuehner & Weber, 1999; Nolen-Hoeksema, 1991, 2000). Concerns have been raised regarding the potential item overlap between & Bugay, 2010), though others have argued that item overlap did not contribute to the association between RRS and BDI-II scores in their data (Erdur-Baker & Bugay, 2010; Roberts et al., 1998; Segerstrom et al., 2000; Treynor, 2003).

Our findings revealed a significant indirect effect in the mediation model, only when the visual and verbal MI scores were combined into a single measure. As over 37% of a recent sample reported experiencing a combination of auditory and visual-based rumination (Lawrence et al., 2018), it is likely that this combined measure captures a more comprehensive account of the participants' MI-based cognitive representations (or lack thereof), and therefore explains a greater amount of variance in their ruminations and depressive symptoms. Previous literature has highlighted the critical role that visual, and especially verbal MI, plays in rumination (Fresco et al., 2002; Moffatt et al., 2020; Nolen-Hoeksema, 1998). While recent research has independently analysed the role of visual and auditory MI in rumination and depressive symptoms (Lawrence et al., 2018), the current paper is the first to investigate the role of MI in rumination and depressive symptoms, using a targeted sample of participants with impoverished MI.

Proposed Antithetical Effects of Mental Imagery on Depressive Symptoms

Despite the significant indirect effect, where reduced combined MI capabilities predicted lower levels of rumination which, in turn, predicted lower depressive symptoms, the total effect of combined MI on depressive symptoms was non-significant, indicating an inconsistent mediation model. Since inconsistent mediation models are a result of a direct effect (c') and indirect effect (ab) being of opposite directions (MacKinnon et al., 2000; Shrout & Bolger, 2002), it is possible that a variable not assessed in the current design may have increased depressive symptoms in those with lower combined MI.

For example, auditory- and visual-based cognitive representations have also been shown to have positive impacts on mood and mental health, as positive visual imagery has been shown to induce positive affect (Holmes et al., 2009), whereas training to produce positive visual MI can reduce depressive symptoms (Blackwell et al., 2015). Likewise, MI has been shown to be effective in adapting distressing memories or addressing previous distressing experiences, with clinically significant effects in depressed patients (Brewin et al., 2009; Wheatley et al., 2007). In the current findings, it is possible that those with reduced volitional MI are less likely to ruminate in a negative capacity, but also less likely to engage in positively framed, beneficial MI. Consequently, the non-significant total effect in the mediation model may be due to the exacerbatory role of MI in depressive symptoms negating the hypothesised protective effect. Despite the non-significant total effect, the current findings are useful in expanding our understanding of the role of MI in rumination and depressive symptoms, and in highlighting the need for further research on the clinical implications of impoverished MI (Blackwell, 2019).

Limitations of the Current Study and Future Directions

The understanding of the subjective experience of MI, as well as its underlying cognitive processes, have often been disputed (Brogaard & Gatzia, 2017; Kosslyn, 1980, 1994; Thomas, 1999). For example, there is notable evidence for the existence of unconscious visual imagery (Brogaard & Gatzia, 2017), and it remains unclear whether this can be experienced by those who report not consciously experiencing MI. Furthermore, there is evidence that involuntary intrusive negative images are still experienced by aphantasic individuals (Birrer et al., 2007; Zeman et al., 2015), and it has consequently been argued that aphantasia is primarily an absence of volition to generate MI (Cavedon-Taylor, 2022; Pounder et al., 2022; Zeman et al., 2015). Maintenance factors in psychopathological conditions, such as imagery-based flashbacks/memories, occur without volition and intrusively. These involuntary mechanisms may remain intact in aphantasia and anauralia, and thereby contribute to psychopathological condition susceptibility (Cavedon-Taylor, 2022; Zeman et al., 2015).

anauralia, and thereby contribute to psychopathological condition susceptibility (Cavedon-Taylor, 2022; Zeman et al., 2015). Future research should build on the current findings by differentiating between voluntary and involuntary MI, in order to independently assess their role in depressive symptoms, and to investigate whether a lack of MI disproportionately impacts different psychopathological symptoms.

Operationalising MI as a measurable process is extremely methodologically challenging (Alderson-Day et al., 2018), and some doubt remains as to whether this is even possible (Schwitzgebel, 2008). Despite measures showing high test-retest reliability, like the IRQ measure, it is unknown how accurately participants respond to items that track in-the-moment subjective experience (Roebuck & Lupyan, 2020). There are, however, methodological workarounds to this uncertainty, such as Descriptive Experience Sampling (DES; Hurlburt & Akhter, 2006). Alderson-Day and Fernyhough (2015) reported that participants overestimated internal representations in comparison to DES, due to self-report questionnaires being susceptible to reporting biases, affecting recall, and judgements on the frequency of occurrence. Future research could therefore build on the current study, by introducing multiple experimental techniques such as DES, or by implementing neuroimaging techniques (e.g., Alderson-Day et al., 2016; Kosmyna et al., 2018) or behavioural measures of MI capabilities (e.g., Keogh & Pearson, 2018), as alternative, and perhaps more direct measures of MI.

