Short Communication

When words and pictures come alive: Relating the modality of intrusive thoughts to modalities of hypnagogic/hypnopompic hallucinations

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ABSTRACT

Hypnagogic and hypnopompic (H&H) hallucinations are those experienced on the borders of sleep and waking. Intrusive thoughts have been proposed to relate to the occurrence of such experiences. In a sample of students (N = 299), the present study investigated the relation between auditory and felt-presence H&H experiences, and specific modalities of intrusive thought (auditory and visual) whilst controlling for age, gender, depression, anxiety and thought suppression. The psychometric properties of the Durham Hypnagogic and Hypnopompic Hallucinations Questionnaire (DHQ) were also examined. Exploratory (N = 299) and, in a second sample, confirmatory (N = 502) factor analyses showed good internal and test–retest reliability for the auditory and felt-presence subscales of the DHQ, but not for the visual subscale. Regression analyses indicated that the sole predictor of auditory H&H hallucinations was intrusive auditory imagery, and the sole predictor of felt-presence H&H experiences was intrusive visual imagery. Explanations for these findings are considered and implications for future research are discussed.

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1. Introduction

Hypnagogic and hypnopompic (H&H) hallucinations are perceptual experiences occurring in the state of drowsiness when going to sleep or waking up, respectively. These experiences can take many forms including hearing one’s name being called, seeing faces, animals, or people, as well as experiencing the presence of another person or being. H&H experiences have been found to have a prevalence of 18% in the general population (Ohayon, 2000), and 85% in student populations (Jones, Fernyhough, & Meads, 2009). Understanding the causes of these experiences may help shed light on the cognitive mechanisms underpinning clinically relevant hallucinations.

We recently developed a new tool for assessing the presence of H&H experiences, the Durham Hypnagogic and Hypnopompic Hallucinations Questionnaire (DHQ: Jones et al., 2009). The first aim of the present article (Section 2 below) was to examine the psychometric properties of the DHQ, including an examination of its test–retest reliability and confirmatory factor analysis to test its proposed three-factor structure.

Our second aim (Section 3 below) was to test a model of potential causative variables in the aetiology of H&H hallucinations. It has been proposed (Jones et al., 2009) that thought suppression and intrusive thoughts may play a role in the generation of H&H hallucinations, with suppressed thoughts rebounding intrusively in the period surrounding sleep. Building on findings of relations between intrusive thoughts and H&H hallucinations in both correlational (Jones et al., 2009) and experimental (Schmidt & Gendolla, 2008) studies, the present study aimed to examine whether the modality of intrusive thoughts (auditory/visual) relates to the modality of any H&H hallucinations experienced. We hypothesised that intrusive auditory imagery would correlate with levels of auditory, but not visual or felt-presence H&H hallucinations, and that intrusive visual imagery would correlate with visual, but not auditory or felt-presence H&H hallucinations. Given that both depression and anxiety are positively associated with intrusive thoughts (e.g., Höping & Jong-Meyer, 2003), and that thought suppression has been found to relate to H&H hallucinations, we controlled for these variables.

2. Study 1: Psychometric properties of the DHQ

2.1. Method

2.1.1. Participants

In order to test the factor structure of the DHQ, 299 university students at a UK university (85 female), with a mean age of 20.63 years (SD = 4.9, range = 18–50), who accepted an e-mail invitation to participate, completed the DHQ. A further sample of UK
university students (N = 502, 329 female), with a mean age of 19.6 years (SD = 1.5, range = 17–24), completed a revised version of the DHQ (DHQ-R). In this second sample, participants were required to enter an anonymous code allowing a subset of them (N = 116, 81 female), with a mean age of 20.1 years (SD = 1.4, range = 18–24), to complete the questionnaires for a second time approximately 3 months later, for the purposes of assessing test–retest reliability. No financial incentive was given for participation. Ethical approval was obtained from the University Departmental Ethics Committee.

2.1.2. Measures and procedure

The Durham Hypnagogic and Hypnopompic Hallucinations Questionnaire (DHQ; Jones et al., 2009) was completed on-line, previously shown to be a reliable way of collecting psychopathology data (Jones, Fernyhough, De-Wit, & Meins, 2008). The DHQ is a 14-item instrument that assesses the presence of auditory, visual and felt-presence H&H hallucinations. Items are scored on a six-point Likert scale ranging with scores calculated for three subscales derived by factor analysis: auditory (DHQaud), visual (DHQvis), and felt presence H&H experiences (DHQpres).

2.2. Results

Using AMOS 7.0, confirmatory factor analysis was performed on the DHQ data (N = 299) to test its three-factor structure (Jones et al., 2009). As data for all three DHQ scales was non-normally distributed, fit was adjudged using Bentler and Yuan’s (1999) F statistic (TF), a modification of the asymptotically distribution free (ADF) statistic which performs well with non-normal data. A three-factor solution, even after allowing correlated errors (between error terms of items on the same factor, suggested by modification indices), differed significantly from the data, TF (73, 226) = 1.42, p < .01 [F(ADF) (73) = 136.81, p < .001, GFI = .91, CFI = .83, RMSEA = .05 (90% CI = .05–.07)].

