


RESEARCH ARTICLE

What is the frequency and nature of visual hallucinations in non-clinical participants?

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Abstract

Objectives: There is a paucity of psychological treatments for visual hallucinations (VH). A key aspect in the psychological treatment of hallucination-related distress is normalisation to explain that these experiences are commonplace and can be non-distressing. In order to normalise VH, it is vital that more is known about VH in non-clinical populations. This study investigated the prevalence, content, context, appraisals, distress, and behavioural reactions to VH in a non-clinical sample.

Design: A cross-sectional study was conducted.

Methods: 466 students completed the Multi-Modality Unusual Sensory Experiences Questionnaire-VH subscale with additional contextual follow-up questions.

Results: Of the 466 participants, 395 (84.8%) reported anomalous visual experiences. 176 (37.77%) participants reported VH similar to the content seen in psychosis. Of the overall sample, 17.38% felt their experience met the VH definition. Participants mainly saw figures, when alone and in the evening. Participants endorsed normalising appraisals: 112 out of 176 (78.87%) believed their mind was playing tricks on them and 83 (58.45%) believed they were tired. However, many also believed the VH was a threat to their mental (66, 46.48%) or physical well-being (41, 28.87%). These negative appraisals were associated with distress.

Conclusion: VH are seemingly common in non-clinical populations and are similar in a number of ways to those of people with psychosis. Awareness that VH occur on a continuum could normalise people's experiences and reduce their negative appraisals and related distress.

KEYWORDS

auditory hallucinations, general population, psychosis, schizophrenia, visual hallucinations

Practitioner points

- Visual hallucinations similar in content to those experienced in psychosis are reported by a third of participants.
- Negative appraisals of threat to psychological or physical well-being are associated with distress.
- Non-threatening, normalising attributions are common and protected against distress.
- Reassessing negative appraisals using a normalising framework may be an effective way to reduce distress.

INTRODUCTION

Hallucinations are defined as ‘perception-like experiences that occur without an external stimulus. They are vivid and clear, with the full force and impact of normal perceptions, and not under voluntary control’ (Diagnostic and Statistical Manual 5; American Psychiatric Association, 2013, pp. 87). A distinction is drawn between complex visual hallucinations (VH) which consist of shadowy figures, formed humans, faces, animals, and other objects (Dudley et al., 2013; Manford & Andermann, 1998) and simple VH that are unformed dots, flashes or other shapes. Complex VH are reported by approximately 27% of people with psychosis (Dudley et al., 2013; Waters et al., 2014).

The most common complex VH in psychosis (Dudley et al., 2013; Manford & Andermann, 1998; van Ommen et al., 2019) and non-clinical populations (Larøi & Van Der Linden, 2005; Lindal et al., 1994; Linszen et al., 2022) are people, faces or figures. For patients with psychosis, VH are associated with greater distress, suicidality, and hospital admissions (Chouinard et al., 2019; Mueser et al., 1990; Oorschot et al., 2012). Despite this, there is a lack of evidence-based psychological treatments for VH, with research limited to case studies (Callcott et al., 2010; Hutton et al., 2012) and case series (Thomson et al., 2017; Wilson et al., 2016).

The lack of effective treatment may arise from the limited understanding of VH. Like auditory hallucinations (AH), VH in psychosis are commonly appraised as a threat to people's physical or mental well-being (Dudley et al., 2012; Gauntlett-Gilbert & Kuipers, 2003). In clinical AH, this leads to emotional distress and behavioural responses of avoidance or escape, which perpetuates the likelihood of unusual experiences occurring (Morrison, 1998) and prevents disconfirmation of the unhelpful appraisal. In comparison, non-clinical AH are less distressing owing to more benign appraisals (Johns et al., 2014; Morrison et al., 2004; Peters et al., 2017), supporting the notion that reframing appraisals may reduce the distress and occurrence of AH (Tsang et al., 2021). Offering such normalisation appraisals is a key component of CBT for AH. However, little is known about VH in non-clinical participants. Enhancing our knowledge of these could therefore develop credible, normalising, and less distressing explanations of VH in psychosis (Dudley, Wilson, Sargeant, & Collerton, 2018).

To do this, the frequency and character of VH in non-clinical populations need to be comprehensively explored. In terms of prevalence, Waters et al. (2014) in a non-systematic review reported estimates of the lifetime prevalence of complex VH in non-clinical populations as between 3.2% and 32%; with a weighted mean of 7.3%, reducing to 6% after excluding the contributions of substance use and physical illness. This large variation in estimates likely reflects the differences in methodology and populations used to assess VH (McGrath et al., 2015).