CONCLUSION

The current study revealed a significant indirect effect between combined MI and depressive symptoms, that was mediated by rumination; however, the total effect of the mediation model was non-significant. While further research is required to tease apart the complex impact which absent MI appears to have on depressive symptoms, the current study was the first to investigate this using a targeted sample of individuals unable to experience MI. Furthermore, it provides tentative support for an increased focus on MI's contribution to the aetiology of depressive symptoms, whereby future research may consider exploring the mechanisms of potential adaptive, as well as maladaptive impacts of absent MI on depressive symptoms.

SUPPLEMENTARY MATERIALS

Appendices

Article references

Alderson-Day, B., & Fernyhough, C. (2015). Relations among questionnaire and experience sampling measures of inner speech: a smartphone app study. Frontiers in Psychology, 6. https://doi.org/10.3389/fpsyg.2015.00517

Alderson-Day, B., Mitrenga, K., Wilkinson, S., McCarthy-Jones, S., & Fernyhough, C. (2018). The varieties of inner speech questionnaire – Revised (VISQ-R): Replicating and refining links between inner speech and psychopathology. Consciousness and Cognition, 65, 48–58. https://doi.org/10.1016/j.concog.2018.07.001

Alderson-Day, B., Weis, S., McCarthy-Jones, S., Moseley, P., Smailes, D., & Fernyhough, C. (2016). The brain's conversation with itself: neural substrates of dialogic inner speech. Social Cognitive and Affective Neuroscience, 11(1), 110–120. https://doi.org/10.1093/scan/nsv094

Alexander, J. D., & Nygaard, L. C. (2008). Reading voices and hearing text: Talker-specific auditory imagery in reading. Journal of Experimental Psychology: Human Perception and Performance, 34(2), 446–459. https://doi.org/10.1037/0096-1523.34.2.446

American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders. Diagnostic and Statistical Manual of Mental Disorders, 5(5). https://doi.org/10.1176/appi.books.9780890425596

Arcangeli, M. (2023). Aphantasia demystified. Synthese, 201(2). https://doi.org/10.1007/s11229-022-04027-9

Baddeley, A. D., & Andrade, J. (2000). Working memory and the vividness of imagery. Journal of Experimental Psychology: General, 129(1), 126–145. https://doi.org/10.1037/0096-3445.129.1.126

Baddeley, A. D., & Logie, R. (1992). Auditory Imagery and Working Memory. Auditory Imagery, 179–197.

Bainbridge, W. A., Pounder, Z., Eardley, A. F., & Baker, C. I. (2021). Quantifying aphantasia through drawing: Those without visual imagery show deficits in object but not spatial memory. Cortex, 135, 159–172. https://doi.org/10.1016/j.cortex.2020.11.014

Baldo, J. V., Bunge, S. A., Wilson, S. M., & Dronkers, N. F. (2010). Is relational reasoning dependent on language? A voxel-based lesion symptom mapping study. Brain and Language, 113(2), 59–64. https://doi.org/10.1016/j.bandl.2010.01.004

Beck, A. T., Steer, R. A., & Brown, G. (1996a). Beck Depression Inventory–II (BDI-II). APA PsycTests. https://doi.org/10.1037/t00742-000

Beck, A. T., Steer, R. A., Ball, R., & Ranieri, W. F. (1996b). Comparison of Beck Depression Inventories-IA and-II in Psychiatric Outpatients. Journal of Personality Assessment, 67(3), 588–597. https://doi.org/10.1207/s15327752jpa6703_13

Birrer, E., Michael, T., & Munsch, S. (2007). Intrusive images in PTSD and in traumatised and non-traumatised depressed patients: A cross-sectional clinical study. Behaviour Research and Therapy, 45(9), 2053–2065. https://doi.org/10.1016/j.brat.2007.03.005

Blackwell, S. E., Browning, M., Mathews, A., Pictet, A., Welch, J., Davies, J., Watson, P., Geddes, J. R., & Holmes, E. A. (2015). Positive Imagery-Based Cognitive Bias Modification as a Web-Based Treatment Tool for Depressed Adults. Clinical Psychological Science, 3(1), 91–111. https://doi.org/10.1177/2167702614560746

Blackwell, S. E. (2019). MI: From basic research to clinical practice. Journal of Psychotherapy Integration, 29(3), 235–247. https://doi.org/10.1037/int0000108

Brewin, C. R., Hunter, E., Carroll, F., & Tata, P. (1996). Intrusive memories in depression: an index of schema activation? Psychological Medicine, 26(6), 1271–1276. https://doi.org/10.1017/s0033291700035996

Brewin, C. R., Wheatley, J., Patel, T., Fearon, P., Hackmann, A., Wells, A., Fisher, P., & Myers, S. (2009). Imagery rescripting as a brief stand-alone treatment for depressed patients with intrusive memories. Behaviour Research and Therapy, 47(7), 569–576. https://doi.org/10.1016/j.brat.2009.03.008

