Loneliness and current environmental context are associated with false perceptions regarding social relations

Phil Reed, Sherlyn Tshering, & Siti Wahab

Swansea University

Correspondence address: Phil Reed,

Department of Psychology,

Swansea University,

Singleton Park,

Swansea, SA2 8PP, UK.

e-mail: p.reed@swansea.ac.uk

Short title: Hallucinations and loneliness.

Abstract

The consequences of loneliness include anxiety, depression, and chronic illnesses, but little is known about its association with cognitive distortions. Three experiments investigated the effect of loneliness, and current context, on the content of false perceptions. 446 participants completed psychometric tests (UCLA Loneliness scale, Hospital Anxiety and Depression Scales, and a Schizotypy scale), and a word-detection task. The word-detection task explored the effects of 'lonely' and 'neutral' contexts (Experiments 1 and 2), as well as 'positive social' contexts (Experiment 3), on false perceptions. In all experiments, participants reporting higher loneliness reported more false perceptions with a 'lonely' content, but only when in a context reflecting a 'lonely' theme. The results show current environmental context and individuals' psychological state combine to affect false perception content. That such findings are found with loneliness, when controlling for depression, anxiety, and schizotypy, show the degree to which this state can distort cognition and perception.

Keywords: loneliness; false perception; cognitive distortion; hallucination content.

Loneliness is a commonly experienced, distressing emotion, involving individuals perceiving themselves to be alone and socially-isolated (Eglit, Palmer, Martin, Tu, & Jeste, 2018). The consequences of loneliness can be severe, including anxiety (Eglit et al., 2018; Sündermann, Onwumere, Kane, Morgan, & Kuipers, 2013), depression (Cacioppo, Hawkley, & Thisted, 2010; Russell, Cutrona, Rose, & Yurko, 1984), chronic illnesses, such as cardiovascular diseases (Cacioppo et al., 2002; Caspi, Harrington, Moffitt, Milne, & Poulton, 2006), suicidal ideation (Teo et al., 2018), and early mortality (Luo & Waite, 2014; Steptoe, Shankar, Demakakos, & Wardle, 2013; Tilvis, Laitala, Routasalo, & Pitkälä, 2011). Loneliness also has been associated with psychoses in clinical samples (da Rocha, Rhodes, Vasilopoulou, & Hutton, 2017; Slotema, Bayrak, Linszen, Deen, & Sommer, 2019). However, little is known about the extent to which loneliness is associated with cognitive distortions or false perceptions in nonclinical samples.

An example of a cognitive distortion is an hallucination, defined as a perceptual experience in the absence of an external stimulus (APA, 2013). Such false perceptions occur in many conditions, and are reported by non-clinical samples (Barrett & Etheridge, 1992; Cella, Taylor, & Reed, 2007; Posey & Losch, 1983). They can be studied experimentally through examining responses to a word-detection task (Randell, Goyal, Saunders, & Reed, 2011; Tsakanikos & Reed, 2005). Participants identify words in a fast-moving sequence of animated images displaying both real words, and non-word letter-stings, by calling out words they see. Words called out but not actually presented are called false perceptions. An individual's temperament and situational context determine the number and theme of false perceptions. Individuals with higher levels of a clinical, or personality, trait, such as schizotypy, have an

increased tendency to report false perceptions (Randell et al., 2011). The current study examined whether those reporting high loneliness would report more false perceptions.

The content of hallucination has been rarely researched despite its clinical significance (Cook, 2015; Reed & Clarke, 2014; Skirrow, Jones, Griffiths & Kaney, 2002). Reed and Clarke (2014) used the above word-detection task to examine the impact of context on hallucinations. Two forms of the task, each containing different words, were administered: one with religiously-themed words, and one neutral words. Individuals high in religiosity reported more false perceptions than those with lower religiosity scores, but only in the religiously-themed context. The current study explored the effects of the theme of the task on false perceptions for those with lower and higher loneliness scores.

Experiment 1

The first experiment compared false perceptions emitted by individuals scoring lower and higher on the UCLA loneliness scale, using the previously employed word-detection task (Reed & Clarke, 2014). Participants were presented with a word-detection task with either a 'lonely' or 'neutral' context of words. The suggestion was that the 'context' of loneliness would produce more loneliness-related false perceptions by those who were lonely.

Method

Participants

One hundred participants (69 female; 31 males) were recruited after responding to advertisements placed around a university campus. As the initial study was exploratory, so this

number of participants was thought sufficient to examine, as this was the number used by Reed

and Clarke (2014) in their study of context and false perceptions. The mean age was 22.85

(*SD*±4.95; range=18-52). All participants had either normal or corrected-to-normal vision, and

none reported any current or history of psychiatric problems. Ethical permission was given by

the Department of Psychology Ethics Committee at the University, and all participants gave

informed consent.

Apparatus and Materials

   University of California, Los Angeles (UCLA) Loneliness Scale (Russell, Peplau, &

Ferguson, 1978) determines feelings of loneliness and social isolation. Participants rate 20 items

from 'never' to 'often, and the total score ranges from 0-60. The internal reliability (*α*) ranges

between .89-.94.