To accurately determine the presence of VH, there are at least three key challenges that need to be overcome. The first is that people often do not report their experiences of VH, owing to the associated stigma (Menon et al., 2005). A second challenge arises from the limitations in measures used to identify VH (Aynsworth, Collerton, & Dudley, 2017). Prevalence has often been estimated on the basis of a single question in wider surveys about mental health (Shevlin et al., 2007) or on measures that ask about ill-defined or ambiguous experiences, such as ‘Do your eyes play tricks on you?’ (Mosimann et al., 2008)

or 'When I look at things they appear strange' (Revised Launay Slade Hallucination Scale; RHS, Morrison et al., 2002). Such broad questions could helpfully encourage disclosure (Menon et al., 2005), increasing sensitivity but have low specificity for clinical VH (Kessler et al., 2005). By contrast, questions such as Question 9 on the most commonly used Launay Slade Hallucination Scale (LSHS; Launay & Slade, 1981) 'On occasions, I have seen a person's face in front of me when no one was there' would seemingly be far more specific for VH but may not capture the commonly reported clinical VH of animals and figures (Dudley et al., 2012).

As an illustration, Aynsworth, Nemat, et al. (2017) used the Revised Hallucination Scale (RHS; Morrison et al., 2002), an adapted version of the LSHS (Launay & Slade, 1981) with undergraduate participants. Endorsement of VH items varied greatly depending on the type of question asked. As demonstrated in Table 1, sensitive items were highly endorsed (Question 2), whilst specific items (Question 1) were less so.

A third issue is that VH are also reported in the context of physical illness, bereavement, tiredness, alcohol and drug use (Collerton et al., 2005; Teeple et al., 2009), or when waking up or falling asleep (Manford & Andermann, 1998). To estimate prevalence, it is important to check these experiences occur outside of these contexts and meet the full definition of VH.

Once it is evident someone is reporting a VH, it is important to understand the phenomenology of these. This will determine if they have similar characteristics to those with psychosis, in order to support the normalisation process and increase treatment options. Gauntlett-Gilbert and Kuipers's (2003) found people with psychosis often experienced VH when they were alone and in a dark environment. These circumstances (low levels of light, social isolation) and experiencing negative emotions (Oorschot et al., 2012) suggest dynamic factors could contribute to VH. Therefore, interventions that help people manage these factors better may be beneficial for reducing VH.

Consequently, this study had three primary aims. The first was to establish the frequency of VH in a non-clinical population in a way that addressed the issues identified about measuring VH. To aid disclosure before completing the measure, participants were provided with a normalising rationale (Menon et al., 2005). Given the limitations of using single items to determine the presence of VH (Aynsworth, Collerton, & Dudley, 2017), this study used a measure comprising multiple specific and sensitive items; the Multimodal Unusual Sensory Experiences Questionnaire (MUSEQ, Mitchell et al., 2017). To ensure the experiences were indeed VH, a definition of VH was provided and participants also rated how well their experience would fit this.

The second aim was to consider the phenomenology of people's VH and compare this to what people reported in psychosis (faces, people and animals) to determine whether the content is similar or not.

The final aim was to test the cognitive understanding of VH. Whilst the study was largely descriptive, it was predicted that catastrophic appraisals of VH being a threat to psychological or physical well-being would be associated with higher levels of distress, whereas benign appraisals would be associated with less negative, even more positive emotional responses.

TABLE 1 Revised LSHS (RHS) item response rates

Item	Never	Response, <i>n</i> (%)			Almost always
		Sometimes	Often		
1. I have seen a person's face in front of me when no one was there	441 (88.56)	51 (10.24)	3 (0.60)	3 (0.60)	
2. When I look at things they appear strange to me	265 (53.21)	221 (44.38)	12 (2.41)	0 (0)	
3. I see shadows and shapes when there is nothing there	293 (58.84)	174 (34.94)	26 (5.22)	5 (1.00)	
4. When I look at things they look unreal to me*	370 (74.45)	121 (24.35)	5 (1.00)	1 (0.20)	
5. When I look at myself in the mirror I look different	269 (54.02)	187 (37.55)	38 (7.63)	4 (0.80)	

Note: *N* = 498. Visual Hallucination Predisposition subscale items of RHS.