Brogaard, B., & Gatzia, D. E. (2017). Unconscious Imagination and the Mental Imagery Debate. Frontiers in Psychology, 8. https://doi.org/10.3389/fpsyg.2017.00799

Calvete, E., Estévez, A., Landín, C., Martínez, Y., Cardeñoso, O., Villardón, L., & Villa, A. (2005). Self-Talk and Affective Problems in College Students: Valence of Thinking and Cognitive Content Specificity. The Spanish Journal of Psychology, 8(1), 56–67. https://doi.org/10.1017/s1138741600004960

Cavedon-Taylor, D. (2022). Aphantasia and psychological disorder: Current connections, defining the imagery deficit and future directions. Frontiers in Psychology, 13. https://doi.org/10.3389/fpsyg.2022.822989

Conway, M. A. (2001). Sensory–perceptual episodic memory and its context: autobiographical memory. Philosophical Transactions of the Royal Society B, 356(1413), 1375–1384. https://doi.org/10.1098/rstb.2001.0940

Cribb, G., Moulds, M. L., & Carter, S. (2006). Rumination and Experiential Avoidance in Depression. Behaviour Change, 23(3), 165–176. https://doi.org/10.1375/bech.23.3.165

Dance, C. J., Ipser, A., & Simner, J. (2022). The prevalence of aphantasia (imagery weakness) in the general population. Consciousness and Cognition, 97, 103243. https://doi.org/10.1016/j.concog.2021.103243

Dawes, A. J., Keogh, R., Andrillon, T., & Pearson, J. (2020). A cognitive profile of multi-sensory imagery, memoryDawes, A. J., Keogh, R., Andrillon, T., & Pearson, J. (2020). A cognitive profile of multi-sensory imagery, memory and dreaming in aphantasia. Scientific Reports, 10(1). https://doi.org/10.1038/s41598-020-65705-7

Dentico, D., Cheung, P., Chang, J.-Y., Guokas, J. J., Boly, M., Tononi, G., & Van Veen, B. D. (2014). Reversal of cortical information flow during visual imagery as compared to visual perception. NeuroImage, 100, 237–243. https://doi.org/10.1016/j.neuroimage.2014.05.081

Donaldson, C., & Lam, D. (2004). Rumination, mood and social problem-solving in major depression. Psychological medicine, 34(7), 1309–1318. https://doi.org/10.1017/s0033291704001904

Ehring, T. (2021). Thinking too much: rumination and psychopathology. World Psychiatry, 20(3), 441–442. https://doi.org/10.1002/wps.20910

Erdur-Baker, Ö., & Bugay, A. (2010). The short version of ruminative response scale: reliability, validity and its relation to psychological symptoms. Procedia - Social and Behavioral Sciences, 5, 2178–2181. https://doi.org/10.1016/j.sbspro.2010.07.433

Faw, B. (2009). Conflicting intuitions may be based on differing abilities: Evidence from mental imaging research. Journal of Consciousness Studies, 16(4), 45-68.

Floridou, G. A., Peerdeman, K. J., & Schaefer, R. S. (2021). Individual differences in mental imagery in different modalities and levels of intentionality. Memory & Cognition, 50(1), 29–44. https://doi.org/10.3758/s13421-021-01209-7

Fresco, D. M., Frankel, A. N., Mennin, D. S., Turk, C. L., & Heimberg, R. G. (2002). Distinct and overlapping features of rumination and worry: The relationship of cognitive production to negative affective states. Cognitive Therapy and Research, 26, 179-18.

Galton, F. (1880). Statistics of Mental Imagery. Mind, 5(19), 301–318. http://www.jstor.org/stable/2246391

Ganis, G., & Schendan, H. E. (2008). Visual mental imagery and perception produce opposite adaptation effects on early brain potentials. NeuroImage, 42(4), 1714–1727. https://doi.org/10.1016/j.neuroimage.2008.07.004

Gulyás, E., Gombos, F., Sütöri, S., Lovas, A., Ziman, G., & Kovács, I. (2022). Visual imagery vividness declines across the lifespan. Cortex, 154, 365–374. https://doi.org/10.1016/j.cortex.2022.06.011

Hayes, A.F. (2018). Mediation, moderation and conditional process analysis : a regression-based approach. New York: The Guilford Press.