   The Oxford-Liverpool Inventory of Feelings and Experiences - Brief (OLIFE-B;

Mason, Linney, & Claridge, 2005) measures levels of schizotypy. It comprises four sub-scales:

unusual experiences (UE), cognitive disorganisation (CD); introvertive anhedonia (IA); and

impulsive nonconformity (IN), and its total can be used to indicate level of schizotypy. It

consists of 43 items to which participants respond 'yes' or 'no'. The total score has a range of

between 0 and 43, and has an internal reliability of between .62-.80. The total schizotypy score

was used as the main function of this measure was to control for the presence of schizotypy, each

of the subscales themselves have been shown to have connections to cognitive distortions, and

analyses of multiple subscales would require very large samples.

   Hospital Anxiety and Depression Scales (HADS; Zigmond & Snaith, 1983) measures

depression and anxiety through 14-items (7 depression; 7 anxiety). Responses on a 0-3 scale are

summed for anxiety and depression scales, giving a range of 0 to 21 for each scale. HADS has

an internal reliability between of .83 for HADS-A and .82 for HADS-D. This measure was used

to control for the influence of anxiety and depression, as they, in themselves, have been

associated with cognitive distortions and hallucinations, and are associated with loneliness.

Word detection Task: Word-detection tasks were presented in PowerPoint. Each word-

detection slide comprised four pink discs, one in each quadrant of the screen, with five or six

black capital letters inside each disc. Each slide was presented for 600ms, with a 1000ms black

slide presented in between. There were 84 trials; 42 containing one real word in one of the four

discs, and letter-strings in each of the other discs; and 42 trials containing only letter-strings.

The real-word and non-word slides were presented in a random order, and the position of the

real-word on the screen was random between participants. The real words used were simple

English words. All words and non-words were matched in terms of length. All words in

'lonely' and 'neutral' conditions were one standard deviation above or below the average of the

used words in frequency using a logarithmic combine measure of the English frequency

vocabulary (Zeno, Ivens, Millard, & Duvvuri, 1995).

In the 'lonely' context, real words were chosen to give a sense of loneliness. To analyze

whether the content of these words implied 'loneliness' a list of words, and a five-point rating

scale, was sent to 80 students at University, who were asked to rate each word according to how

'lonely', or 'social' they thought it was (Randell et al., 2011). Forty-three responses were

returned, and the mean rating for each word calculated. Twenty-one words with mean loneliness

ratings above 3, and 'social' ratings below 2, were chosen (empty, give up, astray, alone,

dumped, apart, enemy, single, split, quiet, lonely, silent, unwed, remote, loner, rival, aloof, cut

off, muted, reject and ignore). Twenty-one neutral words with mean ratings below 2 on each

scale served as the real-words in the neutral context.

Procedure

Participants were seated in a quiet room and tested individually. They were instructed

verbally on the task, and instructions were also displayed on the screen prior to the word-

detection task. Participants were randomly assigned to 'lonely' or 'neutral' group. During the

word-detection task, all words called out by participants were recorded for each trial. The words

reported by the participants that were not present in the slides were recorded as 'false

perceptions'. These were then coded as a 'lonely' or not by two independent raters (if there was

disagreement, it was presented to a third rater). Following the word-detection task, participants

were asked to complete the questionnaires.

Results and Discussion

----Table 1----

Table 1 shows the means (standard deviations) for the loneliness (UCLA), schizotypy

(OLIFE), depression (HADS-D), and anxiety (HADS-A) scores for the sample.

----Table 2----

Table 2 shows the mean (standard deviation) number of 'lonely' false perceptions made,

as well as the number of words correctly identified, and the total number of false perceptions, in

each group. These data are shown for the sample split at the median UCLA score to create a

lower-loneliness (N=48, mean=12.63$\pm$6.89; range=1-24) and higher-loneliness group (N=52,

mean=34.99$\pm$9.51; range=25-57). A mean split was used as this approach has been adopted in

previous examinations of this area (Randell et al., 2011; Reed & Clarke, 2014), and as it is unclear whether relationships between loneliness and false perceptions would display linear or step functions. A group design is neutral with regard to this issue, but a regression analysis assumes a linear relationship (Osborne et al., 2008). The 'lonely' context group, scoring higher in terms of loneliness, emitted more 'lonely-related' false perceptions. An analysis of covariance (ANCOVA) with context (lonely versus non-lonely) and loneliness (lower versus higher) as between-subject factors, and schizotypy (OLIFE), depression (HADS-D), and anxiety (HADS-A) as covariates revealed no main effects of context, $F<1$, $\eta^2_p=.003[95\%CI=.000:.061]$, $pH_0/D=.890$, or loneliness, $F<1$, $\eta^2_p=.002[.000:.055]$, $pH_0/D=.860$, but there was a significant interaction, $F(1,93)=4.93$, $p=.029$, $\eta^2_p=.050[.001:.157]$, $pH_1/D=.570$. Simple effects revealed no difference between lower and higher loneliness groups in the non-lonely context, $F<1$, $\eta^2_p=.005[.000:.069]$, $pH_0/D=.897$, but higher loneliness scores emitted more lonely-themed false perceptions in the lonely context, $F(1,93)=4.80$, $p=.046$, $\eta^2_p=.049[.000:.155]$, $pH_1/D=.6.34$.