**N* = 497.

METHOD

Ethical considerations

The study was approved by a Newcastle University Ethics Committee (reference: 01020_1/2016) and was conducted in accordance with the principles of the Declaration of Helsinki (with the exception of the study not being publicly registered prior to data collection). Participants provided informed consent before completing the measures. They were debriefed at the end of the questionnaire and offered contact with various organisations and researchers. No one took up this offer.

Participants

Undergraduate participants were recruited via department emails, advertisements on University Research Participation Schemes and presentations between October 2016 and April 2017. Demographics including sex, age, and ethnicity were recorded.

Exclusion criteria were previous or current treatment from mental health services, poor visual ability or any organic disorders that may cause VH.

Measures

An adapted version of the 8-item visual subscale of the MUSEQ (Mitchell et al., 2017) was used to measure frequency. The MUSEQ captures a broad range of visual experiences including VH (see Table 2) on a 5-point scale: '0-never' (never happens); '1-hardly ever' (once or twice in my life); '2-rarely' (once or twice a year); '3-occasionally' (a few times a year); to '4-frequently' (at least monthly). For this study, an additional rating point, '5-very frequently' (at least weekly), was added to capture any more frequent experiences.

When participants endorsed a response option greater than zero (i.e. more frequent than 'Never'), they were given a set of follow-up multiple choice questions, which were derived from the Appraisals and Reactions to Visual Hallucinations Interview (Dudley et al., 2012). Response options were based on clinical experience and relevant literature on factors associated with VH.

Firstly, participants were asked 'What did you see?' and were given a free-text response option as well as five yes/no questions. The yes/no questions asked whether participants had seen 'a face', 'lines/dots', 'an animal', 'a figure' or 'other' and they were asked to endorse as many of these options as applied.

Participants were then asked what they were doing at the time of the experience. They were given the following response options: 'Alone', 'In the dark', 'Under the influence of drugs', 'Under the influence of alcohol', 'Withdrawing from drugs', 'Withdrawing from alcohol', 'Unwell', 'Bereaved', 'Feeling good about myself' or 'Other' and were asked to select all that applied. If 'Unwell' or 'Other' were selected, a free-text response box was given for more information.

Participants were asked about the time of day which the visual percept occurred. They were given the following options: 'Waking up', 'In the morning', 'In the afternoon', 'In the evening', 'When falling asleep' or 'During the night'.

Participants were then asked how they were feeling at the time of the onset of the visual experience. They were given the following affective descriptors (anxious; happy; angry; low; supported; excited; fear; comforted; exhilarated; nothing) and responded to each using a four-point scale (1 = Not at all; 2 = A little; 3 = Somewhat; 4 = A lot).

Participants were asked how they appraised the visual experience. The following options were given: 'I'm going mad', 'This is a spiritual experience', 'There is a risk I may get hurt', 'This is a message from someone doing me good', 'My mind is playing tricks on me', 'This is a funny thing', 'I must be sleepy/tired',

TABLE 2 MUSEQ-VH responses

Item	Frequency, <i>n</i> (%)					
	Never (never happened)	Hardly ever (once or twice in life)	Rarely (once or twice a year)	Occasionally (few times a year)	Frequently (at least monthly)	Very frequently (at least weekly)
1. My eyes have played tricks on me	154 (33.05)	69 (14.81)	67 (14.37)	105 (22.53)	60 (12.88)	11 (2.36)
2. I found that lights or colours seem brighter or more intense/vivid than they normally would be	280 (60.09)	60 (12.88)	40 (8.58)	49 (10.52)	27 (5.79)	10 (2.15)
3. I thought of people, objects or landscapes, and could almost see their image in front of my eyes	276 (59.23)	52 (11.16)	46 (9.87)	43 (9.23)	34 (7.27)	15 (3.21)
4. I have looked at a patterned object (e.g. wallpaper, curtains, tiled floor) and a figure or face has emerged	217 (46.57)	49 (10.52)	50 (10.72)	78 (16.74)	54 (11.56)	18 (3.86)
5. I Have seen lights, flashes or other shapes that other people could not see	270 (57.94)	67 (14.38)	40 (8.28)	62 (13.30)	26 (5.58)	1 (0.21)
6. I looked at an object and it transformed itself before my eyes into something else	382 (81.97)	42 (9.01)	19 (4.08)	19 (4.08)	1 (0.21)	3 (0.64)
7. I saw a brief image of an object, animal or person pass me in my peripheral vision, but when I looked there was nothing there	182 (39.06)	70 (15.02)	67 (14.38)	77 (16.52)	50 (10.73)	20 (4.29)
8. I saw people, face or animals, and then found nothing was there	290 (62.23)	71 (15.23)	37 (7.94)	43 (9.23)	19 (4.08)	6 (1.29)

Note: *N* = 466.

