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RESEARCH ARTICLE

# Does disorganised attachment lead to auditory hallucinations via dissociation? An experimental study with an analogue sample

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## Abstract

**Objectives:** Auditory hallucinations (such as hearing voices) are common in clinical and non-clinical populations. Many people who hear voices also report early adversity and have an insecure attachment style. Current cognitive models suggest that dissociation mediates an association between disorganised attachment and auditory hallucinations, but this has not been tested experimentally.

**Design:** We recruited a non-clinical analogue sample highly predisposed to auditory hallucinations and utilised an experimental design to examine the impact of disorganised attachment imagery on hallucinatory experiences, and whether dissociation mediates an expected association.

**Methods:** Participants completed self-report measures of state auditory hallucinations and dissociation before and after random allocation to secure or disorganised attachment conditions.

**Results:** Attachment imagery did not affect auditory hallucinations. Both secure and disorganised attachment conditions increased state dissociation. Secure attachment imagery reduced paranoia, but state dissociation did not mediate this effect. An exploratory analysis found that trait dissociation fully accounted for the association between trait-disorganised attachment and hallucinatory experience while controlling for paranoia.

**Conclusions:** Secure attachment imagery reduces paranoia but not auditory hallucinations and the impact on paranoia is not mediated by dissociation. Secure attachment imagery may be useful in reducing fears and distress associated with voices, rather than the frequency or severity of

hallucinations. Disorganised attachment may increase hallucinatory experiences for people vulnerable to dissociation. Trait dissociation should be assessed in clinical settings and addressed where indicated as a means of targeting vulnerability to distressing voices.

**KEYWORDS**

auditory hallucinations, disorganised attachment, dissociation, imagery, paranoia, priming, voice hearing

## BACKGROUND

Hallucinations are sensory perceptions that occur without corresponding external/somatic stimuli (Arciniegas, 2015). Auditory hallucinations (AHs) typically involve hearing a voice or voices and are a key feature of psychosis as well as being common in non-clinical populations. There is now broad agreement that AHs are maintained by common psychological processes across this continuum (Johns & van Os, 2001).

Attachment theory (Bowlby, 1969) proposes that interactions with early caregivers result in *internal working models* which guide appraisals of self and others, emotion regulation and behaviour in close relationships. Secure attachment typically follows safe and responsive caregiving and is characterised by positive beliefs about self and others, effective emotion regulation skills and an ability to form reciprocal interpersonal relationships (Ainsworth et al., 1978). Insecure avoidant attachment is assumed to result from absent or rejecting early care and is characterised by negative beliefs about others, deactivating emotion regulation (e.g., suppression) and compulsive self-reliance, whereas insecure anxious attachment follows inconsistent early care and is characterised by negative beliefs about the self, hyperactivating emotion regulation (e.g., rumination) and ineffective, repetitive help-seeking (Hazan & Shaver, 1987; Mikulincer & Shaver, 2016).

Anxious and avoidant attachment styles are associated with paranoia in clinical and non-clinical studies (Lavin et al., 2019; Murphy et al., 2020). There is also some evidence that disorganised attachment may be associated with hallucinatory experience (Bucci et al., 2017). Disorganised attachment follows insensitive and incoherent parental behaviour, in which the caregiver is also a source of threat (Main & Hesse, 1990; Main & Solomon, 1986; Paetzold et al., 2015). The infant is torn between the urge to approach and the urge to flee, experiencing "fright without solution" — an early relational trauma (Main & Hesse, 1990, p. 163). In clinical groups, disorganised attachment is associated with sexual and physical abuse in infancy and more severe psychotic symptoms in adulthood (Bucci et al., 2017; Liotti & Gumley, 2008).

The cognitive-attachment model of voices suggests that early relational trauma leads to the development of a disorganised attachment style which predisposes the child to dissociation and, in turn, voice hearing (Berry et al., 2017). Dissociation describes a lack of the normal integration of thoughts, feelings and other internal experiences in the stream of consciousness and memory (Bernstein & Putnam, 1986). This lack of integration increases the likelihood of source monitoring errors including the identification of (typically unwanted) thoughts, feelings, appraisals and memories as an external 'voice' (Berry et al., 2017; Longden et al., 2012). This model is supported by evidence that (a) childhood maltreatment is associated with insecure/disorganised attachment (Baer & Martinez, 2006), (b) early disorganised attachment is associated with higher rates of dissociation in young adults (Byun et al., 2016; Ogawa et al., 1997), and (c) robust and comparable associations between dissociation and voice hearing in both clinical and non-clinical groups (Longden et al., 2020).

Hypothesised links between early interpersonal trauma, attachment style, dissociation and voice hearing are also supported by longitudinal evidence that disorganised attachment precedes dissociation

**Practitioner points**

- Disorganised attachment may lead to increased voices for people predisposed to dissociation.
- Secure attachment imagery may be useful in reducing paranoia for people vulnerable to voices.
- Using imagery with people with psychosis may increase dissociation and should therefore be used with care if individuals are already predisposed to dissociation.

in response to trauma events (Carlson, 1998; Ogawa et al., 1997), and that dissociation mediates the association between childhood trauma and hallucination proneness in cross-sectional studies (Pearce et al., 2017; Varese et al., 2012). While some studies have examined the relationship between trauma, attachment style and voice hearing (e.g., Pilton et al., 2016), the role of dissociation as a potential mediator in the association between attachment style and voice hearing has not been examined, despite associations with both (Varese et al., 2011). *Causal* links between disorganised attachment, dissociation and AHs are theoretically plausible (and have high face validity) but remain untested.