Hinwar, R. P., & Lambert, A. J. (2021). Anauralia: The Silent Mind and Its Association With Aphantasia. Frontiers in Psychology, 12. https://doi.org/10.3389/fpsyg.2021.744213

Holmes, E. A., Blackwell, S. E., Burnett Heyes, S., Renner, F., & Raes, F. (2016). Mental Imagery in Depression: Phenomenology, Potential Mechanisms, and Treatment Implications. Annual Review of Clinical Psychology, 12(1), 249–280. https://doi.org/10.1146/annurev-clinpsy-021815-092925

Holmes, E. A., Lang, T. J., & Shah, D. M. (2009). Developing interpretation bias modification as a "cognitive vaccine" for depressed mood: imagining positive events makes you feel better than thinking about them verbally. Journal of abnormal psychology, 118(1), 76–88. https://doi.org/10.1037/a0012590

Holmes, E. A., & Mathews, A. (2010). Mental imagery in emotion and emotional disorders. Clinical Psychology Review, 30(3), 349–362. https://doi.org/10.1016/j.cpr.2010.01.001

Hurlburt, R. T., & Akhter, S. A. (2006). The Descriptive Experience Sampling method. Phenomenology and the Cognitive

Sciences, 5(3-4), 271–301. https://doi.org/10.1007/s11097-006-9024-0

Isaac, A. R., & Marks, D. F. (1994). Individual differences in mental imagery experience: Developmental changes and specialization. British Journal of Psychology, 85(4), 479–500. https://doi.org/10.1111/j.2044-8295.1994.tb02536.x

Jack, B. N., Le, M. E., Han, N., Harris, A., Spencer, K., & Whitford, T. J. (2019). Inner speech is accompanied by a temporally-precise and content-specific corollary discharge. NeuroImage, 198, 170–180. https://doi.org/10.1016/j.neuroimage.2019.04.038

Jacobs, C., Schwarzkopf, D. S., & Silvanto, J. (2018). Visual working memory performance in aphantasia. Cortex, 105, 61–73. https://doi.org/10.1016/j.cortex.2017.10.014

Just, N., & Alloy, L. B. (1997). The response styles theory of depression: Tests and an extension of the theory. Journal of Abnormal Psychology, 106(2), 221–229. https://doi.org/10.1037/0021-843x.106.2.221

Keogh, R., & Pearson, J. (2018). The blind mind: No sensory visual imagery in aphantasia. Cortex, 105, 53–60. https://doi.org/10.1016/j.cortex.2017.10.012

Kessler, R. C., Berglund, P., Demler, O., Jin, R., Koretz, D., Merikangas, K. R., Rush, A. J., Walters, E. E., & Wang, P. S. (2003). The Epidemiology of Major Depressive Disorder. JAMA, 289(23), 3095. https://doi.org/10.1001/jama.289.23.3095

KoenigRobert, R., & Pearson, J. (2020). Why do imagery and perception look and feel so different? Philosophical Transactions of the Royal Society B, 376(1817), 20190703–20190703. https://doi.org/10.1098/rstb.2019.0703

Kosmyna, N., Lindgren, J. T., & Lécuyer, A. (2018). Attending to Visual Stimuli versus Performing Visual Imagery as a Control Strategy for EEG-based Brain-Computer Interfaces. Scientific Reports, 8(1). https://doi.org/10.1038/s41598-018-31472-9

Kosslyn, S. M., Ganis, G., & Thompson, W. L. (2001). Neural foundations of imagery. Nature Reviews Neuroscience, 2(9), 635–642. https://doi.org/10.1038/35090055

Kosslyn, S. M. (1980). Image and mind. Harvard University Press.

Kosslyn, S. M. (1994). Image and brain: The resolution of the imagery debate. Nature, 372(6503), 289-289.

Kuehner, C., & Weber, I. (1999). Responses to depression in unipolar depressed patients: an investigation of Nolen-Hoeksema's response styles theory. Psychological Medicine, 29(6), 1323–1333. https://doi.org/10.1017/s0033291799001282

Kühner, C., Bürger, C., Keller, F., & Hautzinger, M. (2007). Reliabilität und Validität des revidierten Beck-Depressionsinventars (BDI-II): Befunde aus deutschsprachigen Stichproben. Der Nervenarzt, 78(6), 651-656. https://doi.org/10.1007/s00115-006-2098-7

Lang, P. J. (1979). A Bio-Informational Theory of Emotional Imagery. Psychophysiology, 16(6), 495–512. https://doi.org/10.1111/j.1469-8986.1979.tb01511.x

Lavender, A., & Watkins, E. (2004). Rumination and future thinking in depression. British Journal of Clinical Psychology, 43(2), 129–142. https://doi.org/10.1348/014466504323088015

Lawrence, H. R., Haigh, E. A. P., Siegle, G. J., & Schwartz-Mette, R. A. (2018). Visual and Verbal Depressive Cognition: Implications for the Rumination–Depression Relationship. Cognitive Therapy and Research, 42(4), 421–435. https://doi.org/10.1007/s10608-018-9890-0

Lawrence, H. R., Siegle, G. J., & Schwartz-Mette, R. A. (2022). Imagery- and Verbally-Based Brooding Rumination in Adolescence: Differential Associations with Depressive Symptoms. Adolescent Psychiatry, 12(2), 115–123. https://doi.org/10.2174/2210676612666220415121824

Li, P., Mao, L., Hu, M., Lu, Z., Yuan, X., Zhang, Y., & Hu, Z. (2022). Mindfulness on Rumination in Patients with Depressive Disorder: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. International journal of environmental research and public health, 19(23), 16101. https://doi.org/10.3390/ijerph192316101