'I am stressed' or 'I did not really think about it'. Participants had to rate each on a scale (1 = Not at all; 2 = Considered a little; 3 = Fairly certain; 4 = Convinced).

Finally, participants were asked how they responded when they saw the visual experience. They were given the following responses: 'Tell someone at the time', 'Tell someone later', 'Distract yourself', 'Interact with it', 'Ignored it', 'Reassured myself', 'Check if someone else saw it', 'Leave the room', 'Seek reassurance' or 'Other'. If 'Other' was selected, a free-text response box was given for more information.

For each set of follow-up questions, participants were initially asked about their most recent unusual visual experience. After completing the follow-up questions, they were asked 'Is this typically what you see when you have had this experience?' and were invited to respond 'Yes' or 'No'. If participants responded 'Yes', they moved on to the next question. If participants answered 'No', they were presented with the above follow-up questions again but were asked to answer these, 'Thinking about a typical time this happened'.

Finally, participants themselves judged whether their experience would agree with a clinical VH adapted from Waters et al. (2014).

1. You are wide awake, not sleepy or noticeably unwell. (It is experienced when you are fully conscious),
2. It is not based on something that is really there/you have not misunderstood something that is really there. (It is not elicited by an external stimulus, e.g. a distortion or illusion),
3. It looks real and it is not a picture inside your head. (The image must have physical properties similar to real perceptions and be located in external space),
4. You are not doing it on purpose and it is not within your control. (There is no sense of direct control over the image),

5. There is nothing external to suggest it is really there.

Participants were then asked, 'After reading this definition, do you believe any of your experience(s) to have been a visual hallucination?'. Participants were then presented with four options: 'Not at all', 'Somewhat', 'Fully' or 'Unsure'.

Procedure

Participants were provided with a brief normalising rationale on how common VH were in the general population, and that their presence can be non-pathological and in absence of distress (See Appendix 1). They were then asked to read all eight items of the VH subscale before completing the MUSEQ.

Analytic strategy

In order to examine the relative impact of highly sensitive or specific questions, the endorsement of the least and most specific questions were compared. Question 1, 'My eyes have played tricks on me' was deemed the most sensitive and least specific question as it encompasses a wide range of anomalous visual experiences from illusions, such as mistaking objects for something else, seeing faces within inanimate objects (pareidolia), to VH. Owing to the breadth of the inclusion within this question, it is not evident that it captured VH by definition, which could lead to overestimating the prevalence of VH (Mosimann et al., 2008). In comparison, Question 8, 'I saw people, faces or animals and then found that nothing was there', was the most specific but least sensitive item. This question captured experiences most commonly reported by people with psychosis (Dudley et al., 2013; Manford & Andermann, 1998), so would be more representative of how frequent VH experiences are within a non-clinical student population. This is also the most similar to Item 1 on the RHS (See Table 1). To further explore differences in content according to the item, the free-text responses were reviewed for each question.

Odds ratios were calculated to explore endorsement patterns across the questions. This calculated the likelihood of endorsing VH criteria when item 1 or item 8 were endorsed.

Following this, only follow-up questions for Item 8 were explored owing to this being the most similar experience to VH in psychosis, therefore most appropriate to base normalising information on.

To explore relationships to distress, appraisals of the visual experience were categorised according to their valence of being positive, negative or neutral (Dudley et al., 2012). Positive appraisals were those that indicated the VH had 'special' or helpful ('This is a spiritual experience' and 'This is a message from someone doing me good') value. Negative appraisals were those interpreted as a threat to psychological or physical well-being ('I'm going mad' and 'There is a risk I may get hurt'). Neutral appraisals were 'My mind is playing tricks on me', 'This is a funny thing', 'I must be sleepy/tired', 'I am stressed' and 'I did not really think about it'. Positive emotions were 'happy', 'supported', 'excited', 'comforted' and 'exhilarated'. Negative emotions were 'Anxious', 'Angry', 'Low' and 'Fear'. 'Nothing' was excluded from this part of the analysis because it indicated no emotional response. To test the hypothesis that appraisals would relate to distress, participant's mean scores for each category were calculated and Spearman's correlations were undertaken between appraisal and emotional reaction.