Comparing the number of words correctly identified reveals little effect of context or loneliness. An ANCOVA (context x loneliness) with schizotypy, depression, and anxiety as covariates, revealed no main effects of context, $F(1,93)=1.11$, $p=.295$, $\eta^2_p=.012[.000:.087]$, $pH_0/D=.850$, or loneliness, $F(1,93)=1.03$, $p>.30$, $\eta^2_p=.011[.000:.085]$, $pH_0/D=.852$, and no interaction, $F(1,93)=2.27$, $p=.135$, $\eta^2_p=.023[.000:.112]$, $pH_0/D=.751$. Similarly, there was little effect of context or loneliness on the total number of false perceptions. An ANCOVA (condition x loneliness) with schizotypy, depression, and anxiety as covariates revealed no main effects of context, $F<1$, $\eta^2_p=.004[.000:.064]$, $pH_0/D=.871$, or loneliness, $F<1$, $\eta^2_p=.005[.000:.072]$, $pH_0/D=.885$, and no interaction, $F(1,93)=1.45$, $p=.108$ $\eta^2_p=.015[.000:.095]$, $pH_0/D=.821$.

----Figure 1----

Figure 1 shows the number of lonely-related false perceptions as a percentage of all false perceptions for lower and higher loneliness scorers in both contexts. This measure was used so that the relative occurrence of false perceptions with 'lonely-related' content, for each individual, could be examined irrespective of the actual number of false perceptions. A participant might emit 6 lonely-related false perceptions out of 100, whereas another might emit 2 out of 4 – the latter, despite having fewer actual lonely-related false perceptions, would emit a greater proportion of those false perceptions with a lonely theme). A greater percentage of false perceptions were related to loneliness, when lonely people were in the lonely context. An ANCOVA (context x loneliness) with schizotypy, depression, and anxiety as covariates, revealed no main effects of context, $F(1,93)=2.10$, $p=.137$, $\eta^2_p=.022[.000:.109]$, $pH_0/D=.776$, or loneliness, $F(1,93)=2.24$, $p=.137$, $\eta^2_p=.023[.000:.112]$, $pH_0/D=.752$, but there was a significant interaction, $F(1,93)=4.32$, $p=.041$, $\eta^2_p=.044[.001:.147]$, $pH_1/D=.509$. Simple effects revealed no difference between lower and higher loneliness groups in the non-lonely context, $F<1$, $\eta^2_p=.001[.000:.043]$, $pH_0/D=.896$, but higher loneliness scorers emitted more lonely-themed false perceptions in the lonely context, $F(1,93)=5.98$, $p=.016$, $\eta^2_p=.060[.002:.171]$, $pH_1/D=.692$.

Experiment 2

Experiment 1 found that lonely individuals were more likely to produce lonely-related false perceptions than non-lonely individuals, but only when in a 'lonely' context. These results suggest that the environmental context plays a role, along with the individual's state, in producing false perceptions (Randell et al., 2011; Reed & Clarke, 2014). Experiment 2

attempted to corroborate this finding using a within-subject design, in which individuals experienced both 'lonely' and 'neutral' contexts.

Method

Eighty-two participants (40 female; 42 males) were recruited, as described in Experiment 1. The mean age was 24.87±4.08 (range=18-39). G-Power calculation for a mixed-model interaction, with a small-medium effect size as in Experiment 1 (f = .20), 80% power, and a rejection criterion of $p < .05$, indicated 80 participants would be needed. All had either normal or corrected-to-normal vision, and none reported any current or history of psychiatric problems. The apparatus and materials were as described in Experiment 1. The procedure was as described in Experiment 1, with the exception that the word-detection task was within-subject, and all participants received both 'lonely' and 'neural' conditions (randomized across participants).

Results and Discussion

----Table 3----

Table 3 shows the means (standard deviations) for the loneliness (UCLA), schizotypy (OLIFE), depression (HADS-D), and anxiety (HADS-A) scores for the sample. Inspection of these data reveal that this sample had slightly lower levels of all measures than that of Experiment 1. However, with the exception of the relationship between loneliness and schizotypy, the pattern of correlations between the variables was similar to that in Experiment 1, although with lower correlation values.

----Table 4----

Table 4 shows the mean (standard deviation) number of 'lonely' false perceptions, words correctly identified, and total number of false perceptions, made in each condition. These data are shown for the sample split at the median UCLA score, to create a lower-loneliness (N=45, mean=7.80±4.32; range=0-15) and higher-loneliness group (N=37, mean=24.65±7.61; range=16-45). As in Experiment 1, those with higher loneliness emitted more lonely-related false perceptions in the lonely context. A mixed-model ANCOVA with loneliness (lower versus higher) as a between-subject factor, context (lonely versus neutral) as a within-subject factor, and schizotypy, depression, and anxiety as covariates, revealed no main effects of context, $F<1$, η^2_p=.010[.000:.093], pH_0/D=.890, or loneliness, $F(1,77)$=4.65, p=.060, η^2_p=.057[.000:.178], pH_0/D=.580, but there was a significant interaction, $F(1,77)$=4.70, p=.033, η^2_p= 058[.001:.179], pH_1/D=.581. Simple effects revealed no difference between lower and higher loneliness groups in the non-lonely context, $F<1$, η^2_p=.001[.000:.046], pH_0/D=.831, but higher loneliness scores emitted more lonely-themed false perceptions in the lonely context, $F(1,77)$=5.79, p=.018, η^2_p=.070[.001:.197], pH_1/D=.686.