Imagery priming is an established method of investigating putative causal processes in attachment research (Bartz & Lydon, 2004). Attachment primes activate a sense of security or insecurity by increasing the salience and accessibility of these mental representations, and guided imagery is a particularly effective means of doing so (Gillath & Karantzas, 2019). Security priming is a reliable way to activate a sense of safety and security, resulting in a range of desired outcomes including increased positive affect, decreased negative affect, increased emotional well-being and reduced hostility, compared with insecure primes (Rowe et al., 2020).

In non-clinical samples high in paranoia, security priming has been shown to reduce state paranoia, anxiety and negative affect compared to insecure primes (Bullock et al., 2016; Newman-Taylor et al., 2017). A preliminary study of security priming in two people with schizophrenia diagnoses showed that a brief guided imagery task increased positive affect and reduced paranoia (Pitfield et al., 2020). Subsequent studies have focused on the mechanisms involved, and shown that anxious and avoidant attachment imagery lead to paranoia via increases in negative self/other beliefs and cognitive fusion (Sood et al., 2021; Sood & Newman-Taylor, 2020). To our knowledge, no research to date has primed disorganised attachment or examined causal links between attachment, dissociation and AHs.

The current study sought to examine hypothesised causal links between disorganised attachment, dissociation and hallucinatory experience, using attachment imagery priming in an analogue sample highly predisposed to AHs. We compared disorganised versus secure attachment imagery. Given that AHs and paranoia often co-occur, and secure attachment imagery reduces paranoia, we also measured paranoia as a possible covariate and secondary outcome of interest.

We predicted that:

1. Secure attachment imagery priming will decrease state dissociation, state AHs and state paranoia, compared with disorganised attachment imagery priming.
2. Dissociation will mediate the impact of attachment imagery (secure vs. disorganised) on AHs and paranoia; relative to secure imagery, disorganised imagery will increase state dissociation and which will, in turn, increase state AHs and state paranoia. In contrast, secure imagery priming will decrease state dissociation, state AHs and state paranoia.

# METHOD

## Design

The University of Southampton, UK, granted ethical approval for the study, which was pre-registered on the Open Science Framework (https://osf.io/2xjh3). We used an experimental design; the independent variable was attachment imagery condition (secure vs. disorganised) and the dependent variables were state AHs and paranoia. The hypothesised mediator was state dissociation. The study lasted ~25 min and was run online using Qualtrics (an online survey platform). An a priori G*Power analysis indicated that to detect a medium (0.25) effect size, at $p = .05$, with 80% power, we needed 128 participants.

## Participants

We recruited an international analogue sample of adults (≥18 years) highly predisposed to AHs, using Prolific.[1] Participants were screened using the Launay Slade Hallucination Scale — Revised (LSHS; Bentall & Slade, 1985) and asked if they were currently receiving professional support for any mental health problem(s). If they scored 19 or above on the LSHS (mean of the standardisation sample) and were not receiving professional mental health support, they were invited to participate in the full study. A total of 517 people were screened, of which 212 were invited to participate and 149 did so. We excluded people who started but did not complete the study ($n = 18$), those who reported not holding the imagery in mind for any length of time ($n = 2$) and one person who reported their age as under 18 years.

The final sample comprised 128 participants[2] (males = 78, females = 47, non-binary = 2, prefer not to say = 1), aged 18–51 ($M = 24.52$, $SD = 6.9$). Most were in full or part-time employment (43.5%) or students (37.2%), lived in Europe and identified as White (see Table 1).

## Measures and experimental manipulation

### Trait measures

*Launay Slade Hallucination Scale — revised (LSHS; Bentall & Slade, 1985)*

The LSHS is a 12-item measure of trait hallucinatory type experience. Participants rate their agreement with each statement on a 5-point scale from 1 (strongly disagree) to 5 (strongly agree). The scale has good internal consistency (α = .87) which was also good in the current sample (α = .81).

*Revised psychosis attachment measure (PAM-R; Pollard et al., 2020)*

The PAM-R is a 26-item measure of trait attachment style comprising three subscales: anxious, avoidant and disorganised attachment. Participants rate how representative each item is of them on a 4-point scale from 0 (not at all) to 3 (very much). The anxious, avoidant and disorganised subscales have acceptable to good internal consistency (α = .87, α = .79 and α = .89, respectively). Internal consistency in the present sample was questionable to good (anxious: α = .82, avoidant: α = .67 and disorganised: α = .87).

[1]Prolific is an online research site used to recruit participants in exchange for money. The site has been shown to yield high quality data as participants are more diverse (and likely to be representative of the general population) and honest than on other platforms (Peer et al., 2017, 2022). Participants were paid £3.97 for participation in the current study, given the time taken to complete the questionnaires and imagery task.

[2]The number of participants was equal to the number calculated in the G*Power analysis because we screened participants in batches until we reached the required number.