An exploratory factor analysis using principal components analysis with oblique rotation was then performed to investigate the factor structure of the DHQ in the same sample. Three eigenvalues in excess of one were found (5.06, 2.17 and 1.06), accounting for 59.29% of the variance. Although Kaiser’s rule suggested the extraction of three factors, scree plot inspection and parallel analysis using a Monte Carlo analysis with 1000 repetitions suggested that two factors should be extracted. Items were required to load >.5 onto a factor, and not to cross-load >.3, in order to contribute to a factor. The first factor was found to consist of all five DHQaud items identified by Jones et al. (2009). The second factor was made up of all four original DHQpres items identified by Jones et al. (2009), plus two visual H&H items (items 3 & 9). The confirmatory factor analysis thus failed to replicate the previously identified three-factor structure of the DHQ due to the visual and felt-presence items not forming distinct factors.

As the original DHQaud and DHQpres items loaded most strongly onto the two factors identified, we reanalysed the DHQ data after excluding all visual H&H items. An exploratory factor analysis found two eigenvalues over 1 (3.54, 2.08) which explained 62.48% of the variance. Kaiser’s rule, scree plot analysis, and a parallel analysis using a Monte Carlo analysis with 1000 repetitions, all suggested the extraction of two factors. These corresponded to the original DHQaud and DHQpres factors of Jones et al. (2009) with all items loading uniquely onto a single factor, and not cross-loading. The failure of DHQpres items to form a separate factor in the first analysis appeared to be a function of the lower prevalence of endorsement of DHQpres items relative to DHQaud or DHQvis experiences. Indeed, of the four items on the DHQ that over two-thirds of participants said they had never experienced, three were visual items. These findings suggest that the visual H&H items may best be used as non-scored filler items, not forming a distinct factor. For this reason our findings are henceforth given for solely the DHQaud and DHQpres subscales, and we refer to this alternate scoring system as the revised DHQ (DHQ-R).

The DHQ-R was then administered to the second sample (N = 502) to examine its psychometric properties. A confirmatory factor analysis was performed to test the DHQ-R’s two-factor structure. As the DHQaud and DHQpres were non-normally distributed, fit was again adjudged using Bentler and Yuan’s (1999) F statistic (TF). Both one-factor, TF (27, 475) = 6.26, p < .001 [F(ADF) (27) = 178.37, p < .001, GFI = .89, CFI = .61, RMSEA = .11 (90% CI = .09–.12)] and two-factor, TF (26, 476) = 2.35, p < .001 [F(ADF) (26) = 64.38, p < .001, GFI = .96, CFI = .90, RMSEA = .05 (90% CI = .04–.07)] solutions were significantly different to the data. After allowing for correlated errors between error terms on the same factor (Byrne, Shavelson, & Muthén, 1989), as suggested by modification indices (items 5&6, 5&8 and 4&10), the two-factor solution was not significantly different to the data, TF (23, 479) = 1.41, n.s. [F(ADF) (23) = 33.92, n.s., GFI = .98, CFI = .97, RMSEA = .03 (90% CI = .00–.05)].

The DHQaud, $z = .81$, and the DHQpres, $z = .85$, subscales showed satisfactory internal reliability. Both the DHQaud, $r(114) = .71$, p < .001, and the DHQpres, $r(114) = .72$, p < .001, showed satisfactory test–retest reliability.

2.3. Discussion of Study 1

The three-factor structure of the DHQ was not supported. The lower rate of endorsement of visual items, as compared to auditory or felt-presence items, was likely the reason for this. A revised version of the DHQ (DHQ-R) which retains, but does not score, visual H&H items was found to have a clear two-factor structure (auditory and felt-presence), with each of these subscales showing good internal and test–retest reliability. The DHQ-R hence appears to have superior psychometric properties to the original DHQ.

3. Study 2: Relation of modality of mental imagery to modality of H&H experiences

3.1. Method

3.1.1. Participants, measures and procedure

Data for Study 2 were obtained from the 299 university students who took part in the first phase of Study 1, who completed further on-line questionnaires as follows:

3.1.1.1. White Bear Suppression Inventory (WBSI; Wegner & Zanakos, 1994). This in 15-item self-report measure of tendency to suppress thoughts, each item is scored on a five-point Likert scale. Several factor analyses have confirmed that the WBSI measures both thought suppression and intrusive thoughts, and following Jones and Fernyhough (2006) two subscales of the WBSI were employed, intrusive thoughts (WBSIintru) and thought suppression (WBSIsup).