There was little effect of context or loneliness on correctly identified words. An ANCOVA (loneliness x context), with schizotypy, depression, and anxiety as covariates revealed no main effects of context, $F(1,77)$=2.34, p=.130, η^2_p=.029[.000:.134], pH_0/D=.729, or loneliness, $F<1$, η^2_p=.010[.000:.093], pH_0/D=.899, and no interaction, $F<1$, η^2_p=.009[.000:.090], pH_0/D=.858. There was little effect of context or loneliness on the total number of false perceptions. An ANCOVA (condition x loneliness) with schizotypy, depression, and anxiety as covariates revealed no main effects of context, $F<1$, η^2_p=.009[.000:.090], pH_0/D=.859, or loneliness, $F(1,77)$=3.43, p=.068, η^2_p=.042[.000:.156], pH_0/D=.610, and no interaction, $F<1$, η^2_p=.006[.000:.082], pH_0/D=.873.

----Figure 2----

Figure 2 shows the number of lonely-related false perceptions as a percentage of all false perceptions for lower and higher loneliness scorers in both contexts. A numerically greater percentage of false perceptions were related to loneliness when lonely people were in the lonely context. An ANCOVA (context x loneliness), with schizotypy, depression, and anxiety as covariates, revealed no main effect of context, $F<1$, $\eta^2_p=.003[.000:.066]$, $pH_0/D=.885$, a main effect of loneliness, $F(1,77)=11.51$, $p<.001$, $\eta^2_p=.130[.023:.271]$, $pH_1/D=.971$, but no interaction, $F(1,77)=1.82$, $p=.181$, $\eta^2_p=.023[.000:.122]$, $pH_0/D=.777$. Simple effects revealed no difference between lower and higher loneliness groups in the non-lonely context, $F(1,77) = 2.29$, $p = .134$, $\eta^2_p = .028[.000:.133]$, $pH_0/D = .731$, but higher loneliness scores emitted more lonely themed false perceptions in the lonely condition than the lower loneliness scores, $F(1,77) = 10.51$, $p = .002$, $\eta^2_p = .120[.018:.259]$, $pH_1/D = .954$.

Experiment 3

The preceding experiments demonstrated that being in a lonely-context produces more false perceptions for lonely individuals. Experiment 3 further explored this effect by including a third group in which participants were exposed to a 'social' context, in which words reflected positive social interactions, in addition to groups exposed to 'lonely' and 'neutral' contexts. This study was conducted to determine if socially-themed words, as opposed to 'lonely-themed' words, would impact false perceptions in people who reported more loneliness.

Method

Two hundred and sixty-four participants (149 female; 115 male) were recruited as described in Experiment 1. G-Power calculation for a mixed-model interaction, with a small-medium effect size as in Experiment 1 (f' = .20), 80% power, and a rejection criterion of $p < .05$, indicated 244 participants would be needed. The mean age was 24.12 ($\pm$ 4.58; range = 18-51). All participants had either normal or corrected-to-normal vision, and none reported any current or history of psychiatric problems. The apparatus and materials were as described in Experiment 1. The procedure was as described in Experiment 1, with the exception that the participants were randomly divided into three groups for the word detection task. One group received the 'lonely' condition, and a second group received the 'neutral' words, as described in Experiment 1. The third group received 'Social' words representing positive social concepts, determined as described in Experiment 1 (friend, social, couple, unite, famous, group, noisy, family, loved, valued, chatty, lively, praise, worthy, mingle, civil, engage, feast, active, buddy and fiesta).

Results and Discussion

----Table 5----

Table 5 shows the means (standard deviations) for the loneliness (UCLA), schizotypy (OLIFE), depression (HADS-D), and anxiety (HADS-A) scores for the sample.

----Table 6----

Table 6 shows the mean (standard deviation) number of 'lonely' false perceptions, words correctly identified, and total number of false perceptions made in each context. These data are shown for the sample split at the median of the UCLA scores to create a lower-loneliness (N=150, mean= 8.98$\pm$5.43; range=0-18) and higher-loneliness group (N=114,

mean=31.07$\pm$9.62; range=19-56). Those who were in the lonely context, and scored higher in terms of loneliness, emitted more lonely-related false perceptions. An ANCOVA (context x loneliness), with schizotypy, depression, and anxiety as covariates, revealed a main effect of context, $F(2,255)=10.93$, $p<.001$, $\eta^2_p=.024[.024:.143]$, $pH_1/D=.994$, not for loneliness, $F(1,255)=3.39$, $p=.061$ $\eta^2_p=.009[.000:.045]$, $pH_0/D=.785$, but there was a significant interaction, $F(2,255)=3.24$, $p=.041$, $\eta^2_p=.025[.000:.069]$, $pH_1/D=.632$. Simple effects revealed no difference between lower and higher loneliness groups in the social context, $F<1$, $\eta^2_p=.001[.000:.020]$, $pH_0/D=.937$, or neutral context, $F<1$, $\eta^2_p=.003[.000:.028]$, $pH_0/D=.933$, but higher loneliness scores emitted more lonely themed false perceptions in the lonely context, $F(1,255)=4.72$, $p=.030$, $\eta^2_p=.013[.001:.054]$, $pH_1/D=.944$.