**TABLE 1** Participant characteristics.

| | *N* | Percentage |
|---|---|---|
| Employment | | |
| Full-time or part-time employment | 56 | 43.5 |
| Student | 48 | 37.2 |
| Unemployed | 15 | 12.4 |
| Looking after the home or caring for family | 1 | 0.8 |
| Unable to work due to health or disability | 2 | 1.6 |
| Other situation | 3 | 2.3 |
| Prefer not to answer | 3 | 2.3 |
| Residence | | |
| Poland | 24 | 18.8 |
| Portugal | 24 | 18.8 |
| South Africa | 11 | 8.6 |
| UK and Northern Ireland | 10 | 7.8 |
| United States of America | 10 | 7.8 |
| Italy | 9 | 7 |
| Mexico | 7 | 5.5 |
| Chile | 6 | 4.7 |
| Greece | 6 | 4.7 |
| Hungary | 4 | 3.1 |
| Spain | 4 | 3.1 |
| Canada | 2 | 1.6 |
| Australia, Belgium, Czech Republic, Denmark, France, Germany, Ireland, Israel, Kazakhstan, Latvia, Norway | 11 (1 each) | 8.8 |
| Ethnicity (participant defined) | | |
| White European | 65 | 50.8 |
| Latin/Latin American/Hispanic | 14 | 11 |
| Southern European/Mediterranean | 9 | 7 |
| Eastern European/Slavic | 8 | 6.2 |
| Not registered | 8 | 6.2 |
| Other | 7 | 5.5 |
| Mixed | 5 | 3.9 |
| Non-specific European | 4 | 3.1 |
| African | 3 | 2.3 |
| Asian/East Asian | 2 | 1.6 |
| Black African | 1 | 0.7 |
| Black American | 1 | 0.7 |

*Dissociative Experiences Scale (DES-II; Carlson & Putnam, 1993)*

This is a 28-item measure of trait dissociation. Participants estimate the percentage of time they have specific dissociative experiences. The scale yields an overall dissociation score and subscale scores for amnesic dissociation, absorption and imaginative involvement and depersonalization and derealization. The scale has excellent internal consistency ($\alpha = .95$) which was also excellent in the current sample ($\alpha = .93$).

## State measures

*Continuum of auditory hallucinations—state assessment (CAHSA; Schlier et al., 2017)*
The CAHSA is a 9-item measure of state AHs. We asked respondents to indicate the "current" applicability of items (rather than over the last day) from 1 (not at all) to 7 (very much). The scale yields a total score and four subscales: vivid imagination, perceptual sensitivity, intrusive thoughts and AHs. Internal consistency has not been reported to our knowledge, but was good in the current sample ($\alpha = .80$).

*Clinician Administered Dissociative Symptom Scale — 6-item version (CADSS-6; Rodrigues et al., 2021)*[3]
This short measure of state dissociative experiences is based on the 23-item CADSS (Bremner et al., 1998), administered by a clinician in clinical settings and can be used as a self-report scale in research (Lemons & Lynn, 2016). Participants indicate how they are feeling "at this time" on a 5-point scale from 0 (no presence of dissociation) to 4 (extreme presence of dissociation). The scale yields a total dissociation score and subscale scores for depersonalization, derealization and amnesia. Internal consistency for the long form is excellent ($\alpha = .94$), not reported for the 6-item version (Rodrigues et al., 2021), and was acceptable in the present sample ($\alpha = .78$).

*Brief paranoia checklist (BPC; Schlier et al., 2016)*
The BPC is a 5-item measure of state paranoia. Participants indicate how much each item applies to them "at the moment" from 1 (not at all) to 5 (very much). The scale has good internal consistency ($\alpha = .88$) which was also good in the current sample ($\alpha = .83$).

## Experimental manipulation

*Attachment imagery priming scripts*[4]
Audio imagery scripts based on traditional attachment primes (Bartz & Lydon, 2004) were adapted for people predisposed to AHs (following Sood et al., 2021). Participants are asked to remember a time when they were with another person and felt safe, secure and trusting (secure attachment) or with someone they experienced as inconsistent, unreliable and frightening (disorganised attachment). Once an image is identified, participants are prompted to close their eyes and recreate the situation as vividly as possible, focusing on all their senses.

*Manipulation checks*
Participants completed three imagery manipulation checks. They first rated the extent to which they felt safe and secure during the imagery prime (*felt security* following Luke et al., 2012) by scoring six items on a 6-point scale from 1 (not at all) to 6 (very much), yielding an average felt security score. Internal consistency is excellent ($\alpha = .97$; Sood et al., 2021) and was excellent in the current sample ($\alpha = .96$). They then rated vividness of the image on a 10-point scale from 1 (not at all) to 10 (very much), and finally estimated the percentage of time they had held the image in mind over the testing period (0–100%). The manipulation checks were used to compare pooled data between groups, and not to make inclusion/exclusion decisions for individual participants, as per our pre-registration and following other priming studies in analogue psychosis groups (e.g., Newman-Taylor et al., 2021; Sood et al., 2021, 2022).

[3]We used the short version to reduce participant burden and given that the effects of one-shot (single) primes are usually short-lived (Rowe et al., 2020).

[4]See Supplementary Material.

## Procedure

Participants accessed the study through Prolific. After providing informed consent, all completed the measure of trait AHs (LSHS) and asked whether they were currently receiving mental health support to determine eligibility. Participants were then thanked and paid for the screening assessment. Eligible participants were informed they would be contacted to take part in the full study within 4 days.

