

Illusory social agents within and beyond voices: A computational linguistics analysis of the experience of psychosis

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Objectives. Psychosis has a strong social component and often involves the experience of being affected by ‘illusory social agents’. However, this experience remains under-characterized, particularly for social agents in delusions and non-vocal hallucinations. One useful approach is a form of computational linguistics called corpus linguistics that studies texts to identify patterns of meaning encoded in both the semantics and linguistic structure of the text.

Methods. Twenty people living with psychosis were recruited from community and inpatient services. They participated in open-ended interviews on their experiences of social agents in psychosis and completed a measure of psychotic symptoms. Corpus linguistics analysis was used to identify key phenomenological features of vocal and non-vocal social agents in psychosis.

Results. Social agents i) are represented with varying levels of richness in participants’ experiences, ii) are attributed with different kinds of identities including physical characteristics and names, iii) are perceived to have internal states and motivations that are different from those of the participants, and iv) interact with participants in various ways including through communicative speech acts, affecting participants’ bodies, and moving through space. These representations were equally rich for agents associated with hallucinated voices and those associated with non-vocal hallucinations and delusions.

Conclusions. We show that the experience of illusory social agents is a rich and complex social experience reflecting many aspects of genuine social interaction and is not solely present in auditory hallucinations, but also in delusions and non-vocal hallucinations.

Practitioner Points

- The experience of being affected by illusory social agents in psychosis extends beyond hallucinated voices.
- They are a rich and complex social experience reflecting many aspects of genuine social interaction.

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- These are also likely to be a source of significant distress and disability.

One of the most striking aspects of psychosis is that delusions and hallucinations are strongly social in nature and typically involve the experience of being bothered by, or interacting with, ‘illusory social agents’ (Bell, Mills, Modinos, & Wilkinson, 2017). Although there was some consideration of similar experiences in earlier literature (Cameron, 1959), only recently have these experiences been considered to be of phenomenological interest in terms of informing cognitive models of psychosis (Alderson-Day & Fernyhough, 2016; Alderson-Day et al., 2021; Bell, 2013; Leudar, Thomas, McNALLY, & Glinski, 1997; Rosen et al., 2016; Wilkinson & Bell, 2016). Notably, however, almost all of these studies have focused on hallucinated voices, rather than delusions or non-auditory experiences in psychosis, and most involve coding broad features from interviews or use survey methodology with pre-selected questions.

Traditionally, fine-grain phenomenological studies of agents in psychosis have used qualitative analysis of open-ended interview transcripts (e.g., Beavan, 2011; Corstens & Longden, 2013) or approaches from phenomenological philosophy (e.g., Humpston & Broome, 2015; Larøi, Haan, Jones, & Raballo, 2010). Both are important but, by design, rely on systematic but subjective analyses that may mean the findings are not reproducible to the same degree as quantitative analyses.

One alternative approach is a form of computational linguistics called corpus linguistics, which is the computer-aided study of the systematic patterns in texts to identify patterns of meaning encoded in both the semantics and linguistic structure of the text (McEnery & Hardie, 2011). It involves both statistical and interpretive elements, allowing for analysis of meaning while maintaining reproducibility of key results. A fundamental feature of corpus linguistics is the use of statistical tests to identify features of language that are particularly frequent in the data when compared to a reference corpus. Reference corpora are elected to represent ‘typical’ discourse, and therefore, comparison highlights distinctive features of the target text. Statistical tests are also used to identify significant patterns in the data that are further analysed using qualitative techniques, such as concordancing, which shows how specific words or phrases are used in context.

Initial studies have applied this approach to understanding the experience of hallucinated voices in psychosis. Demjén and Semino (2015) initially applied this to the experience of voices as described in a published autobiographical account and later to interviews with 40 voices hearers in an early intervention programme for psychosis (Collins et al., 2020) – reporting how linguistic features represented important features of identity and social interaction related to voice-related distress. Indeed, the social features of voices have been previously identified as being important in driving the distress and disability associated with voice hearing in psychosis (Mawson, Cohen, & Berry, 2010).

In an attempt to better understand the phenomenology of illusory social agents in psychosis, across voices and other key experiences in psychosis – namely delusions and non-vocal hallucinations – we completed 20 open-ended interviews with patients about their experience of agents in psychosis. We subsequently conducted a corpus linguistics analysis of the text to identify the types of qualities of social agents including how they are perceived to think, behave, and interact.