There was little effect of context or loneliness on words correctly identified. An ANCOVA (loneliness x context), with schizotypy, depression, and anxiety as covariates, revealed no main effects of context, $F(2,255)=1.37$, $p=.154$, $\eta^2_p=.001[.000:.014]$, $pH_0/D=.948$, or loneliness, $F(1,255)=1.94$, $p=.254$, $\eta^2_p=.007[.000:.041]$, $pH_0/D=.863$, and no interaction, $F(2,255)=2.44$, $p=.099$, $\eta^2_p=.019[.000:.059]$, $pH_0/D=.955$. There was little effect of context or loneliness on the total number of false perceptions. An ANCOVA (context x loneliness), with schizotypy, depression, and anxiety as covariates, revealed no main effects of context, $F<1$, $\eta^2_p=.002[.000:.021]$, $pH_0/D=.996$, or loneliness, $F<1$, $\eta^2_p=.001[.000:.015]$, $pH_0/D=.941$, and no interaction, $F<1$, $\eta^2_p=.005[.000:.031]$, $pH_0/D=.992$.

----Figure 3----

Figure 3 shows the number of lonely-related false perceptions expressed as a percentage of all false perceptions for lower and higher loneliness scorers in all groups. These data show a greater percentage of false perceptions were related to loneliness when lonely people were in the

lonely condition. An ANCOVA (context x loneliness) with schizotypy, depression, and anxiety as covariates, revealed a significant main effect of context, $F(2,255)=19.52$, $p<.001$, $\eta^2_p=.1328[.061:.207]$, $pH_1/D=.999$, no main effect of loneliness, $F(1,255)=2.12$, $p=.138$, $\eta^2_p=.008[.000:.043]$, $pH_0/D=.838$, but an interaction, $F(2,255)=5.53$, $p=.004$, $\eta^2_p=.042[.004:.094]$, $pH_1/D=.507$. Simple effects revealed no difference between lower and higher loneliness groups in the social context, $F<1$, $\eta^2_p=.001[.000:.022]$, $pH_0/D=.909$, or neutral context, $F<1$, $\eta^2_p=.001[.000:.023]$, $pH_0/D=.935$, but higher loneliness scores emitted more lonely themed false perceptions in the lonely condition than the lower loneliness scores, $F(1,255)=10.13$, $p=.001$, $\eta^2_p=.038[.006:.094]$, $pH_1/D=.913$.

These data replicated the effects reported in Experiments 1 and 2, but demonstrated that the exposure to socially-themed words (as opposed to lonely-themed words) had little effect on the perception of those who were lonely. This finding is in line with previous studies that have demonstrated that when the individuals' state and their present context are congruent, they report more false perceptions consistent with the context and state.

General Discussion

The current series of studies demonstrated that loneliness can be associated with distorted perceptions, when lonely individuals are placed in a context that has a 'lonely' theme. These data extend the literature on the cognitive effects of loneliness (Cacioppo et al., 2010; Eglit et al., 2018; Sündermann et al., 2013). They also corroborate findings from previous studies showing that hallucinatory content can be understood as a joint product of individuals' states and their current context (Randell et al., 2011; Reed & Clarke, 2014). That these findings were noted on a

nonclinical sample suggests the potential pervasiveness of the effects of loneliness on cognitive style and distortions. They also imply that once an individual is lonely, then exposure to contexts which are congruent with that state, may serve to potentiate perceptions of loneliness, making the situation worse.

It was suggested that a 'lonely' context would lead to false perceptions regarding loneliness for those scoring high on a loneliness scale. A context may provide a framework for cognitive processing (Phillips & Singer, 1997), and the current study supports the view that activation of beliefs and values through environmental contexts influences the content of the individual's false perceptions (Reed & Clarke, 2014). Lonely contexts may have activated stored beliefs, and, when individuals processed ambiguous letter-strings in a context of 'loneliness', they more likely perceived a lonely-related word. In order for such priming to occur, individuals must hold the relevant beliefs or traits (Higgins, 1996). Therefore, individuals scoring high on loneliness were effectively primed, and more influenced, by their context.

The current findings replicated previous associations between anxiety and loneliness (Eglit et al., 2018; Sündermann et al., 2013), and depression and loneliness (Cacioppo et al., 2010; Russell et al., 1984). However, the effects of loneliness on false perceptions were independent of these psychological correlates of loneliness. Loneliness was also found to correlate to some extent with schizotypy, again corroborating previous findings regarding loneliness and personality disorders (da Rocha et al., 2017; Slotema et al., 2019). That the association between loneliness and false perceptions was independent of schizotypy is important to notes, given the strong associations previously noted between these variables (Tsakanikos & Reed, 2005)

Conclusions

These data support a view that context influences hallucinatory content, especially when the context is personally relevant. This extends previous clinical findings regarding the effects of prolonged exposure to particular contexts on hallucinatory content, and demonstrates that short-term contextual exposure also affects content. The current data show a potentially negative impact of loneliness on cognitive distortions in a nonclinical sample, highlighting the need to address loneliness to improve mental health.