Lyubomirsky, S., Caldwell, N. D., & Nolen-Hoeksema, S. (1998). Effects of ruminative and distracting responses to depressed mood on retrieval of autobiographical memories. Journal of Personality and Social Psychology, 75(1), 166–177. https://doi.org/10.1037/0022-3514.75.1.166

Lyubomirsky, S., Tucker, K. L., Caldwell, N. D., & Berg, K. (1999). Why ruminators are poor problem solvers: Clues from the phenomenology of dysphoric rumination. Journal of Personality and Social Psychology, 77(5), 1041–1060. https://doi.org/10.1037/0022-3514.77.5.1041

MacKinnon, D. P., Krull, J. L., & Lockwood, C. M. (2000). Equivalence of the mediation, confounding and suppression effect. Prevention Science, 1(4), 173–181. https://doi.org/10.1023/a:1026595011371

Malhi, G. S., & Mann, J. J. (2018). Depression. The Lancet, 392(10161), 2299–2312. https://doi.org/10.1016/s0140-6736(18)31948-2

McGuire, P. K., Silbersweig, D. A., Wright, I., Murray, R. M., Frackowiak, R. S., & Frith, C. D. (1996). The neural correlates of inner speech and auditory verbal imagery in schizophrenia: relationship to auditory verbal hallucinations. The British Journal of Psychiatry, 169(2), 148–159. https://doi.org/10.1192/bjp.169.2.148

McLaughlin, K. A., Borkovec, T. D., & Sibrava, N. J. (2007). The Effects of Worry and Rumination on Affect States and Cognitive Activity. Behavior Therapy, 38(1), 23–38. https://doi.org/10.1016/j.beth.2006.03.003

Milton, F., Fulford, J., Dance, C., Gaddum, J., Heuerman-Williamson, B., Jones, K., Knight, K. F., MacKisack, M., Winlove, C., & Zeman, A. (2021). Behavioral and Neural Signatures of Visual Imagery Vividness Extremes: Aphantasia versus Hyperphantasia. Cerebral cortex communications, 2(2), tgab035. https://doi.org/10.1093/texcom/tgab035

Moffatt, J., Mitrenga, K. J., Alderson-Day, B., Moseley, P., & Fernyhough, C. (2020). Inner experience differs in rumination and distraction without a change in electromyographical correlates of inner speech. PLoS ONE, 15(9). https://doi.org/10.1371/journal.pone.0238920

Moritz, S., Hörmann, C. C., Schröder, J., Berger, T., Jacob, G. A., Meyer, B., Holmes, E. A., Späth, C., Hautzinger, M., Lutz, W., Rose, M., & Klein, J. P. (2013). Beyond words: Sensory properties of depressive thoughts. Cognition and Emotion, 28(6), 1047–1056. https://doi.org/10.1080/02699931.2013.868342

Newby, J. M., & Moulds, M. L. (2011a). Characteristics of intrusive memories in a community sample of depressed, recovered depressed and never-depressed individuals. Behaviour Research and Therapy, 49(4), 234–243. https://doi.org/10.1016/j.brat.2011.01.003

Newby, J. M., & Moulds, M. L. (2011b). A comparison of the content, themes, and features of intrusive memories and rumination in major depressive disorder. British Journal of Clinical Psychology, 51(2), 197–205. https://doi.org/10.1111/j.2044-8260.2011.02020.x

Nolen-Hoeksema, S., & Morrow, J. (1991). A prospective study of depression and posttraumatic stress symptoms after a natural disaster: The 1989 Loma Prieta earthquake. Journal of Personality and Social Psychology, 61, 115–121. https://doi.org/10.1037/0022-3514.61.1.115.

Nolen-Hoeksema, S. (1991). Responses to Depression and Their Effects on the Duration of Depressive Episodes. Journal of Abnormal Psychology, 100(4), 569–582. https://doi.org/10.1037/0021-843X.100.4.569

Nolen-Hoeksema, S. (1998). Ruminative coping with depression. In Motivation and self-regulation across the life span (pp. 237–256). Cambridge University Press.

Nolen-Hoeksema, S. (2000). The role of rumination in depressive disorders and mixed anxiety/depressive symptoms. Journal of Abnormal Psychology, 109(3), 504–511. https://doi.org/10.1037/0021-843X.109.3.504

Nolen-Hoeksema, S. (2004). The response styles theory.

Patel, T., Brewin, C. R., Wheatley, J., Wells, A., Fisher, P., & Myers, S. (2007). Intrusive images and memories in major depression. Behaviour Research and Therapy, 45, 2573–2580. https://doi.org/10.1016/j.brat.2007.06.004.