Method

Participants

Participants were recruited from a psychosis outpatient service and an acute psychiatric inpatient ward. Participants were invited to participate if they a) were aged 18-65; b) were identified by the clinical team as having psychosis; c) were English-language speakers; and d) had capacity to consent to the research. The study was approved by the London-Dulwich NHS Research Ethics Committee (Ref: 17/LO/0171).

For this study, 27 participants (13 women and 15 inpatients) were recruited with 20 interviews included in the final analysis. Data from seven participants were excluded because they either reported not hearing voices or experiencing delusion-like experiences or were reluctant to discuss these experiences with the interviewer.

Materials and measures

Qualitative interview

This was an open format qualitative interview led by a topic guide that included the following: experiences of hearing things that others cannot hear, characteristics of the voice/thing that is heard, nature of the relationship between the person and the voice, experience of delusions, exploration of any characters in the delusions and how the participant relates to them, and exploration of links between past experiences and delusions.

Psychotic symptom rating scales

Auditory hallucinations and delusions were measured using the Psychotic Symptom Rating Scales: Voices (PSYRATS-V) and Psychotic Symptom Rating Scales: Delusion (PSYRATS-D) scales (Haddock, McCARRON, Tarrier, & Faragher, 1999).

Demographic information

Gender, age, and ethnicity were recorded.

Procedure

Participants were interviewed in the clinic where they had outpatient appointments or in the ward in which they were an inpatient. After discussing the study and agreeing to consent, participants engaged in the open-ended interview, which was audio-recorded. Interviews were transcribed verbatim, and any references to identifiable names, addresses, and other personally identifying information were removed to create anonymized transcripts used in the analysis. In the second part, participants provided brief demographic information and completed the PSYRATS with the interviewer. The open-ended interview was completed before the PSYRATS to avoid shaping later responses.

Analysis

Anonymized verbatim transcripts were analysed using a corpus linguistics approach that combines quantitative and qualitative techniques. In particular, the software package

#*LancsBox* (version 4) was used to analyse the corpus (Brezina, McEnery, & Wattam, 2018; Brezina, Timperley, & McEnery, 2015). The #*LancsBox* analysis files minus the original transcripts have been made available on the online archive: <https://osf.io/4zwq8/>

Initial processing

Initial processing of the interview text involved corpus annotation where references to vocal illusory social agents and non-vocal illusory social agents were tagged. Tags allowed references to social agents to be identified in the text, regardless of their different linguistic forms (e.g., ‘voice’, ‘she’, ‘he’, ‘demon’). Agent tagging was initially completed by the first author and checked by one of the two other authors. Although most references to agents in language are clear, a small minority were ambiguous references and were discussed with co-researchers to agree upon the final tagging.

The final tagged transcripts were loaded into the #*LancsBox* software package for analysis. A general reference corpus was used for comparison with the interview corpus. The reference corpus is a large corpus of semi-structured interviews with people from different demographics, across a range of contexts, offering a more general representation of language behaviours in this interaction context and thereby helping us to discern what topics and features were particularly prominent in our data. The reference corpus consisted of the subset of the British National Corpus (version BNC1994) collected and labelled as Oral History Interviews (Aston & Burnard, 1998).

Keywords were identified to characterize which words were more frequent in the clinical corpus compared with the comparison corpus (Baker, 2010). We used two statistical measures to generate keywords: (i) log likelihood (LL), a test of statistical significance; and (ii) log ratio, an effect size statistic, representing the size of the difference between two corpora for each statistically significant item. We used a LL cut-off of 10.83 ($p < 0.001$) and a log ratio cut-off point of 1.5, which meant that all keywords we considered were at least three times more common in the clinical corpus.

Social agent characterization

We used the #*LancsBox* keyword in context (‘KWIC’) and collocation (‘GraphColl’) analyses to characterize the illusory social agents described in the clinical interview texts.

Types of social agents. We used the keyword in context (‘KWIC’) analysis to concordance (i.e., list each occurrence with the words surrounding it) all references to i) vocal illusory social agents, and ii) non-vocal illusory social agents. This allowed us to determine the range of references (i.e., the number of ‘types’), their frequency, and how they were used.