RESULTS

Data integrity

Responses were checked for duplicates or errors, removing five responses. The final data set of 466 participants completed all eight frequency questions. 52 participants (11.2%) did not fully complete the follow-up questions. No data were removed for being atypical.

Demographics

About 82.1% of participants were female (380 female vs. 83 male), and white (89.9%) or Asian (5.2%). The mean age was 20.1 years ($SD = 3.46$, range 18–45).

Frequency of visual experiences

Three-hundred and ninety five participants (84.8%) endorsed at least one item on the MUSEQ-VH subscale (see Table 2). For Question 1, there was a high rate of endorsement with 312 people (66.95%) saying this had happened. For Item 8, there was a relatively high rate of endorsement (176 or 37.77%), with over 5% saying this happens monthly or more.

Table 3 illustrates the content of what people saw. Item 1 captured a wider variety of anomalous visual experiences including simple VH (lines and dots) and ‘other’ perceptions compared with Item 8. When free-text responses were also reviewed, Item 1 captured simple VH (lights or dots), misinterpreting objects or people as something or someone else, and pareidolia (seeing faces in inanimate objects such as tiles, carpets or wallpapers). In comparison, Item 8 responses included more fully formed perceptions such as animals (insects and pets), people (both familiar and unknown) and life-like figures. Given the evident greater specificity of responses in Item 8, the remainder of the analysis is focused on this question.

Endorsement of visual hallucinations criteria

As demonstrated in Table 4, of the 422 participants included, 81 (19.19%) endorsed they had a VH to some degree on the most VH-like question (Item 8). When Item 1 was endorsed, this increased the likelihood that their experience met the VH definition, compared with when Item 1 was not endorsed, $p = .007$; OR = 1.84; (95% CI = 1.18–2.85). If Item 8 was endorsed, there was an even higher likelihood that the criteria for a VH would be endorsed, than when item 8 was not endorsed, $p < .001$; OR = 2.84 (95% CI = 1.90–4.25).

TABLE 3 Content of visual hallucinations

Content	Frequency n (%)	
	Item 1, $N = 312$	Item 8, $N = 176$
Face	43 (13.78)	52 (29.55)
Lines/dots	71 (22.76)	2 (1.14)
Animal	41 (13.14)	39 (22.16)
Figures	163 (52.24)	90 (51.14)
Other	63 (20.19)	10 (5.69)

Note. Answers were not mutually exclusive.

TABLE 4 Endorsement of visual hallucinations criteria against the definition

VH criteria	Item 1		Item 8	
	<i>n</i>	%	<i>n</i>	%
Not at all	100	38.31	30	21.43
Somewhat	91	34.86	63	45
Fully	21	8.05	18	12.86
Unsure	49	18.77	29	20.71

Note. Item 1 *N* = 261, Item 8 *N* = 140.

Follow-up questions

Participants could select multiple items for the follow-up questions so responses were not mutually exclusive. There was a high degree of overlap (57.75%–91%) between typical and most recent experiences. Experiences rated as ‘not typical’ tended to be because the experience was so rare that participants did not have a ‘typical’ example. Therefore, only the most recent experience data are reported.

Content of visual hallucinations

Table 3 demonstrates the content of people's VH. 90 (63.38%) participants reported seeing a figure, 52 (36.62%) reported seeing a face, 39 (27.46%) reported seeing an animal, 10 (7.04%) reported seeing something else (i.e., they endorsed the ‘other’ response option), and 2 (1.41%) reported seeing lines or dots.

Time of day visual hallucinations occurred

In terms of when the VH occurred, 61 (42.96%) reported in the evening, 53 (37.32%) reported the afternoon, 47 (33.10%) reported during the night, 25 (17.10%) reported when falling asleep, 19 (13.38%) reported in the morning, and 6 (4.23%) reported when waking up.

Context of the visual hallucinations

When asked about the context under which people saw the VH, 94 (66.20%) were alone, 37 (26.06%) were in the dark, 26 (18.31%) reported that they were doing something else, selecting the ‘other’ category, 21 (14.79%) reported feeling good about themselves, 12 (8.45%) were under the influence of alcohol, 9 (6.34%) were under the influence of drugs, 3 (2.11%) reported withdrawing from alcohol, 2 people were bereaved (1.41%), and 1 person (0.70%) reported withdrawing from drugs. No one reported feeling unwell.