Eligible participants then received a link for the full study and were asked to complete this on a computer, alone, in a quiet space. They completed demographic and trait measures followed by a brief filler before completing state measures of dissociation, AHs and paranoia. Participants were then automatically randomly allocated (by Qualtrics) to the secure or disorganised attachment imagery condition (at a ratio of 1:1), and listened to the relevant 3-min guided imagery audio recording. They then repeated the state measures while holding the image in mind, and completed the three manipulation checks (felt security, vividness of image and percentage of time the image was held in mind). Finally, all completed a mood repair task[5] before being thanked and debriefed.

## Data analysis

We analysed the data using SPSS 26. Inspection of histograms, Q-Q plots and normality tests indicated that most variables were normally distributed, though trait AHs and dissociation were positively skewed (as expected given that the sample was screened for predisposition to AHs). Inspection of boxplots revealed nine outliers across all state variables (most in the dissociation measure), which were Winsorized and replaced with the 5th and 95th percentiles (Field, 2013). We chose to use 90% Winsorization because we expected this would sufficiently address any outliers in the dataset.

We assessed any pre-manipulation between-group differences on demographic and trait measures using paired sample *t*-tests and chi-square for gender. One-way analyses of variance (ANOVAs) were used to assess between-group differences on imagery manipulation checks.

We used mixed-model ANOVAs, with one between-participants factor (attachment imagery: secure vs. disorganised) and one within-participants factor (time: pre- vs. post-imagery [Time 1 vs. Time 2]) to test whether secure attachment imagery reduced state AHs, dissociation and paranoia, compared to disorganised attachment imagery.

Using PROCESS v.3 (Hayes, 2017) for SPSS, we examined whether attachment imagery affected state AHs and paranoia via dissociation. We covaried Time 1 scores while modelling Time 2 scores (Hayes, 2018) and covaried paranoia in the AHs model, and vice versa to account for any shared variance between these variables. We inferred indirect effects using percentile bootstrapping, with 5000 bootstrapped samples that produced 95% confidence intervals (CI) for each indirect effect. Mediation is observed when the CIs do not straddle zero (Hayes, 2018).

# RESULTS

## Pre-manipulation differences between groups

Table 2 provides descriptive statistics for demographic and trait measures. There were no between-group differences in age ($t$ (126) = 0.76, $p$ = .94), gender ($X^2$ (3, 128) = 1.102, $p$ = .78), trait predisposition to AHs ($t$ (126) = −0.09, $p$ = .93), anxious attachment ($t$ (126) = 0.01, $p$ = .99), avoidant attachment, ($t$ (126) = 0.40, $p$ = .69), disorganised attachment ($t$ (126) = − 0.72, $p$ = .47) or trait dissociation ($t$ (126) = −0.41, $p$ = .68) — the groups were comparable on all demographic and trait measures prior to imagery manipulation.

[5]The mood repair task consisted of asking participants for the five best things in their life.

**TABLE 2** Descriptive statistics for demographic and trait measures across conditions.

| | Secure (*N* = 66) | Disorganised (*N* = 62) |
|---|---|---|
| | *M* (*SD*) | *M* (*SD*) |
| Age | 24.56 (6.64) | 24.47 (7.22) |
| Auditory hallucination predisposition | 25.14 (5.89) | 25.22 (5.16) |
| Anxious attachment | 1.50 (0.64) | 1.50 (0.73) |
| Avoidant attachment | 1.68 (0.58) | 1.64 (0.51) |
| Disorganised attachment | 1.23 (0.70) | 1.31 (0.63) |
| Dissociation | 26.03 (15.43) | 27.11 (14.43) |

**TABLE 3** Descriptive statistics for state measures pre- and post-imagery manipulation.

| | Secure (*N* = 66) | | Disorganised (*N* = 62) | |
|---|---|---|---|---|
| | Time 1 | Time 2 | Time 1 | Time 2 |
| | *M* (*SD*) | *M* (*SD*) | *M* (*SD*) | *M* (*SD*) |
| State hallucinations | | | | |
| Auditory hallucinatory experiences (total) | 4.06 (1.17) | 4.00 (1.25) | 4.00 (1.09) | 3.97 (1.20) |
| Vivid imagination | 4.65 (1.46) | 4.81 (1.53) | 4.84 (1.47) | 4.81 (1.62) |
| Perceptual sensitivity | 4.14 (1.71) | 3.96 (1.89) | 4.09 (1.70) | 4.19 (1.85) |
| Intrusive thoughts | 4.57 (1.52) | 4.42 (1.62) | 4.58 (1.42) | 4.39 (1.68) |
| Auditory hallucinations | 2.90 (1.57) | 2.78 (1.72) | 2.51 (1.38) | 2.47 (1.27) |
| State dissociation | | | | |
| State dissociation (total) | 3.32 (3.65) | 4.99 (4.28) | 3.08 (3.06) | 5.41 (3.79) |
| Derealisation | 1.18 (1.61) | 1.91 (1.70) | 1.08 (1.51) | 2.10 (1.67) |
| Depersonalisation | 0.91 (1.47) | 1.44 (1.68) | 0.92 (1.26) | 1.78 (1.65) |
| Amnesia | 1.27 (1.36) | 1.68 (1.68) | 1.10 (1.40) | 1.58 (1.57) |
| State paranoia | | | | |
| Paranoia | 9.43 (4.69) | 8.34 (3.91) | 10.39 (4.48) | 10.53 (4.97) |

*Note*: Time 1 = pre-imagery; Time 2 = post-imagery.