Qualities of social agents. To understand how social agents were described as being experienced and perceived by participants, we used collocation analysis using the #*LancsBox* GraphColl function. Collocations are combinations of words that frequently co-occur in a corpus (Brezina et al., 2015) and represent the idea that important aspects of meaning are not contained within individual words but can be found in the characteristic associations of a word (i.e., the company it keeps), including other words and structure with which it frequently co-occurs. We identified adjective collocates that highlighted

how social agents are described in the corpus, and verb collocates, which gave a sense of the activities and behaviours that social agents reportedly engaged in that were statistically more prevalent in the target text.

Subsequent to the identification of verb collocates using corpus linguistics methods, we classified them into four process types based on Halliday and Matthiessen (2014). This approach is particularly suited to identifying the properties of illusory social agents because it is designed to identify how language is used to represent agency in inner and outer experiences. The four Halliday and Matthiessen (2014) process types used to classify verb collocates were as follows:

- I. *Material processes* relate to physical action and have a material outcome. They can be either creative (i.e., brings about something new) or transformative (i.e., doing something to/changing something that already exists) processes.
- II. *Mental processes* refer to internal mental states and are grouped into four subcategories: perception (e.g., seeing, hearing), cognition (e.g., knowing), emotion, and desire/wanting.
- III. *Verbal processes* relate to communications more broadly. These can include verbs like 'scream', which indicates volume, and lie, which indicates something about the speaker's intention.
- IV. *Behavioural processes* relate specifically to physiological actions. These processes allow the distinction between mental processes (e.g., see) and the outward manifestation of these (e.g., watch). They also include physical actions for mental states (e.g., laugh, cry).

We used a collocation window of 4 words to the left and 4 words to the right of the node (e.g., the word that referred to social agents). We focused on the left collocates for adjectives on the basis that adjectives generally tend to precede referents (e.g., 'good spirit') and on the right collocates for verbs to capture actions that are most likely ascribed to the social agents (e.g., 'people insulting me'). We used the squared variant of the mutual information statistic (MI^2) to determine the strength of a collocation, with a minimum score of 3 and a minimum frequency of 5, following McEnery (2004).

Results

Demographics and PSYRATS scores

The mean age was 46.0 years. Participants in the study identified as White British ($N = 11$), British African or Caribbean ($N = 3$), White European ($N = 2$), British Asian ($N = 2$), British Latino ($N = 1$), and mixed heritage ($N = 1$). Of the total participants included in the analysis, 14 reported hearing hallucinated voices in the last two weeks allowing an assessment using the PSYRATS-V. The mean score was 19.4 with a mean length of time hearing voices of 17.4 years. Reports on the number of voices heard by participants ranged from 1 to 284 voices. Researchers identified 12 participants with delusions, with a mean PSYRATS-D score of 9.5. The mean length of time of the beliefs was 16.1 years.

Social agent characterization

Types of social agents

There were 1551 references to vocal social agents and 1365 references to non-vocal agents. For both types of agents, third person singular ('he', 'she', 'it') and plural ('they', 'them')

pronouns were the most commonly used in the corpus. The noun ‘voice(s)’ was the second most common reference ($N = 236$) to vocal social agents. Both types of agent were frequently referred to by the noun ‘people’ (vocal social agent, $N = 93$; non-vocal social agent, $N = 81$). The 10 most frequent labels associated with both tags are listed in Table 1.

Overall, the pronoun ‘they’ was the most frequent in both tags with a count of 404 for vocal social agents and 291 associated with non-vocal social agents. This pronoun was used in reference to human and supernatural illusory social agents, which were the most common type of social agents in participants’ experiences. Perdue, Dovidio, Gurtman, and Tyler (1990) suggest that plural pronouns such as ‘we’, ‘us’, ‘they’, and ‘them’ are linked to categorization of people or agents as part of ingroup or outgroup. Third person plural pronouns such as ‘they’ and ‘them’ are references for outgroup members. In the corpus, the ingroup designator ‘we’ was only used a total of 30 times and in all cases, except one, were in the context of the illusory social agents’ direct speech referencing their own collective (e.g., ‘we will kill you’, ‘we know what you’ve done’). Only one participant used the pronoun ‘we’ in reference to the activities of an army that she felt part of (‘we’re involved in new world order’).