Appraisals of visual hallucinations

People endorsed a range of appraisals (see Table 5). To at least some degree, 112 (78.87%) participants reported thinking that their mind was playing tricks on them, 83 (58.45%) believed it was because they were tired, 66 (46.48%) believed they were going mad, 54 (37.33%) believed they were stressed, 52 (36.62%) did not think about it, 41 (28.87%) believed that they were at risk of being hurt, 38 (26.76%) believed it was funny, 23 (16.20%) believed it was a spiritual experience and 11 (7.75%) believed the VH had a special message for them.

TABLE 5 Appraisals of visual hallucinations

Appraisal	Conviction <i>n</i> (%)			
	Not at all	Considered a little	Fairly certain	Convinced
I'm going mad	76 (53.52)	43 (30.28)	19 (13.38)	4 (2.82)
This is a spiritual experience	119 (83.80)	17 (11.97)	3 (2.11)	3 (2.11)
There is a risk I might get hurt	101 (71.13)	25 (17.61)	12 (8.45)	4 (2.82)
This is a message from someone doing me good	131 (92.25)	8 (5.63)	2 (1.41)	1 (0.70)
My mind is playing tricks on me	30 (21.13)	46 (32.39)	45 (31.69)	21 (14.79)
This is a funny thing	104 (73.24)	22 (15.49)	14 (9.86)	2 (1.41)
I must be sleepy/tired	59 (41.55)	36 (25.35)	27 (19.01)	20 (14.08)
I am stressed	89 (62.67)	28 (19.72)	14 (9.86)	11 (7.75)
I did not really think about it	90 (63.38)	25 (17.61)	10 (7.04)	17 (11.97)

Note: *N* = 142.

TABLE 6 Emotions reported when experiencing visual hallucinations

Emotion	Intensity of emotion <i>n</i> (%)			
	Not at all	A little	Somewhat	A lot
Anxious	68 (47.88)	31 (21.83)	25 (17.61)	18 (12.68)
Angry	121 (85.21)	13 (9.15)	6 (4.23)	2 (1.41)
Low	96 (67.61)	25 (17.61)	12 (8.45)	9 (6.34)
Fear	83 (58.45)	26 (18.31)	21 (14.79)	12 (8.45)
Nothing	74 (52.11)	23 (16.20)	19 (13.38)	26 (18.31)
Happy	90 (63.38)	36 (25.35)	11 (7.75)	5 (3.52)
Supported	118 (83.10)	14 (9.86)	9 (6.34)	1 (0.70)
Excited	117 (82.39)	14 (9.86)	8 (5.63)	3 (2.11)
Comforted	116 (81.69)	12 (8.45)	12 (8.45)	2 (1.41)
Exhilarated	125 (88.03)	8 (5.63)	6 (4.23)	3 (2.11)

Note: *N* = 142.

Emotional impact of visual hallucinations

Demonstrated in Table 6, participants reported a range of emotions including feeling anxious ($n = 74$, 52.12%), nothing ($n = 68$, 47.89%), fear ($n = 59$, 41.55%), happy ($n = 52$, 36.62%), low ($n = 46$, 32.39%), excited ($n = 28$, 17.61%), comforted ($n = 26$, 18.31%), supported ($n = 24$, 16.9%) angry ($n = 21$, 14.79%), and exhilarated ($n = 17$, 11.97%).

Relationships between appraisals and emotions

There were no significant relationships between positive appraisals and positive ($r_s = .11$, $p = .17$) or negative ($r_s = .04$, $p = .64$) emotions, or between negative appraisals and positive emotions ($r_s = -.094$, $p = .26$). There was a significant relationship between negative appraisals and negative emotions ($r_s = .54$, $p < .001$), indicating threat-based appraisals were associated with greater negative emotion.

There was a significant positive relationship between neutral appraisals and positive emotions ($r_s = .17$, $p = .046$), with those people reporting more neutral appraisals having stronger positive emotions. There was also a significant relationship between neutral appraisals and negative emotions ($r_s = .23$, $p = .01$). Further review of the neutral appraisals indicated that they captured a broad range of possible appraisals,

therefore, they were further categorised. 'I am sleepy/tired' and 'I am stressed' were related to personal circumstances and general well-being so were categorised as 'Neutral—context related'. 'My mind is playing tricks on me', 'This is funny' and 'I did not really think about it' were not related to personal well-being or circumstances so were categorised into 'Neutral—non-contextual'. There was not a significant relationship between 'Neutral—non-contextual' and negative emotions ($r_s = -.05, p = .54$), but there was with positive emotions ($r_s = .28, p < .001$). There was no significant relationship between positive emotions and 'Neutral—context related' ($r_s = -.004, p = .97$), whereas there was a significant relationship with negative emotions ($r_s = .39, p < .001$) indicating that when appraisals are in relation to personal circumstances, such as being stressed or tired, a more negative emotion was experienced. Whereas, when people appraised the experiences as neutral and unrelated to circumstances, the more positive they felt.