References

American Psychiatric Association. (2013).Diagnostic and statistical manual of mental disorders (5th ed.). Arlington, VA: Author.

Barrett, T.R., & Etheridge, J.B. (1992). Verbal hallucinations in normals, I: People who hear 'voices'. *Applied Cognitive Psychology*, *6*(5), 379-387.

Cacioppo, J., Hawkley, L., & Thisted, R. (2010). Perceived social isolation makes me sad: 5-year cross-lagged analyses of loneliness and depressive symptomatology in the Chicago Health, Aging, and Social Relations Study. *Psychology and Aging*, *25(2)*, 453-463.

Cacioppo, J., Hawkley, L., Crawford, L., Ernst, J., Burleson, M., & Kowalewski, R., et al. (2002). Loneliness and health: Potential mechanisms. *Psychosomatic Medicine*, *64(3)*, 407-417.

Caspi, A., Harrington, H., Moffitt, T., Milne, B., & Poulton, R. (2006). Socially isolated children 20 years later. *Archives of Pediatrics & Adolescent Medicine*, *160*(8), 805.

Cella, M., Taylor, K., & Reed, P. (2007). Violation of expectancies produces more false positive reports in a word detection task in people scoring high in unusual experiences scale. *Personality and Individual Differences*, *43*(1), 59-70.

Cook, C. (2015). Religious psychopathology: The prevalence of religious content of delusions and hallucinations in mental disorder. *International Journal of Social Psychiatry*, *61*(4), 404-425.

da Rocha, B.M., Rhodes, S., Vasilopoulou, E., & Hutton, P. (2018). Loneliness in psychosis: a meta-analytical review. *Schizophrenia Bulletin*, *44*(1), 114-125.

Eglit, G., Palmer, B., Martin, A., Tu, X., & Jeste, D. (2018). Loneliness in schizophrenia: Construct clarification, measurement, and clinical relevance. *PLOS ONE*, *13*(3), e0194021.

Luo, Y., & Waite, L. (2014). Loneliness and mortality among older adults in China. *The Journals of Gerontology Series B: Psychological Sciences And Social Sciences*, *69*(4), 633-645.

Mason, O., Linney, Y., & Claridge, G. (2005). Short scales for measuring schizotypy. *Schizophrenia Research*, *78*(2-3), 293-296.

Osborne, L.A., McHugh, L., Saunders, J., & Reed, P. (2008). Parenting stress reduces the effectiveness of early teaching interventions for autistic spectrum disorders. *Journal of Autism and Developmental Disorders*, *38*(6), 1092.

Posey, T. B., & Losch, M. E. (1983). Auditory hallucinations of hearing voices in 375 normal subjects. *Imagination, Cognition and Personality*, *3*(2), 99-113.

Randell, J., Goyal, M., Saunders, J., & Reed, P. (2011). Effect of a context of concrete and abstract words on hallucinatory content in individuals scoring high in schizotypy. *Journal of Behavior Therapy And Experimental Psychiatry*, *42*(2), 149-153.

Reed, P., & Clarke, N. (2014). Effect of religious context on the content of visual hallucinations in individuals high in religiosity. *Psychiatry Research*, *215*(3), 594-598.

Russell, D., Cutrona, C. E., Rose, J., & Yurko, K. (1984). Social and emotional loneliness: an examination of Weiss's typology of loneliness. *Journal of Personality and Social Psychology*, *46*(6), 1313.

Russell, D., Peplau, L. A., & Ferguson, M. L. (1978). Developing a measure of loneliness. *Journal of personality assessment*, *42*(3), 290-294.

Skirrow, P., Jones, C., Griffiths, R., & Kaney, S. (2002). The impact of current media events on

hallucinatory content: The experience of the intensive care unit (ICU) patient. *British

Journal Of Clinical Psychology*, *41*(1), 87-91.

Slade, P. D., & Bentall, R. P. (1988). *Sensory deception: A scientific analysis of hallucination*.

London: Croom Helm.

Slotema, C. W., Bayrak, H., Linszen, M. M., Deen, M., & Sommer, I. E. C. (2019).

Hallucinations in patients with borderline personality disorder: characteristics, severity,

and relationship with schizotypy and loneliness. *Acta Psychiatrica Scandinavica*, *139*(5),

434-442.

Steptoe, A., Shankar, A., Demakakos, P., & Wardle, J. (2013). Social isolation, loneliness, and

all-cause mortality in older men and women. *Proceedings of The National Academy Of

Sciences*, *110*(15), 5797-5801.

Sündermann, O., Onwumere, J., Kane, F., Morgan, C., & Kuipers, E. (2013). Social networks

and support in first-episode psychosis: exploring the role of loneliness and anxiety. *Social

Psychiatry And Psychiatric Epidemiology*, *49*(3), 359-366.