Darics and Koller (2019) highlight that ‘elite’ social actors are likely to be represented as individuals, whereas those who are less prominent or ‘ordinary’ tend to be assimilated into collectives. Among participants whose experiences involved numerous social agents, only social agents who were experienced positively by the participants, or those who were perceived to be particularly powerful and frightening or to have higher levels of intelligence were referred to with singular pronouns. References to social agents as a group can be seen in references such as ‘voices’, ‘people’, ‘they’, and ‘them’. The male third person singular pronoun ‘he’ was more frequent in both vocal social agents and non-vocal social agents than the female equivalent ‘she’. This finding is line with the results of previous voice hearing studies, which found that although participants report hearing male, female, and children’s voices, the identity of voices was frequently described as male (Corstens & Longden, 2013; McCarthy-Jones et al., 2014).

Identities of agents

Vocal agents’ identities. In the clinical corpus, the most common type of illusory vocal social agents experienced aurally were humans, with approximately 40 different labels

Table 1. Most frequent words used to reference illusory social agents in the interview texts

Type	Frequency referring to vocal social agents	Frequency referring to non-vocal social agent
they	404	291
voice(s)	236	-
he	192	128
it	75	139
them	125	89
she	76	117
people	93	81
him	47	33
her	26	41
one(s)	32	25

(e.g., 'person', 'guy') used to describe them. The majority of these were internally individuated agents (Wilkinson & Bell, 2016) recognized by individual characteristics such as physical traits, gender, or race (e.g., 'guy very short', 'White girl') but without a named identity that would be recognized by others. Only two participants used first names to identify their vocal social agents. In both cases, although the participants heard multiple voices, only the social agents who were experienced as supportive were named. There are also several instances in the clinical corpus where social agents are aggregated into groups or referred to by a collective and represented without individuation (e.g., 'two others', 'people', 'bunch of guys').

Nearly half of the human vocal social agents were externally individuated; that is, they were associated with identities from the wider social world (Wilkinson & Bell, 2016). These included relatives, neighbours, former acquaintances, and service people from places such as cafes and public services frequented by the participant. Externally individuated illusory social agents were often referred to by their relation to another social actor (e.g., 'dad', 'sister-in-law', 'wife'). In a minority of instances, social agents were also identified by their social function or role (e.g., 'waitress', 'umpire').

Vocal social agents that were supernatural or animals were reported using just 8 and 4 labels, respectively. Supernatural beings were variously described by participants as 'demons', 'spirits', and 'ghosts'. Others were less clear on what the social agents were but felt that they were more than humans. These social agents were simply referred to as 'things', 'something' of a 'demonic nature', or part of a 'higher power'. Only one participant reported illusory social agents that were animals that spoke to him. There were a minority of instances, captured by 4 reference types (e.g., refrigerator), where participants reported hearing sounds from inanimate objects.

Non-vocal agents' identities. This encompassed experiences of illusory social agents in delusions and visual and tactile hallucinations. There were 1365 references to these agents in the clinical corpus.

Similar to the reports of vocal agents, the majority of these social agents were described as humans using approximately 45 different reference types. Of these, over half were externally individuated agents. These agents included relatives, former acquaintances, members of a former cult, and ex-partners. These agents were more often referred to by their personal names and by their relation to another social agent or the participant (e.g., 'mother-in-law', 'daughter', 'neighbour'). In several instances, illusory social agents were identified based on their social function or role (e.g., 'doctors', 'prison guards', 'telepaths', 'umpires') and specific traits, such as gender and stature (e.g., 'little boy'; 'girl', 'Black woman'). There were two instances where internally individuated agents were referred to as a collective (e.g., 'my army').

Illusory social agents described as humans but unknown to the participant were typically talked about as a collective (e.g., 'people', 'people in black jackets'). Three participants identified social agents by their first or full names (e.g., 'Jimi Hendrix', 'Robbie'). Specific names were only used in cases where the social agents were celebrities. In a minority of cases, social agents were identified by their physical traits such as age, race, and gender (e.g., 'White person', 'girl'). One participant identified the same social agent by their function ('IT guy', 'personal trainer') and in terms of their relationship to another social agent ('lover').