Behavioural reaction to visual hallucinations

When considering people's behavioural responses to VH, 70 people ignored it (49.30%), 47 (33.10%) reported reassuring themselves, 31 (21.83%) reported distracting themselves, 30 (21.13%) reported telling someone at the time, 26 (18.31%) reported telling someone later, 23 (16.20%) reported they had to leave the room, 15 (10.56%) reported checking if someone else also saw the VH, 13 (9.15%) reported seeking reassurance from someone, 10 (7.04%) reacted differently and selected 'other' and 6 (4.23%) people interacted with the VH, such as trying to talk to or touch it.

DISCUSSION

This study explored VH in a non-clinical student sample to better understand how frequent they were, their content, the context in which they occurred, and how people appraised and responded to these experiences. Using the MUSEQ, a large range of visual perceptions were reported. A sensitive but non-specific question about people's eyes playing tricks on them was endorsed by two-thirds of participants. A question that was much more specific to VH experienced in psychosis, such as seeing people, faces or animals was endorsed by a smaller number but still constituted over a third of the sample. Of those who endorsed this, just over half of people reported their experiences would meet the definition of VH but only 12.86% said it would fully meet the definition. Therefore, in the context of the overall sample of 422 participants, slightly under a fifth reported VH-like experiences to some degree, with around 5% reporting their VH fully met the clinical criteria, despite the lack of a clinical disorder. This indicates that VH-like experiences occur relatively frequently and are not necessarily a sign of psychopathology.

Non-clinical participants' experiences were similar to those in psychosis in terms of content (figures and faces) and the context in which they occur (Dudley et al., 2012; Gauntlett-Gilbert & Kuipers, 2003). VH in non-clinical people are commonly explained due to factors such as sleep and drugs. However, such factors were only endorsed by the minority of people, suggesting alternative explanations for VH are needed. Given the similarities in clinical and non-clinical VH experiences, similar factors could be contributing to VH.

In terms of appraisals of VH, the majority of people understood these as their eyes playing tricks on them, and a little over a third of people did not give their VH experience much thought at all. Notably, when people had such neutral appraisals, they were associated with positive emotions, indicating that the more belief in satisfactory and reassuring explanations, the more positive people felt.

Importantly though, not all 'normalising' appraisals were non-distressing. Explanations of being tired or stressed were still associated with higher distress, whereas explaining them as their mind playing tricks on them was not. When creating psycho-education resources, attention needs to be paid to what is deemed a 'normalising' account of hallucinations. Typically, explanations of being stressed or tired are viewed as ways to normalise people's experiences, but this study shows that such understandings could inadvertently increase distress.

In relation to negative appraisals, nearly half of the sample endorsed threat-based appraisals of their VH, such as that they were going mad or would be hurt by the VH. Greater endorsement of these appraisals was associated with higher distress, similar to those with psychosis (Dudley et al., 2012; Gauntlett-Gilbert & Kuipers, 2003). Such a relationship between appraisals and distress supports the tenets of the cognitive understanding of VH and targeting appraisals during CBT (Collerton & Dudley, 2004; Morrison et al., 2000).

Given the similarities between VH in non-clinical and clinical populations, an important question to ask therefore is what then leads to people needing care. It could be that the VH in non-clinical groups happen so rarely that they are not too distressing. However, it is important to note that over 5% of the current sample reported seeing VH on at least a monthly basis, which is relatively frequent. So it is assumed it is not the occurrence alone that leads to seeking help. VH in people with psychosis often occur as multimodal experiences (Montagnese et al., 2021) so a person not only sees a VH but also reports other hallucinations at the same time (Dudley, Aynsworth, Cheetham, et al., 2018). This may add to the compelling sense that these experiences are real (Dudley, Aynsworth, Mosimann, et al., 2018). It may be that for non-clinical participants these phenomena occur independently of other unusual experiences so can be normalised more effectively.

Strengths of this study are that it excluded people receiving current treatment for mental health issues and used a number of very specific screening questions to capture the full range of unusual visual experiences and their context. It addressed issues of under-reporting owing to stigma, by using a normalising rationale, providing multi-item measures, and a strict definition of VH to help establish a clear prevalence estimate.