Pearson, J., Clifford, C. W. G., & Tong, F. (2008). The Functional Impact of Mental Imagery on Conscious Perception. Current Biology, 18(13), 982–986. https://doi.org/10.1016/j.cub.2008.05.048

Pearson, J., Naselaris, T., Holmes, E. A., & Kosslyn, S. M. (2015). MI: Functional Mechanisms and Clinical Applications. Trends in Cognitive Sciences, 19(10), 590–602. https://doi.org/10.1016/j.tics.2015.08.003

Pearson, J. (2019). The human imagination: the cognitive neuroscience of visual mental imagery. Nature Reviews Neuroscience, 20(10), 624–634. https://doi.org/10.1038/s41583-019-0202-9

Pounder, Z., Jacob, J., Evans, S., Loveday, C., Eardley, A. F., & Silvanto, J. (2022). Only minimal differences between individuals with congenital aphantasia and those with typical imagery on neuropsychological tasks that involve imagery. Cortex, 148, 180-192. https://doi.org/10.1016/j.cortex.2021.12.010

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. Behavior Research Methods, 40(3), 879–891. https://doi.org/10.3758/BRM.40.3.879

Roberts, J. E., Gilboa, E., & Gotlib, I. H. (1998). Ruminative response style and vulnerability to episodes of dysphoria: Gender, neuroticism, and episode duration. Cognitive Therapy and Research, 22(4), 401–423. https://doi.org/10.1023/a:1018713313894

Roebuck, H., & Lupyan, G. (2020). The Internal Representations Questionnaire: Measuring modes of thinking. Behavior Research Methods, 52(5), 2053–2070. https://doi.org/10.3758/s13428-020-01354-y

Roelofs, J., Muris, P., Huibers, M., Peeters, F., & Arntz, A. (2006). On the measurement of rumination: A psychometric evaluation of the ruminative response scale and the rumination on sadness scale in undergraduates. Journal of Behavior Therapy and Experimental Psychiatry, 37(4), 299–313. https://doi.org/10.1016/j.jbtep.2006.03.002

Schwitzgebel, E. (2008). The Unreliability of Naive Introspection. The Philosophical Review, 117(2), 245–273. https://doi.org/10.1215/00318108-2007-037

Segal, S. J., & Fusella, V. (1969). Effects of Imaging On Signal-To-Noise Ratio, With Varying Signal Conditions. British Journal of Psychology, 60(4), 459–464. https://doi.org/10.1111/j.2044-8295.1969.tb01219.

Segerstrom, S. C., Tsao, J. C. I., Alden, L. E., & Craske, M. G. (2000). Worry and Rumination: Repetitive Thought as a Concomitant and Predictor of Negative Mood. Cognitive Therapy and Research, 24(6), 671–688. https://doi.org/10.1023/a:1005587311498

Shrout, P. E., & Bolger, N. (2002). Mediation in experimental and non-experimental studies: New procedures and recommendations. Psychological Methods, 7, 422–445.

Steffen, A., Nübel, J., Jacobi, F., Bätzing, J., & Holstiege, J. (2020). Mental and somatic comorbidity of depression: a comprehensive cross-sectional analysis of 202 diagnosis groups using German nationwide ambulatory claims data. BMC Psychiatry, 20(1). https://doi.org/10.1186/s12888-020-02546-8

Stöber, J. (1998). Worry, problem elaboration and suppression of imagery: the role of concreteness. Behaviour Research and Therapy, 36(7-8), 751–756. https://doi.org/10.1016/s0005-7967(98)00027-8

Takahashi, J., & Gyoba, J. (2021). A Preliminary Single-case Study of Aphantasia in Japan. Tohoku Psychologica Folia, 79, 26–32. http://hdl.handle.net/10097/00131206

Talamini, F., Vigl, J., Doerr, E., Grassi, M., & Carretti, B. (2023). Auditory and visual mental imagery in musicians and non-musicians. Musicae Scientiae, 27(2), 428-441 . https://doi.org/10.1177/10298649211062724

Thomas, N. J. T. (1999). Are Theories of Imagery Theories of Imagination? An Active Perception Approach to Conscious Mental Content. Cognitive Science, 23(2), 207–245. https://doi.org/10.1207/s15516709cog2302_3

Treynor, W. (2003). Rumination Reconsidered: A Psychometric Analysis. Cognitive Therapy and Research, 27(3), 247–259. https://doi.org/10.1023/a:1023910315561

Tullett, A. M., & Inzlicht, M. (2010). The voice of self-control: Blocking the inner voice increases impulsive responding. Acta Psychologica, 135(2), 252–256. https://doi.org/10.1016/j.actpsy.2010.07.008

Wang, Y. P., & Gorenstein, C. (2013). Psychometric properties of the Beck Depression Inventory-II: a comprehensive review. Revista Brasileira de Psiquiatria, 35(4), 416–431. https://doi.org/10.1590/1516-4446-2012-1048

Watkins, E., & Moulds, M. L. (2007). Reduced concreteness of rumination in depression: A pilot study. Personality and Individual Differences, 43(6), 1386–1395. https://doi.org/10.1016/j.paid.2007.04.007

Watkins, E., & Roberts, H. (2020). Reflecting on rumination: Consequences, causes, mechanisms and treatment of rumination. Behaviour Research and Therapy, 127, 103573–103573. https://doi.org/10.1016/j.brat.2020.103573