Supernatural beings were involved in a minority of non-aural experiences and described using 24 reference types (e.g., 'skeleton', 'spirit'). These were all, with the

exception of one, described as evil. Illusory social agents that were labelled with animal names were in the minority and described using approximately 12 reference types. These included anthropomorphous animals (e.g., ‘monkey man’, ‘mice with glasses’) and general animals (e.g., birds, slugs). A minority of experiences, captured by 11 reference types, involved social agents that were experienced as cartoon characters and animated objects (e.g., ‘popeye’, ‘dancing flashing lights’).

Intentions, behaviours, and activities of agents

This section focuses on the verb collocates of illusory social agents in a window of 0 words to the left and 4 words to the right. These collocates reflect what illusory social agents are represented as doing, and the intentions are ascribed to them by participants.

Vocal agents’ intentions, behaviours, and activities. Table 2 lists the activities vocal social agents were reported as doing, and MI² score for each lemma collocate.

Predictably, nearly half the verb collocates associated with vocal social agents were verbal processes that took place either between social agents or social agents and participants. Seven collocates (‘say’, ‘tell’, ‘talk’, ‘explain’, ‘speak’, ‘ask’, and ‘take’) represented illusory social agents as engaging in interactive conversations either with other agents or with the participants. The collocate ‘take’ was counted both as a verbal process, because in context it is a colloquial metaphorical expression denoting the voices verbally guiding the participant through something, and as a material process in accordance with the basic meaning of ‘take’. Here, basic meaning refers to a current meaning listed in the dictionary that is either more concrete (what they evoke is easier to imagine, see, hear, feel, smell, and taste), related to bodily action, or more precise, as opposed to vague (Pragglejaz Group, 2007).

Eight collocates capture verbal processes that showed illusory social agents in communicative acts that could be described as negative or unpleasant for the participants: ‘argue’, ‘shout’, ‘insult’, ‘bully’, ‘call’ (name-calling), ‘go’, ‘start’, and ‘make’. Some of these, such as insulting and bullying (by means of name-calling and spreading rumours), were particularly prominent for one participant whose experience was dominated by public shaming. The collocate ‘make’ (both a verbal and a material process) showed illusory social agents belittling participants (e.g., ‘they make rude comments about me’). ‘Start’ was used in a colloquial way to indicate the beginning or intensifying of verbal harassment from social agents (e.g., ‘they start on me even more’), while ‘goes’ was used similarly to describe the social agent narrating, and possibly discussing, passages from a bible chapter which the participant disliked because of the apocalyptic themes within.

A number of collocates represented material processes that vocal social agents performed. The collocates ‘do’, ‘keep’, ‘pull’, ‘bring’, ‘go’, ‘leave’, ‘come’, ‘make’, and ‘help’ are transformative material processes that portrayed illusory social agents as influencing participants’ mental and physical well-being and environment. Eight of these actions implicitly characterized the agents as intrusive and unwelcome characters that negatively impacted on participants’ mental well-being (e.g., ‘they *bring* me down’). Three participants reported social agents being able to physically touch them by pulling on or attacking their bodies. In addition, the negated auxiliary ‘don’t’ was frequently used to describe social agents restricting participants’ movements (e.g., ‘they *don’t* let me out’). Illusory social agents were also represented as independent beings that were able to come and go from participants’ physical and mental spaces of their own volition. The

Table 2. Activities of Vocal Social Agents. Words in bold are those that were also identified in the keyword analysis that appeared significantly more frequently in the data in comparison with the reference corpus