Teo, A. R., Marsh, H. E., Forsberg, C. W., Nicolaidis, C., Chen, J. I., Newsom, J., ... & Dobscha,

S. K. (2018). Loneliness is closely associated with depression outcomes and suicidal

ideation among military veterans in primary care. *Journal of Affective Disorders*, *230*,

42-49.

Tilvis, R., Laitala, V., Routasalo, P., & Pitkälä, K. (2011). Suffering from loneliness indicates

significant mortality risk of older people. *Journal of Aging Research*, *2011*, 1-5.

Tsakanikos, E., & Reed, P. (2005). Seeing words that are not there: Detection biases in

schizotypy. *British Journal of Clinical Psychology*, *44*(2), 295-299.

Zeno, S., Ivens, S.H., Millard, R.T., & Duvvuri, R. (1995). *The educator's word frequency guide*. Touchstone Applied Science Associates.

Zigmond, A.S., & Snaith, R.P. (1983). The hospital anxiety and depression scale. *Acta Psychiatrica Scandinavica*, *67*(6), 361-370.

Table 1: Experiment 1: Means (standard deviations) for the loneliness (UCLA), schizotypy (OLIFE), depression (HADS-D), and anxiety (HADS-A) scores, and Pearson correlations between variables.

	Mean (SD)	OLIFE	HADS-D	HADS-A
Loneliness (UCLA)	24.25 (13.97)	.628***	.642***	.548***
Schizotypy (OLIFE)	20.19 (8.77)		.523***	.599***
Depression (HADS-D)	5.28 (3.16)			.460***
Anxiety (HADS-A)	9.73 (3.77)			

*p < .05; **p < .01; ***p < .001

Table 2: Experiment 1: Mean (standard deviation) number of words correctly identified, total and lonely false perceptions, for lower and higher loneliness groups, in the 'lonely' and 'neutral' contexts.

	Lonely			Neutral		
	Correct	Total False	Lonely False	Correct	Total False	Lonely False
Low loneliness	37.40 (2.08)	1.60 (.88)	.30 (.66)	38.50 (2.63)	1.86 (1.27)	.61 (.99)
High loneliness	38.70 (2.56)	2.23 (1.04)	.90 (.92)	38.50 (2.54)	1.77 (1.19)	.36 (.79)

Table 3: Experiment 2: Means (standard deviations) for the loneliness (UCLA), schizotypy (OLIFE), depression (HADS-D), and anxiety (HADS-A) scores, and Pearson correlations between variables.

	Mean (SD)	OLIFE	HADS-D	HADS-A
Loneliness (UCLA)	15.03 (10.35)	.196***	.440***	.268***
Schizotypy (OLIFE)	17.32 (6.24)		.396***	.602***
Depression (HADS-D)	3.95 (3.23)			.456***
Anxiety (HADS-A)	7.26 (3.64)			

*p < .05; **p < .01; ***p < .001

Table 4: Experiment 2: Mean (standard deviation) number of words correctly identified, total and lonely false perceptions, for lower and higher loneliness groups, in 'lonely' and 'neutral' contexts.

	Lonely			Neutral		
	Correct	Total False	Lonely False	Correct	Total False	Lonely False
Low loneliness	40.09 (6.75)	1.00 (1.24)	.33 (.77)	41.76 (5.86)	.91 (1.08)	.29 (.82)
High loneliness	39.35 (7.43)	1.57 (1.68)	.97 (1.30)	40.05 (6.44)	1.19 (1.28)	.38 (.55)

Table 5: Experiment 3: Means (standard deviations) for the loneliness (UCLA), schizotypy (OLIFE), depression (HADS-D), and anxiety (HADS-A) scores, and Pearson correlations between variables.

	Mean (SD)	OLIFE	HADS-D	HADS-A
Loneliness (UCLA)	18.52 (13.29)	.482***	.508***	.494*** .
Schizotypy (OLIFE)	15.50 (7.13)		.371***	.561***
Depression (HADS-D)	4.52 (3.24)			.494***
Anxiety (HADS-A)	8.20 (3.98)			

*p < .05; **p < .01; ***p < .001

Table 6: Experiment 3: Mean (standard deviation) number of words correctly identified, total and lonely false perceptions, for lower and higher loneliness groups, in 'lonely', 'neutral', and 'social' contexts'.

		Correct	Total False	Lonely False
Lonely	Lower-loneliness	36.80 (4.80)	2.00 (1.53)	.63 (.89)
	Higher-loneliness	39.08 (3.98)	1.72 (1.32)	1.24 (1.07)
Neutral	Lower-loneliness	39.25 (5.73)	1.90 (1.35)	.34 (.62)
	Higher-loneliness	38.00 (6.13)	1.72 (.88)	.38 (.62)
Social	Lower-loneliness	38.96 (4.86)	1.71 (1.29)	.51 (.82)
	Higher-loneliness	39.26 (5.50)	1.90 (1.12)	.56 (.88)