Table 3 provides the descriptive statistics for state measures in the two conditions, pre- (Time 1) and post- (Time 2) imagery manipulation.

## Attachment imagery manipulation checks

There were no differences between secure and disorganised conditions in the percentage of time the image was held in mind ($t(126) = 1.24$, $p = .22$) or vividness of the image ($t(126) = 1.34$, $p = .18$). Felt security was successfully manipulated ($t(112.51) = 6.97$, $p = .01$), with the secure group ($M = 4.88$, $SD = 1.10$) reporting higher security than the disorganised group ($M = 3.27$, $SD = 1.47$).

**TABLE 4** Mixed-model ANOVAs for state measures.

| | Effect of time | | Effect of imagery | | Interaction: Imagery × time | |
|---|---|---|---|---|---|---|
| | *F* (1,126) | *p* | *F* (1,126) | *p* | *F* (1,126) | *p* |
| State hallucinations | | | | | | |
| Auditory hallucinatory experiences (total) | 2.43 | .12 | 0.05 | .82 | 0.11 | .73 |
| Vivid imagination | 1.14 | .29 | 0.12 | .73 | 2.06 | .15 |
| Perceptual sensitivity | 0.24 | .62 | 0.08 | .77 | 3.33 | .07 |
| Intrusive thoughts | 4.22 | .07 | 0.00 | .96 | 0.07 | .84 |
| Auditory hallucinations | 1.00 | .32 | 1.88 | .17 | 0.26 | .61 |
| State dissociation | | | | | | |
| Dissociation (total) | 71.53 | .001** | 0.02 | .88 | 1.93 | .17 |
| Derealisation | 49.75 | .001** | 0.02 | .87 | 1.37 | .24 |
| Depersonalisation | 43.02 | .001** | 0.47 | .50 | 2.44 | .12 |
| Amnesia | 15.94 | .001** | 0.33 | .57 | 0.11 | .74 |
| State paranoia | | | | | | |
| Paranoia | 3.33 | .07 | 3.25 | .07 | 20.40 | .02* |

*$p < .05$; **$p < .001$.

## Main analyses

### State auditory hallucinations

There was no main effect of condition ($F$ (1,126) = 1.88, $p$ = .17), time ($F$ (1,126) = 1.00, $p$ = .32) or condition × time interaction ($F$ (1,126) = 0.26, $p$ = .61) on state AHs (see Table 4).

### State dissociation

There was no main effect of condition ($F$ (1,126) = 0.02, $p$ = .88) or condition × time interaction ($F$ (1,126) = 1.93, $p$ = .17) on state dissociation, but there was an effect of time ($F$ (1,126) = 71.53, $p < .001$, $\eta_p^2 = 0.39$; see Table 4). Dissociation increased from Time 1 to Time 2 in both secure ($t$ (65) = −5.30, $p$ = .001, $d$ = 0.43) and disorganised ($t$ (61) = −7.41, $p$ = .001, $d$ = 0.75) conditions (see Figure 1).

### State paranoia

There was no main effect of condition ($F$ (1,126) = 3.25, $p$ = .07) or time ($F$ (1,126) = 3.33, $p$ = .07) on state paranoia, but there was a condition × time interaction ($F$ (1,126) = 20.40, $p$ = .02; see Table 4). The two conditions did not differ in state paranoia at Time 1 ($F$ (1(126) = 1.02, $p$ = .31), but did differ at Time 2 ($F$ (1(126) = 4.80, $p$ = .03). Paranoia decreased from Time 1 to Time 2 in the secure condition ($t$ (65) = 2.56, $p$ = .01, $d$ = 0.21), but did not change in the disorganised condition ($t$ (61) = −0.43, $p$ = .67; see Figure 1).

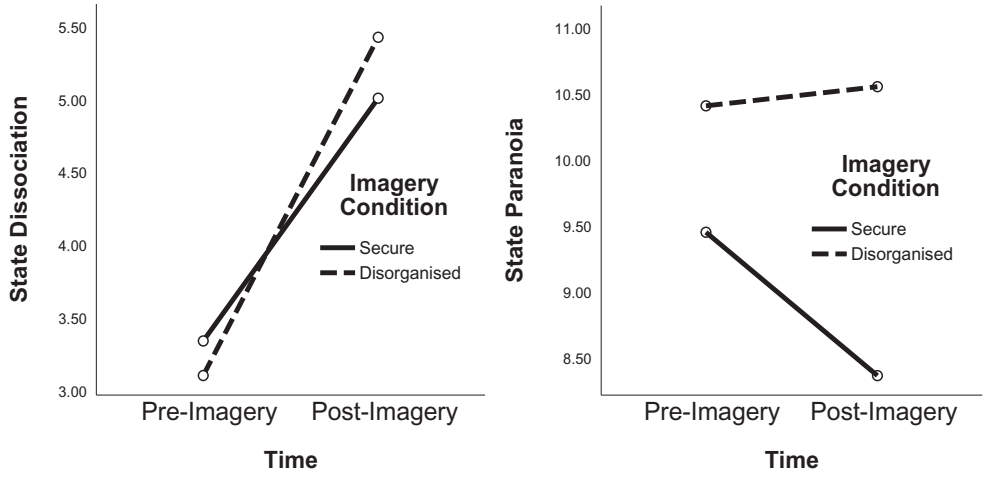


**FIGURE 1** State dissociation and paranoia pre- and post-imagery manipulation.

## Mediation analyses

Both secure and disorganised attachment imagery increased state dissociation, which was positively correlated with state AHs and state paranoia pre- and post-imagery (see Supplementary Material), meeting the criteria for mediation analysis (Hayes, 2017).