Verb Collocate	Value (MI ²)	Frequency in corpus	Context
Say	11.36	15	'they say different things you know the voices' – P15
Tell	10.17	8	'they're uh.. just.. .telling me how it is you know' – P4 'the voices told me that I have to leave because I'm not safe' – P1
Talk	9.59	8	'they talk amongst themselves if you like' – P10
Argue	9.121	3	'group of people that lived next door that would argue about me' – P9
Insult	8.95	1	'people insulting or bullying me' – P9
Defend	8.92	1	'he was defending me as a friend' – P9
Try	8.52	8	'they try to make trouble for me' – P8
Don't	8.18	5	'they don't let me out' – P2 'they don't really care' – P9
Go	8.18	9	'they go away sometimes' – P2 'he goes through the bible revelations with me' – P8
Know	7.85	4	'they know I'm talking about them' – P2
Shout	7.79	3	'they're shouting' – P5
Get	7.56	6	'We'll get you out of your flat if it's the last thing we do' – P3
Call	7.53	2	'she calls me names' – P8
Bring	7.51	1	'they bring me down sometimes' – P17
Can	7.24	7	'he could be American using a London accent' – P18
Want	7.21	6	'they want to protect me from bad people' – P1
Do	7.19	9	'he can do my head in' – P8
Keep	7.04	2	'he keeps disturbing my life' – P17
Make	6.95	8	'voices make me out to be inadequate' – P3 'they try and make me cry' – P4
Come	6.94	6	'she'll come and help me' – P8
Start	6.88	5	'they start on me even more' – P15
Have	6.69	8	'the voices have colour to them' – P4
Speak	6.62	4	'people speak to me in the street' – P3
Pull	6.21	2	'they will pull you' – P5
Sit	6.18	2	'he's sat there listening now' – P18
Listen	6.17	3	'they say they can listen' – P8
Kill	6.15	5	'he said kill him kill him' – P7
Laugh	5.98	4	'he is laughing through me' – P18
Leave	5.98	2	'he won't leave me alone' – P17
Think	5.91	5	'he goes pahaha at whatever he thinks is funny' – P18
Give	5.74	4	'they give me bad thoughts' – P2
Bully	5.73	1	'they were bullying me about rape' – P9
Help	5.55	5	'his voice will help me' – P14
See	5.02	3	'people can see me watching it' – P9
Take	4.09	5	'the voices take me through the forest' – P1

collocate 'help' portrayed social agents as offering support and comfort to participants. One collocate ('give') was a creative material process because illusory social agents were represented as bringing about something to the participants cognition (e.g., 'they *give* me bad thoughts').

Two collocates ('laugh' and 'listen') highlighted behavioural processes of illusory social agents. As described by Thompson (2013), behavioural processes capture outward signs of mental processes and mental states. These collocates are the communicative or interactive result of illusory social agents' mental processes such as being able to hear, and experience different mental states and humour.

Five collocates ('see', 'know', 'think', 'want', and 'try') captured mental processes of illusory social agents. In terms of perception, participants reported social agents being able to see participants' activities and bodies. Participants experienced this as intrusive because it was against their wishes and interfered with their ability to engage in certain activities (e.g., being intimate with partners). Social agents were characterized as knowing and thinking beings that were aware of the participants' history (e.g., 'they *know* already about me... that I'm bad') and present activities (e.g., 'they *know* I am talking about them'). One participant described her voice as having plans (e.g., 'he *thinks* he's going to get the money back') and being able to physically laugh through the participant at things the social agent thought funny. Finally, some participants made inferences about the intentions and/or desires of the social agents using verbs such as 'try' and 'want'.

Non-vocal agents' intentions, behaviours, and activities. Verb collocates of non-vocal illusory social agents are shown in Table 3. The list of collocates suggests that these agents were engaged in more material and behavioural processes than the vocal social agents above. They were also involved in verbal processes, however, to a much lesser degree than vocal agents: only four verb collocates ('talk', 'say', 'speak', and 'tell') were verbal processes. With these agents, communications directed at participants did not always come directly in spoken form. Rather, they were often transmitted through various modes (e.g., television, lights, and intuition). Some participants did not hear agents communicating but felt certain that social agents were talking about them while others could hear social agents mocking or making plans to harm them in these indirect ways.

Twenty-two collocates associated with these agents are material processes where a social agent was doing something to a participant or another social agent. Most of these collocates were transformative material processes as they represented illusory social agents affecting participants' bodies and environments. Nine of these ('hurt', 'persecute', 'start', 'knock', 'hold', 'do', 'stand', 'get', and 'kill') represented the agents as causing physical hurt and mental distress to participants or restricting their movements (as in illusory social agents standing in someone's way, preventing their access to their kitchen, and opening the front door). The collocate 'get', when used as a material process, portrays social agents entering the minds of participants and attacking them from within.