Watkins, E. R. (2008). Constructive and unconstructive repetitive thought. Psychological Bulletin, 134(2), 163–206. https://doi.org/10.1037/0033-2909.134.2.163

Weßlau, C., & Steil, R. (2014). Visual mental imagery in psychopathology — Implications for the maintenance and treatment of depression. Clinical Psychology Review, 34(4), 273–281. https://doi.org/10.1016/j.cpr.2014.03.001

Wheatley, J., Brewin, C. R., Patel, T., Hackmann, A., Wells, A., Fisher, P., & Myers, S. (2007). "I'll believe it when I can see it": Imagery rescripting of intrusive sensory memories in depression. Journal of Behavior Therapy and Experimental Psychiatry, 38(4), 371–385. https://doi.org/10.1016/j.jbtep.2007.08.005

Whitford, T. J., Jack, B. N., Pearson, D., Griffiths, O., Luque, D., Harris, A., Spencer, K., & Le, M. E. (2017). Neurophysiological evidence of efference copies to inner speech. ELife, 6, e28197 . https://doi.org/10.7554/elife.28197

Yao, B., & Scheepers, C. (2011). Contextual modulation of reading rate for direct versus indirect speech quotations. Cognition, 121(3), 447–453. https://doi.org/10.1016/j.cognition.2011.08.007

Yao, B. (2021). Mental Simulations of Phonological Representations Are Causally Linked to Silent Reading of Direct Versus Indirect Speech. Journal of Cognition, 4(1), 6. https://doi.org/10.5334/joc.141

Zeman, A., Dewar, M., & Della Sala, S. (2015). Lives without imagery – Congenital aphantasia. Cortex, 73, 378–380. https://doi.org/10.1016/j.cortex.2015.05.019

Zeman, A., Milton, F., Della Sala, S., Dewar, M., Frayling, T., Gaddum, J., Hattersley, A., Heuerman-Williamson, B., Jones, K., MacKisack, M., & Winlove, C. (2020). Phantasia–The psychological significance of lifelong visual imagery vividness extremes. Cortex, 130, 426–440. https://doi.org/10.1016/j.cortex.2020.04.003

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PHILOSOPHY

Book Review

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Hermann Schmitz. 2023. **Atmospheres, with an introduction by Tonino Griffero**. Milan, Italy: Mimesis International, pp. 1 – 140, Pb £11.99 ($15.99). ISBN: 9788869774447.

The assumed mind-matter distinction, which has been prevalent in the Western world since at least Greek philosophy, poses a serious problem for the scientific understanding of conscious experience. These difficulties have led some scholars to argue that the language of science is constitutively ill-suited to explain mental phenomena. The reason being that consciousness is inextricably connected to the subjective point of view of that experiencing consciousness, and any theory that tries to explain it in a solely objective manner has to abandon that single viewpoint (Nagel, 1974; Williams, 2005). On the other hand, some scholars have come to criticise the fundamental assumptions science makes about physical reality. For these scholars, consciousness is a ubiquitous feature of the basic physical constituents of the universe (Goff, 2019). Hermann Schmitz's philosophical work on atmospheres takes yet a different approach to the mind-matter problem. Considering the vocabulary of natural sciences an arbitrary construction that masks our life experiences, Schmitz disposes of it and attempts to make sense of conscious experience only with concepts that are immediately given to human perception — a method he calls New Phenomenology.

Atmospheres is a collection of eight essays, selected by Schmitz himself and with an introduction by Tonino Griffero. It delves into the theory of New Phenomenology, examining the relationship between conscious experience and the corporeal world. The book is structured in a logical manner: it begins with Griffero's introduction, which provides a comprehensive overview and necessary background on Schmitz as a thinker and his phenomenological gripe with the scientific interpretation of sensory experience, followed by each essay highlighting different aspects of New Phenomenology. At first, its basic concepts are defined, such as what are atmospheres and feelings. Then deeper analyses of the theory are presented, exploring how collective experiences of atmospheres work, the atmosphere of cities, the phenomenological perception of landscapes, and concluding with an essay on how atmospheres can be purposefully manipulated.

More preoccupied with gaining a better grasp of what it is like to have conscious experience than with science's quest for objective knowledge, Schmitz furnishes his phenomenological analysis with concepts that can seem absurd from a scientific perspective, but are rather intuitive from the standpoint of what is actually given to human perception. Schmitz talks of a "felt body" (*Leib*, p. 46) that is different from the "physical body" (*Körper*, p. 47) which can be seen and touched. This felt body is where stirrings like anxiety, thirst, sexual appetite or tiredness, and feelings like joy or sadness, are experienced. Also, it occupies a "surfaceless space" (p. 32), which in contrast to "local space" (*Ortsraum*, p. 32) cannot be confined in a three-dimensional volume with surfaces as its clear limits. An atmosphere, Schmitz asserts, is an "expanded occupation of a surfaceless space [in the field of lived presentness] in which something is experienced as appearing" (p. 35). Feelings, in turn, are "effused atmospheres and forces that grasp us felt-bodily" (p. 45). This conception of feelings as atmospheres is the central thesis of the book, in which Schmitz argues that feelings have been misconstrued since the times of Democritus as private states of the inner world of consciousness. Rather, they are something that appears from outside one's psyche and affects oneself involuntarily.