We first tested whether dissociation mediated the effect of attachment imagery (secure vs. disorganised) on AHs (see Figure 2). There was no direct effect of attachment imagery on AHs ($b = -.05$, SE = 0.15, 95% CE = −0.35, 0.24) and no indirect effect of attachment imagery on AHs via dissociation ($ab = 0.03$, SE = 0.04, 95% CE = −0.01, 0.16). The total effect of secure/disorganised imagery on AHs was negative and non-significant ($b = -0.02$, SE =0.15, 95% CE = −0.32, 0.27), suggesting that attachment imagery had no effect on voice hearing.

We then tested whether dissociation mediated the effect of attachment imagery on paranoia (see Figure 3). There was a direct effect of attachment imagery on paranoia ($b = 1.25$, SE = 0.46, 95% CE = 0.33, 2.17), though there was no indirect effect via dissociation ($ab = 0.01$, SE = 0.07, 95% CE = −0.15, 0.17). The total effect of secure/disorganised imagery on paranoia was positive and significant ($b = 1.26$, SE = 0.46, 95% CE = 0.35, 2.17), suggesting that attachment imagery had an effect on paranoia, though not via dissociation.

## Exploratory analysis

Given the unexpected results and based on the cognitive-attachment model of voices (Berry et al., 2017) we then used PROCESS to run an exploratory mediation analysis to test whether trait dissociation mediated the association between trait disorganised attachment and state AHs (pre-prime), with trait anxious and avoidant attachment styles as covariates (see Figure 4). Dissociation mediated the association between trait disorganised attachment and state AHs prior to imagery manipulation. While the total effect of trait disorganised attachment on state AHs was insignificant ($b = 0.27$, SE = 0.29, 95% CE = −0.44, 0.70), trait disorganised attachment predicted trait dissociation ($b = 5.74$, SE = 2.74., 95% CE = 0.31, 11.17) and trait dissociation predicted state AHs ($b = 0.05$, SE = 0.01, 95% CE = 0.03, 0.06). There was no direct effect of trait disorganised attachment on state AHs ($b = -0.14$, SE = 0.27, 95% CE = −0.66, 0.39), though there was an indirect effect of trait disorganised attachment on state AHs via dissociation ($ab = 0.27$, SE = 0.14, 95% CE = 0.01, 0.37), suggesting that the association between disorganised attachment and state AHs was statistically fully accounted for by trait dissociation.

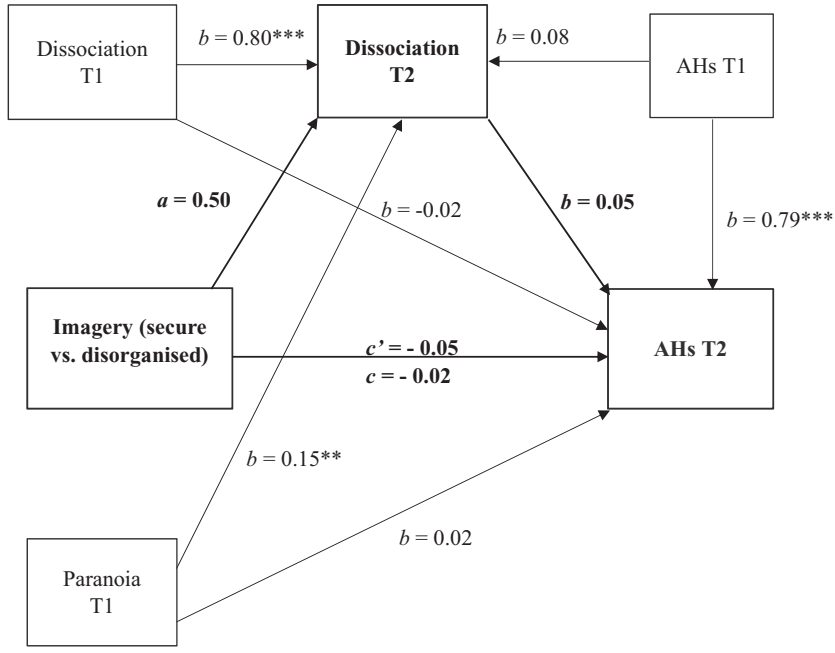


**FIGURE 2** The effect of attachment imagery on auditory hallucinations via dissociation. T1 = Time 1, pre-imagery; T2 = Time 2, post-imagery. AHs = auditory hallucinations. Path c' denotes the direct effect, and path c denotes the total effect. Estimated path coefficients are unstandardized. The indirect effect (ab) is reported in the text. $^{**}p < .01$; $^{**}p < .01$; $^{***}p < .001$.

## DISCUSSION

We examined the impact of secure and disorganised attachment imagery priming on dissociation and AHs in an analogue sample highly predisposed to voice hearing. We predicted that primed disorganised attachment would increase state AHs via state dissociation, compared with primed secure attachment. Contrary to our hypotheses, attachment imagery did not affect state AHs. Both secure and disorganised attachment imagery increased state dissociation. Secure attachment imagery reduced state paranoia, but this was not mediated by dissociation.