Six collocates of transformative processes ('come', 'go', 'leave', 'fly', 'walk', and 'follow') depicted social agents as moving around space. Similar to the vocal agents in the previous section, non-vocal agents were portrayed as independent and mobile beings who were able to freely enter and leave physical and mental spaces regardless of participants wishes. Two collocates ('make' and 'help') illustrated social agents' attempts to influence the actions/situations of real and illusory agents. For example, 'help' was used to characterize an illusory social agent's abilities to support people in need. Three collocates ('spread', 'take', and 'put') were creative material processes that brought about something (e.g., smells on bodies or environment) or someone (e.g., police) new. The collocate 'take' was used in the context of illusory social agents taking naked pictures of a participant and distributing it among other illusory social agents, but also denote social agents taking over participants' brain or agency.

Table 3. Activities of Non-Vocal Social Agents. Words in bold are those that were also identified in the keyword analysis that appeared significantly more frequently in the data in comparison with the reference corpus

Verb Collocate	Value (MI ²)	Frequency in corpus	Context
Follow	9.97	5	'people following me' – P11
Come	9.55	10	'minds coming into my own' – P7
Knock	8.57	1	'they knocked one of them [windpipe] out' – P17
Persecute	8.44	1	'they persecute me for it' – P14
Want	8.41	8	'he wants the flat and he wants my garden' – P3 'they want to harm me' – P1
Go	8.08	7	'they're going to give me a new home' – P4 'she was going across the road to the car' – P16
Get	8.03	6	'they get on so well together' – P6 'they get into my mind and attack the nervous system' – P14
Spread	7.98	2	'she has just spread a bunch of things about me' – P9
Know	7.94	8	'they know where I'm living' – P1 'everybody knows what's wrong with me' – P2
Stand	7.88	3	'they stand altogether' – P1
Try	7.85	8	'they were trying to contact me' – P8
Do	7.82	5	'they'll do whatever they have to do' – P2 'they are doing my head in' – P14
Kill	7.64	4	'we're going to kill her' – P1
Keep	7.43	4	'I saw the guy keeping an eye on her' – P16
See	7.41	3	'my men can see us through the lights' – P13
Put	7.17	3	'she put police on me twice' – P16
Hold	7.12	2	'someone want to hold you' – P5
Hurt	7.03	1	'they hurt me' – P14
Say	6.99	8	'they were saying something about me' – P12
Take	6.83	3	'they want to take you' – P5
Look	6.81	5	'they were looking at me but there were no words' – P8
Eat	6.8	1	'some of them eat to become strong' – P14
Talk	6.78	5	'it was talking to me' – P12
Leave	6.69	4	'they can leave you' – P5
Walk	6.44	4	'people walk through walls' – P8
Flying	6.33	1	'little lizards flying about the room' – P2
Tell	6.31	3	'they told me in my dreams that it's going to happen' – P17
Start	6.24	4	'they start on me' – P14
Watch	6.23	4	'they were watching me' – P11
Find	5.64	3	'they find me so sexy' – P17
Make	5.44	3	'we will make him buy things' – P16
Help	5.29	2	'she will help children having bad dreams' – P14
Speak	5.11	2	'he spoke to me' – P11
Think	4.63	2	'when they think that person has done enough' – P14
Hear	4.13	1	'they can hear my thoughts' – P1

Two collocates highlighted behavioural processes of social agents. These verbs portrayed social agents observing participants ('watch', 'look'). More mental processes were attributed to the non-vocal social agents when compared to vocal agents. In terms of perception, social agents were able to hear and see participants. Cognitively, these agents

were also portrayed as knowing and thinking beings who were aware of participants' history and current activities. A minority of participants commented on the mental states of illusory social agents as captured by the collocates 'get' and 'find'. For example, one participant felt her social agents were attracted to her ('they *find* me so sexy') and associated these feelings to be the driver behind the social agents constantly trying to touch her body. Another participant reported social agent got angry with him and a third commented on social agents' affections for each other ('they *get* on so well together'). Social agents were perceived to have motivations, plans, and desires, as represented by the collocates 'try', 'want', and 'going' to.