However, there were several limitations. First, the undergraduate sample may not be representative of the general population. This study's endorsement rates of 37.77% were higher than the 27% reported in non-clinical participants when developing the MUSEQ (Mitchell et al., 2017). However, Mitchell et al. (2017) included both student and community populations so the difference could be reflective of our younger sample. The frequency estimate in our study did, however, reduce to 19.19% when asked if the participant's experiences matched, to at least some degree, a provided definition of VH.

The study relied on participants' memories of unusual visual experiences, which may have occurred many days, months, weeks or years ago. Also, given it was a self-report, the accurateness of people endorsing their experience against the VH criteria is unknown. This study used a cross-sectional design, using correlational analysis to explore relationships limiting confidence in the causality of these relationships.

Despite these limitations, this work has potential clinical utility in being able to provide rich normalising information on the frequency and nature of non-clinical VH. The content of VH reported in non-clinical people was strikingly similar to those with psychosis, that is people, figures and animals (Dudley et al., 2012; van Ommen et al., 2019), and they tend to occur when they are alone, tired, and in the dark (Gauntlett-Gilbert & Kuipers, 2003). Such conditions are when peoples' visual systems are more likely to make mistakes. The ambiguous quality of visual data available when tired and in the dark, or when feeling anxious could require the perceptual systems to fill in the gaps based on what people expect to see and, therefore, lead to seeing VH (Dudley et al., 2014). Hence, supporting people to improve the quality of their visual data, e.g. turning the light on, could be a way of reality-testing people's VH and reducing associated distress.

Furthermore, the relationship between negative appraisals and distress supports the use of a cognitive approach to working with VH (Collerton & Dudley, 2004). Given the considerable distress and impact on the functioning of VH for those with psychosis (Dudley et al., 2012), supporting people to find more neutral and normalising appraisals through psycho-education may help people to recover (Berry & Hayward, 2011).

Future work could explore differences between clinical and non-clinical VH drawing on methodologies that result in richer, more detailed accounts from participants about their VH, as has been done for AH (Milligan et al., 2013; Woods et al., 2015). This in combination with the development of more sensitive and specific measures could enable VH to be better estimated and measured (Aynsworth, Collerton, & Dudley, 2017).

In summary, this study found two-thirds of a non-clinical student sample reported anomalous visual experiences when asked to respond to a very broad, non-specific item. When asked specifically about VH-like experiences, a third of participants reported such experiences that shared many characteristics of VH in people with psychosis. However, most commonly, people held neutral normalising beliefs about their experiences, which was related to less distress. Where people held more threat-based beliefs, they were more distressed by their VH.

AUTHOR CONTRIBUTIONS

Charlotte Aynsworth: Conceptualization; data curation; formal analysis; funding acquisition; investigation; methodology; project administration; visualization; writing – original draft; writing – review and editing. **Julie Rolinson:** Conceptualization; investigation; methodology; project administration; resources; software; writing – review and editing. **Maryam Pervez:** Formal analysis; writing – review and editing. **Daniel Collerton:** Conceptualization; methodology; project administration; resources; software; supervision; visualization; writing – review and editing. **Robert Dudley:** Conceptualization; formal analysis; methodology; project administration; resources; software; supervision; validation; visualization; writing – review and editing.

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CONFLICTS OF INTEREST

We have no known conflicts of interest to disclose.

DATA AVAILABILITY STATEMENT

Data are available from the corresponding author upon request.

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APPENDIX 1

Rationale provided to participants before taking part in the study

This is an invitation to take part in a research study investigating the experience of visual hallucination-like experiences or visions. Before you decide if you wish to take part, it is important for you to understand why the research is being carried out and what it will involve. Please take time to read the following information carefully before deciding whether to participate. Purpose: There has been a lot of research into the cognitive processes of people who hear things that others do not (auditory hallucinations). This research has shown that these experiences can be quite common and can be non-distressing or even positively valued by some people. There has been less research regarding people who see things that others do not (sometimes called visual hallucinations). We do not know much about these experi-

ences and what causes them. However, we do know that seeing fleeting images, seeing shadows in the corner of your eye or even more complex images are common and can happen when we are falling asleep, waking up or when stressed etc. and are not necessarily distressing or a sign of mental illness. This study is interested in how common visions are in the general population and their nature, as this has not been extensively researched before now.