The groups did not differ on demographic or trait variables, and the manipulation checks showed comparable ratings for the vividness of imagery and percentage of time the image was held in mind, and expected differences in felt security — participants in the secure condition felt more secure than those in the disorganised condition. These results suggest that observed changes in dissociation, AHs and paranoia can be attributed to the attachment imagery priming, and we can be confident that observed effects are causal given the experimental design and randomisation to condition.

The planned analyses did not support the proposition that activation of a disorganised attachment style would increase state AHs via increased state dissociation. However, an exploratory mediation analysis revealed that *trait* dissociation fully accounted for the association between *trait* disorganised attachment and pre-imagery state AHs. This suggests that *an enduring disorganised attachment style* may lead to an increase in voices for people *already predisposed to dissociation*. This has implications for our understanding of voice-hearing, particularly for people vulnerable to dissociation (cf. Berry et al., 2017). Our results are consistent with good evidence for an association between trait dissociation and AHs (Longden et al., 2020), correlational research showing that trait dissociation mediates the association between fearful attachment (as a proxy for disorganised attachment) and AHs (Williams, 2017), and preliminary findings that treating dissociation may reduce voice severity (Varese et al., 2021).

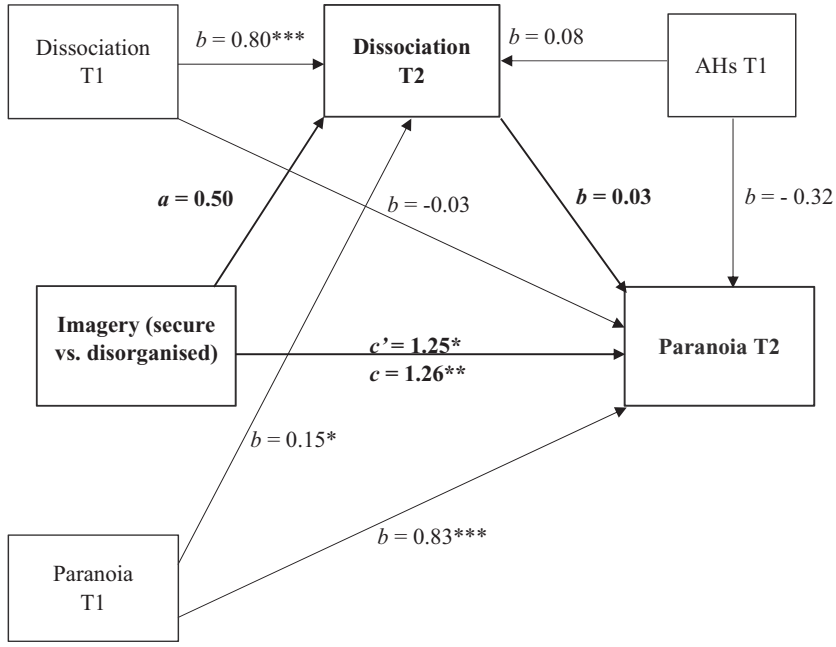


**FIGURE 3** The effect of attachment imagery on paranoia via dissociation. T1 = Time 1, pre-imagery; T2 = Time 2, post-imagery. AHs = auditory hallucinations. Path c' denotes the direct effect, and path c denotes the total effect. Estimated path coefficients are unstandardized. The indirect effect (ab) is reported in the text. *$p < .05$; **$p < .01$; ***$p < .001$.

State dissociation increased over time in both imagery conditions (rather than just the disorganised condition, as predicted). While unexpected, this is consistent with research showing that script-driven imagery may trigger a dissociative physiological response in people with a diagnosis of borderline personality disorder (Bichescu-Burian et al., 2017), and that imagery rescripting may trigger dissociation in people with psychosis (Paulik et al., 2020). The increase in dissociation in the disorganised condition is consistent with the cognitive-attachment model of voices (Berry et al., 2017) which predicts that those high in trait disorganised attachment habitually dissociate in response to stress. The finding that secure attachment imagery increased dissociation raises potential clinical concerns. We are not aware of other attachment priming studies that have examined dissociation in people vulnerable to voices, other mental health analogue groups, or clinical groups. It is possible that the prime prompted a mild increase in dissociation with participants 'tuning out' of wider present moment awareness while 'tuning in' to the imagery task. Alternatively, the increase in dissociation might be due to secure images provoking distress in people with trauma histories (akin to fear of compassion; Gilbert et al., 2011). However, this has not been seen in previous priming studies which have recruited participants with high non-clinical paranoia, in which secure attachment priming is consistently associated with increased felt security (Newman-Taylor et al., 2021; Sood et al., 2021, 2022). The current study is the first to examine secure attachment priming in people vulnerable to voice-hearing, and future priming studies should control for past trauma (and linked beliefs).

State paranoia reduced from pre- to post-imagery in the secure imagery condition as predicted, though no change was seen in the disorganised condition. This is consistent with previous research showing that secure attachment priming reduces paranoia (Sood et al., 2021, 2022; Sood & Newman-Taylor, 2020). In the current study, the effect was found in a sample highly predisposed to AHs who had not been selected for elevated levels of paranoia, indicating that the effect of attachment security priming on paranoia is replicable and robust.