3.1.1.2. Hospital Anxiety and Depression Scale (HADS: Zigmond & Snaith, 1983). This 14-item scale consists of a seven-item anxiety subscale and a seven-item depression subscale. Items are scored on a four-point Likert scale, with higher scores (potential range 0–28) representing higher levels of anxiety/depression. This scale has been shown to have satisfactory psychometric properties (ibid).

3.1.1.3. Intrusive visual imagery (McCarthy-Jones, Knowles, & Rowse, in preparation). This 10-item scale assesses intrusive visual imagery. Items include “I have images in my mind that I cannot stop”
3.1.1.4. Intrusive verbal imagery (McCarthy-Jones et al., in preparation). This 10-item scale specifically assesses intrusive verbal imagery. Items include “I have verbal thoughts in my mind that I cannot stop” and “There are some words or phrases that enter my head without me being able to avoid it”. Items are scored on a five-point Likert scale ranging from “Strongly agree” to “Strongly disagree”. Higher scores (potential range 10–50) represent higher levels of intrusive verbal thought. This tool has been found to have satisfactory internal and test–retest reliability (ibid).

3.2. Results

Descriptive statistics are presented in Table 1. Correlational analyses are presented in Table 2. The specificity of intrusive thought modality to DHQaud was investigated using multiple linear regression. DHQaud was entered as the dependent variable, with age, gender, anxiety, depression, and WBSI sup entered in the first step, and intrusive visual imagery, intrusive verbal imagery, and the mean-centred interactions between intrusive visual imagery × anxiety, intrusive verbal imagery × depression, intrusive visual imagery × anxiety, and intrusive verbal imagery × depression, entered in a second step. The first step was significant, $F(5,293) = 3.34, R^2 = .05, p < .01$. The second step was also significant, $F(6,287) = 4.43, \Delta R^2 = .08, p < .001$, with the overall model also being significant, $F(11,287) = 4.04, R^2 = .13, p < .001$. The only significant predictor in the final model was intrusive visual imagery score, $\beta = .30, p < .001$.

These analyses were then repeated with DHQpres as the dependent variable. The first step was significant, $F(5,293) = 6.94, R^2 = .10, p < .001$, as was the second step, $\Delta F(6,287) = 6.84, \Delta R^2 = .06, p < .01$, with the overall model also being significant, $F(11,287) = 5.25, p < .001$. The only significant predictor in the final model was intrusive visual imagery scores, $\beta = .24, p < .01$.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (SD)</th>
<th>Internal reliability (z)</th>
</tr>
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<tbody>
<tr>
<td>DHQaud</td>
<td>4.59 (4.54)</td>
<td>.80</td>
</tr>
<tr>
<td>DHQpres</td>
<td>4.16 (4.34)</td>
<td>.85</td>
</tr>
<tr>
<td>WBSI sup</td>
<td>33.91 (6.79)</td>
<td>.83</td>
</tr>
<tr>
<td>Intrusive verbal imagery</td>
<td>19.55 (8.40)</td>
<td>.90</td>
</tr>
<tr>
<td>Intrusive visual imagery</td>
<td>20.81 (7.59)</td>
<td>.87</td>
</tr>
<tr>
<td>HADS anxiety</td>
<td>8.19 (4.07)</td>
<td>.82</td>
</tr>
<tr>
<td>HADS depression</td>
<td>4.25 (3.26)</td>
<td>.71</td>
</tr>
</tbody>
</table>

Table 2

Partial correlations (controlling for age and gender, $N = 299$).

<table>
<thead>
<tr>
<th></th>
<th>DHQaud</th>
<th>DHQpres</th>
<th>WBSI sup</th>
<th>IVVis</th>
<th>IIverb</th>
<th>HADS anxiety</th>
<th>HADS depression</th>
</tr>
</thead>
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<td>DHQaud</td>
<td>1</td>
<td>.27*</td>
<td>.05</td>
<td>.18</td>
<td>.31*</td>
<td>.18</td>
<td>.21*</td>
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<td>–</td>
<td>1</td>
<td>.16</td>
<td>.33*</td>
<td>.24*</td>
<td>.31*</td>
<td>.26*</td>
</tr>
<tr>
<td>WBSI sup</td>
<td>–</td>
<td>–</td>
<td>1</td>
<td>.54*</td>
<td>.45*</td>
<td>.50*</td>
<td>.34*</td>
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<tr>
<td>Intrusive verbal imagery</td>
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<td>–</td>
<td>–</td>
<td>1</td>
<td>.58*</td>
<td>.53*</td>
<td>.37*</td>
</tr>
<tr>
<td>Intrusive visual imagery</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>1</td>
<td>.48*</td>
<td>.40*</td>
</tr>
<tr>
<td>HADS anxiety</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>1</td>
<td>.65*</td>
</tr>
<tr>
<td>HADS depression</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>1</td>
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*p < .001 (i.e., ~.05/21).
References