The above definitions reveal how precise Schmitz tries to be in his conceptualisations. This clarity is indeed appreciated, given the abstruse nature of conscious experience and how unusual it is to find such clarity in contemporary Continental philosophy; however, it also highlights the flaws of Schmitz's theory more starkly. To begin with, it is quite surprising, given it is a foundational thesis within New Phenomenology, that Schmitz never really argues why feelings are atmospheres. While he does repeatedly assert that the interpretation of feelings as inner states projected onto the world is false, we can only find one sentence in the whole book where a reason for that is provided. Schmitz claims that because it is impossible to construct a coherent relationship between the conscious being and a closed private world of experience, this demonstrates that the latter does not exist. But, pointing only to an inconsistency within a theory does not seem enough to completely reject it. Moreover, even if we believed Schmitz's argument to be a thorough refutation of what he calls the "psychologistic paradigm" (p. 124), it is not fully clear on what grounds we should be warranted to say feelings are atmospheres, and not some other thing. Schmitz does not explicitly justify his decision on atmospheres, although we can surmise that a weighty component of it lies in the phenomenon of the social contrast of feeling. Namely, that feelings such as joy or grief can be collectively contagious, in contrast with felt-bodily stirrings of another kind, like vigour or weariness. This spread of emotions across individuals is indeed explained by defining feelings as atmospheres that grasp us; however, the psychologistic paradigm can also account for it without the need to resort to atmospheres.

A proposal to abandon the psychologistic model must be strongly supported by an alternative theory with greater explanatory power, serving as a rebuttal. But, in the first place, Schmitz does not emphasise any advantages that New Phenomenology may have over the psychologistic paradigm, other than providing an arguably better account of the contagiousness of feelings. Secondly, New Phenomenology is itself not devoid of inconsistencies. To begin with, Schmitz allows at one point for the possibility of someone sensing an atmosphere of feeling, and remaining within it, while at the same time being grasped by a completely different feeling, for example a sad person in the midst of

a joyful congregation. This seems to clash with Schmitz's supposition that opposing feelings cannot coexist in the same space because each atmosphere "claims for itself the total occupation of lived presentness" (p. 36).

Schmitz also defends that feelings are not things, as that would be an undue reification. Rather, they are a new kind of object, a "quasi-thing" (*Halbding*, p. 51). Quasi-things arguably distinguish themselves from things because they can. Schmitz also defends that feelings are not things, as that would be an undue reification. Rather, they are a new kind of object, a "quasi-thing" (*Halbding*, p. 51). Quasi-things arguably distinguish themselves from things because they can exist in a discontinuous manner, and because the action through which they produce an effect is indistinguishable from themselves. Other examples of quasi-things are voice, chronic and recurring pain, or the rushing weight that we feel when we slip; however, this addition of an ontological category looks suspiciously like an ad-hoc manoeuvre, and it also brings with it further complications that would demand a thorough revision of ontological concepts and principles. Such problems are left unaddressed in this book, and it is worth wondering whether the revised ontology would possess more theoretical advantages than the current one.

The thesis of feelings as atmospheres does thus not fare well when used to confront the psychologistic paradigm: it does not yet have enough explanatory power to be a competing alternative. We believe, however, that the thesis becomes much more persuasive when understood in its purest phenomenological sense, as a way of talking about how human beings experience feelings. In this aspect, combined with Schmitz's account of how it is that atmospheres affect us felt-bodily — through "encorporation" (*Einleibung*, p. 34) of "kinetic suggestions and synesthetic characters" (p. 35) — New Phenomenology was indeed a groundbreaking theory. Moreover, through influencing Gernot Böhme's work, it played an important part in what Griffero calls an "atmospheric turn" (p. 11) in the humanities from 1995 onward. Again, according to Griffero, Böhme's success is due to the fact that he makes atmospheres the cornerstone of an "aesthetic work" (p. 10), encompassing professional fields such as art, design, advertising, cosmetics, or acoustic furnishing — whose core task is redefined as the manipulation of atmospheres. Under the light of aesthetics in Böhme's sense, which Schmitz prefers to call "impression technique" (p. 133), the usual demand for strict systematicity in philosophy is relaxed, and the reader can overlook some of the vagueness of the concepts found in New Phenomenology. Thus, this book can be greatly appreciated by aesthetic workers looking for inspiration, and those familiar with philosophy who wish to reflect on how atmospheric productions affect their daily experience.

References

Goff, P. (2019). Galileo's Error: Foundations for a New Science of Consciousness. Rider.
Schmitz, H. (2023). Atmospheres. Mimesis International.
Nagel, T. (1974). What Is It Like to Be a Bat? The Philosophical Review, *83*(4): 435–450. https://doi.org/10.2307/2183914
Williams, B. (2005). Descartes: The Project of Pure Enquiry. Routledge.

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