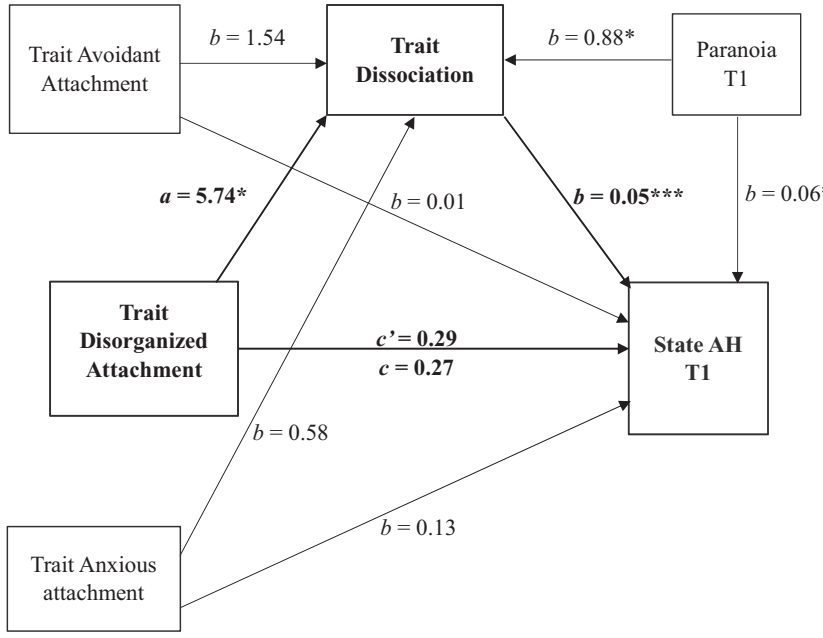


**FIGURE 4** The effect of trait disorganised attachment on state auditory hallucinations via trait dissociation. T1 = Time 1, pre-imagery; T2 = Time 2, post-imagery. AHs = auditory hallucinations. Path c' denotes the direct effect, and path c denotes the total effect. Estimated path coefficients are unstandardized. The indirect effect (ab) is reported in the text. *$p < .05$; ***$p < .001$.

## Limitations

The main limitation of the present study is the question of whether we effectively primed disorganised attachment. While we can be confident that the conditions diverged in terms of felt security, this does not mean that that the disorganised prime was necessarily valid (despite being based on validated measures of disorganised attachment). Future studies should include a neutral priming condition and/or additional attachment style-specific manipulation checks. A further limitation is the sensitivity of the state AHs and dissociation measures (CAHSA and CADSS-6); both demonstrate reliability but may lack the sensitivity needed to capture changes over short time frames. Linked to this, the CADSS-6 has not been fully validated (though internal consistency for our sample was acceptable). Finally, our findings are limited by the representativeness of the sample; most participants were White and employed or in education, and all were recruited via an online research platform — this group may not reflect the wider clinical population.

## Research and clinical implications

We suggest that future research further examine the role of trait dissociation in the association between disorganised attachment and AHs. If disorganised attachment, assessed using self-report questionnaires or activated experimentally, is shown to increase AHs in people already vulnerable to dissociation, we will need to refine cognitive models of voice-hearing, and target dissociation in intervention studies (cf. Longden et al., 2012; Varese et al., 2021).

The current study shows that security priming is effective in reducing paranoia in people highly predisposed to AHs (and not selected for elevated levels of paranoia). If replicated in clinical groups, attachment imagery could be used to reduce fears and distress associated with AHs rather than the

frequency or severity of AHs. Importantly, this is in line with cognitive-behavioural and other psychological approaches to psychosis that prioritise distress and quality of life over symptom reduction.

The increase in dissociation following both types of attachment imagery also has research and potential clinical implications. If replicated, it would be sensible to assess vulnerability to dissociation in clinical settings, particularly if using imagery techniques (for example in trauma work) and be ready to facilitate means of managing dissociation so that people can benefit from imagery-based psychological therapies (cf. Paulik et al., 2020).

Finally, we note the growing number of attachment priming studies targeting attenuated psychotic-type experiences. As far as we are aware, these are all separate datasets which may in time facilitate meta-analyses.

## Conclusion

This is the first study to examine the impact of secure and disorganised attachment priming on dissociation and AHs. Secure (vs. disorganised) attachment imagery reduced state paranoia but not state AHs and the impact on paranoia was not mediated by state dissociation. These findings suggest that secure attachment imagery may be useful in reducing fears and distress associated with voices rather than effecting change in voices directly (cf. Moran et al., 2021). The increase in state dissociation across conditions suggests that we should assess vulnerability to dissociation when using imagery in clinical practice, and be prepared to support people to manage this if required.

We also found that an enduring disorganised attachment style may lead to increased AHs for people predisposed to dissociation. This suggests that trait attachment and dissociation should be assessed in clinical settings and incorporated into psychological formulation and treatment plans where these factors are likely to be linked to psychosis. Additionally, dissociation may be targeted in therapy where indicated by the formulation, as a means of supporting people to address vulnerability to distressing voices.

### AUTHOR CONTRIBUTION

Joseph Puckett — conceptualisation, methodology, data curation, investigation, formal analysis, writing (original draft preparation, review and editing). Monica Sood and Katherine Newman Taylor — conceptualisation, methodology, supervision, writing (review and editing).

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### CONFLICT OF INTEREST STATEMENT

None.

### DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

### ETHICAL APPROVAL

This work has been carried out in accordance with the Declaration of Helsinki. Informed consent was obtained from all participants and privacy rights were observed throughout.

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## SUPPORTING INFORMATION

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