Discussion

This study aimed to characterize the experience of illusory social agents in psychosis by using computational corpus linguistics to identify the characteristics of agents as described in open-ended interviews. Here, we report that agents are perceived to have internal states and motivations, interact with participants through speech acts, affecting participants' bodies and moving through space, and are represented with varying degrees of richness. The results reported here largely support and extend Alderson-Day et al. (2021) findings on personification in hallucinated voices from patients in first-episode psychosis services and highlight how a similar range of rich agentive experience is experienced across psychosis and is not solely restricted to hallucinated voices.

In terms of the depth and complexity of agent representations, the majority were what (Wilkinson & Bell, 2016) described as 'internally individuated' – meaning they were identifiable by the individual based on the illusory social agents unique properties but did not correspond to any person or agent in the external world that others would recognize. However, illusory social agents were also endowed with motivations and mental states that were not fully accessible to the participants and to a level of complexity that is usually associated with human-level intelligence (Thompson, 2013). They were represented in the corpus as having an inner life consisting of thoughts, feelings, knowledge, intentions, and plans. For the majority of the participants, particularly those on the wards, illusory social agents appeared frequently and were relatively dynamic characters that sometimes irritated or angered the participants but at other times offered comfort and humour.

Based on the scalar model of minimal to complex personification of voices developed by Semino, Demjén, and Collins (2020), these qualities of (i) having 'online' emotions, (ii) possessing internal states and motivations that are not accessible to the participants, (iii) engaging in interactions with participants, and (iv) having different behaviours suggest that many social agents are personified in complex ways that are similar to the way real people are perceived in the shared external social world. Notably, Wilkinson and Bell (2016) suggested that 'externally individuated' illusory social agents in psychosis (i.e., those that do correspond to external identities) reflect a richer agent representation than internally individuated ones, but the evidence presented here suggests that internally individuated agents may be equally as rich in terms of their human-like agentive properties.

The use of Hallidayan process types to analyse illusory social agent representation allows us to bridge the gap between definitions of agency in clinical psychology as detailed in Wilkinson and Bell (2016) with the linguistic principle of agency. In linguistics, semantic agency is a graded category in that agents can have different levels of agency with

those that are able to effect material change being more agentic than those that do not (Darics & Koller, 2019).

The analysis also showed that majority of the speech acts by voices were rapport-damaging acts designed to attack participants 'face' (Demjén, Marszalek, Semino, & Varese, 2020) their sense of self-worth and their reputation. Illusory social agents in general also frequently infringed on participants' sociality rights. Acts such as making threats, telling participants to harm others, warning participants that their environment is dangerous, and warning participants to not trust or communicate with others in their social world all interfere with participants' right to associate with others and to be treated fairly.

Indeed, these features have been highlighted as a significant source of distress and impairment arising from hallucinated voices (Mawson et al., 2010) and are now a focus of psychological therapies that aim to modify them through altering the relationship between voice hearer and voice (Hayward, Bogen-Johnston, & Deamer, 2018; Trower et al., 2004; Ward et al., 2020). In this study, these processes were also the dominant characteristics of non-vocal agents, suggesting that relational approaches used in these therapies may be relevant beyond hallucinated voices.

We note several potential shortcomings of this study. Although the first study to examine illusory social agents across voices, non-vocal hallucinations, and delusions, the sample size is relatively modest, limiting the extent to which we can draw conclusions about the prevalence of the characteristics identified here across the diversity of people who experience psychosis. The comparison corpus used here was the Oral History Interviews section of the British National Corpus due to the fact that it covers a large diversity of topics, across a wide range of British dialects, and samples large numbers of interviews with approximately 4.5 million words (Rayson, Leech, & Hodges, 1997). However, the comparison therefore identifies which words are most characteristics of the patient versus general public sample. This has likely under-identified which aspects of the experiences are specific to those with a need for care rather than persistent but benign psychotic experiences (Peters et al., 2016), and further comparison with a non-need-for-care group is warranted.

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Conflict of interest

All authors declare no conflict of interest.

Author contributions

Vaughan Bell (Conceptualization; Investigation; Methodology; Project administration; Supervision; Writing – review & editing) Zsófia Demjén (Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Supervision; Writing – review & editing) Lisha Shiel (Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Project administration; Writing – original draft; Writing – review & editing).

Data availability statement

The raw data consist of interview transcripts and have not been made publicly available. However, all files from the intermediate analysis stages are available at <https://osf.io/4zwwq8/>

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