*p < .05; **p < .01; ***p < .001

Figure 1: Mean percentage of lonely-related false perceptions emitted by lower and higher loneliness scorers in lonely and neutral conditions.
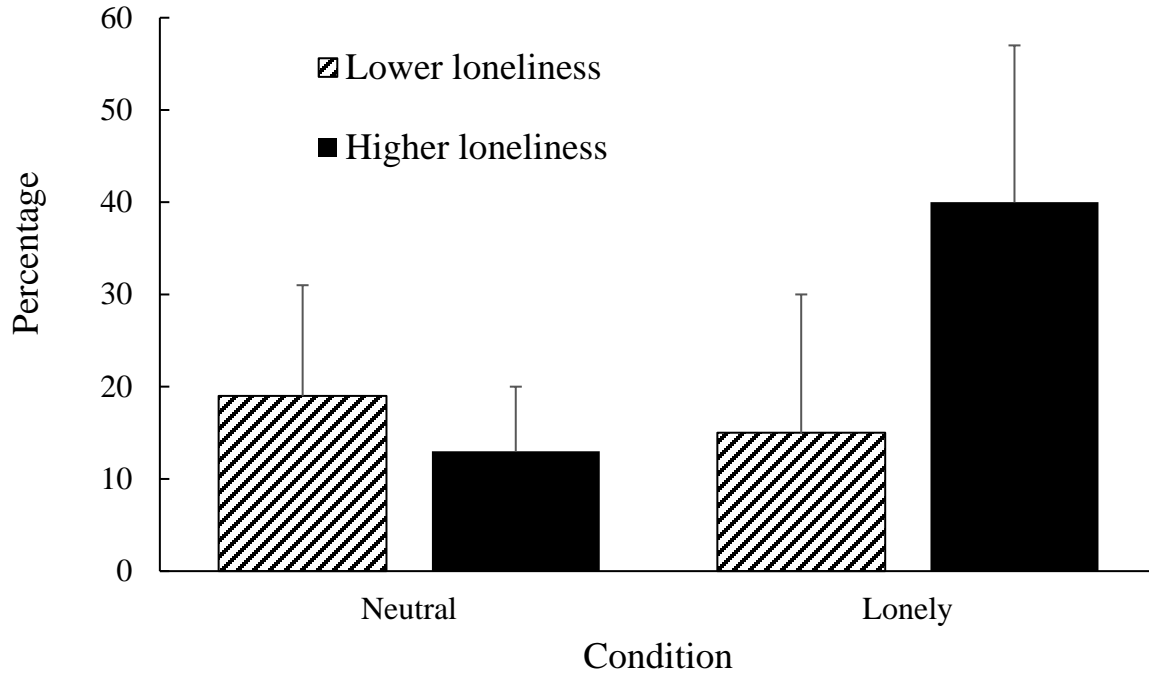
Figure 2: Mean percentage of lonely-related false perceptions emitted by lower and higher loneliness scorers in lonely and neutral conditions.
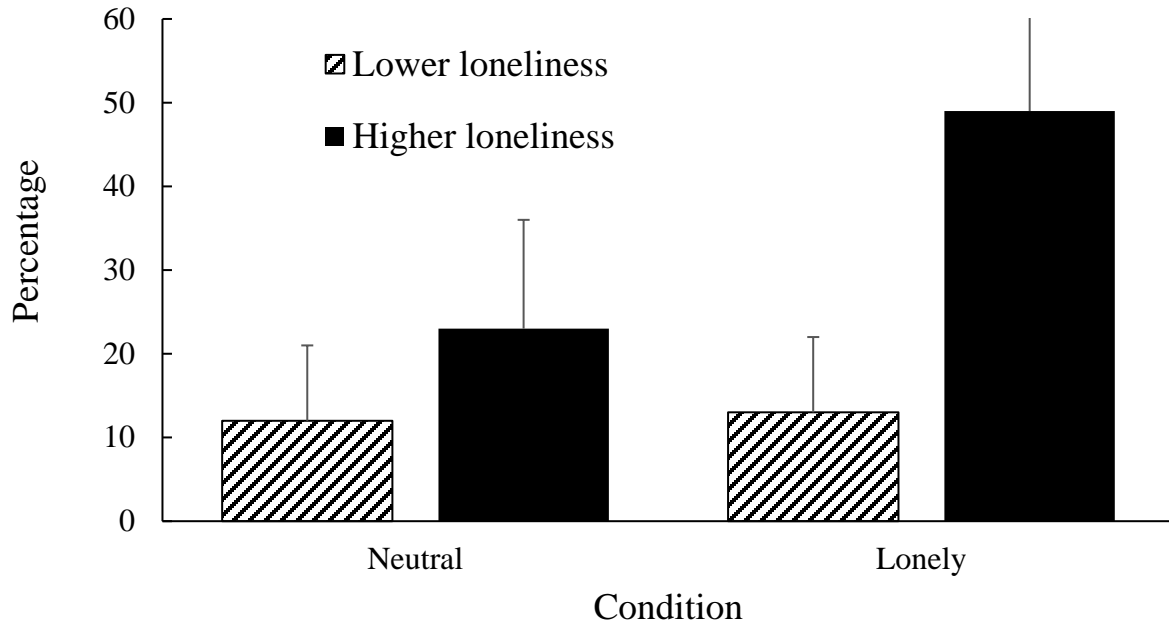
Figure 3: Mean percentage of lonely-related false perceptions emitted by lower and higher loneliness scorers in the social, lonely, and neutral conditions.