Schizophrenia Research xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

Schizophrenia Research

journal homepage: www.elsevier.com/locate/schres

Patients with psychosis struggle with scalar implicatures

Martien Wampers [a,b,*], Sofie Schrauwen [c], Marc De Hert [a,b], Leen Gielen [a], Walter Schaeken [c]

[a] University Psychiatric Hospital KU Leuven, Leuvensesteenweg 517, 3070 Kortenberg, Belgium
[b] University of Leuven, Faculty of Medicines, Department of Neurosciences, Herestraat 49, Box 721, 3000 Leuven, Belgium
[c] University of Leuven, Faculty of Psychology and Educational Sciences, Laboratory of Experimental Psychology, Tiensestraat 101, Leuven, Belgium

ARTICLE INFO

Article history:
Received 27 March 2017
Received in revised form 6 July 2017
Accepted 28 August 2017
Available online xxxx

Keywords:
Psychosis
Language
Pragmatics
Reasoning
Scalar implicatures

ABSTRACT

Pragmatic language difficulties in people with psychosis have been demonstrated repeatedly but one of the most studied types of pragmatic language, i.e. scalar implicatures (SIs), has not yet been examined in this population. SIs are a special kind of pragmatic inferences, based on linguistic expressions like some, or, must. Such expressions are part of a scale of informativeness organized by informativity (e.g. some/many/all). Although semantically the less informative expressions imply the more informative ones, pragmatically people generally infer that the use of a less informative expression implies that the more informative option is not applicable. Based on the pragmatic language difficulties of people with psychosis we hypothesized that they may be less likely to derive these pragmatic SIs. We conducted two studies in which the ability of people with psychosis to derive SIs was compared to that of healthy controls matched for age and educational level. In the second study we additionally explored the possible link between the capacity to derive SIs and theory of mind (ToM) ability.
In general, people with psychosis were less likely to derive SIs than controls. However, the patient group was not homogeneous: half had problems deriving SIs, the other half did not. This dichotomization seems linked to ToM ability because in the patient group, better ToM was associated with a higher ability to derive SIs. Based on the nature of the stimuli used in the SI-task we speculate that this link may not be a direct but an indirect one.

1. Introduction

Successful social interactions rely heavily on one's ability to go beyond the explicit, literal content of conversational statements and grasp the actual, intended meaning for in daily communication, the message that one wants to express is often not explicitly mentioned. For decades, researchers have illustrated the difficulties patients diagnosed with psychosis experience when they have to decode the non-literal content of conversational statements. These difficulties include trouble grasping the figurative meaning of proverbs and metaphors and problems with understanding humor and irony (e.g., Bambini et al., 2016; Brüne and Bodenstein, 2005; Sponheim et al., 2003). Langdon et al. (2002b) showed for instance that patients with psychosis made more errors than controls in a story comprehension task, when the speech was metaphorical or ironic. More broadly, Linscott (2005) demonstrated that such patients were less compliant with Gricean conversational rules. A broad assessment of the pragmatic skills of patients with psychosis, using the Assessment Battery of Communication, showed that the impairments in patients with psychosis is extended to many domains of communicative skills (Colle et al., 2013). It's important to note that even when syntax and semantics are more or less intact, people with psychosis sometimes still show difficulties at the discourse level (e.g., Andreasen et al., 1985; Frith and Allen, 1988).

Although pragmatic language has been studied extensively in the context of psychosis, one of the most studied types of pragmatic inferences namely scalar implicatures (SIs) (Guasti et al., 2005; Papafragou and Musolino, 2003), to the best of our knowledge, have not yet been studied in people with psychosis. In the present study, we therefore aim to gain insight in the ability of people with psychosis to derive SIs. We believe that the study of scalar stimuli in the context of psychosis has the potential to advance our understanding of the mechanisms underlying pragmatic language deficit in patients with psychosis. Scalar stimuli allow a high level of control over both stimulus content and context, which may be problematic in more complex language stimuli like stories or in stimuli with fixed content like proverbs. This high level of manipulability of scalar stimuli creates new ways to study the influence of minor stimulus changes on pragmatic language comprehension.

SIs are based on linguistic expressions like some, or, must etc. Such expressions are part of a scale of informativeness that is ordered from less informative to more informative. Examples of such scales are: <Some/many/all>, <May/must>, <Sometimes/often/always>.

The statement

(1) Some patients were attentive will be generally interpreted as
(2) Some but not all patients were attentive

* Corresponding author at: Leuvensesteenweg 517, 3070 Kortenberg, Belgium.
E-mail address: martien.wampers@upckuleuven.be (M. Wampers).

http://dx.doi.org/10.1016/j.schres.2017.08.053
0920-9964/

And not as

(3) All patients were attentive.

However, on a strictly semantic level "some" means "some and possibly all". The (implicit) addition of "but not all" does not follow logically but is the result of a SI. These SIs occur because interlocutors regard human conversation as a cooperative process, guided by a number of communicative principles or maxims (Grice, 1975). One of these maxims, the maxim of quantity, requires utterances to provide no more and no less information than is necessary for the purpose and clarity of the conversation. This maxim underlies the SI above. A sentence like (1) might be considered underinformative: it's not clear whether or not all patients were attentive. The speaker thus seems to violate the maxim of quantity. But since the receiver/listener assumes the speaker to be cooperative and to obey the maxim of quantity, he infers that the speaker used the weaker "some" because the stronger "all" was not applicable. He therefore derives a SI and concludes that "some but not all" patients were attentive.

According to Nieuwland et al. (2010), people with pragmatic language difficulties, would be less sensitive to violations of the conversational maxims and hence less likely to derive pragmatic inferences including SIs. Based on data about pragmatic language difficulties in people with psychosis, we hypothesize that people with psychosis will be less prone to derive SIs. However, we don't want to make too strong a claim, because not all work on scalar expressions in clinical populations points in this direction. For instance, Chevallier et al. (2010) reported no significant differences in the number of pragmatic responses on the disjunction (interpreting "or" as "A or B, but not both", instead of the logical "A or B or both) between children with and without autism spectrum disorders (ASD).

In the present study, we test how people with psychosis respond to underinformative statements containing "some". We expect patients with psychosis to have problems deriving SIs: they will respond less pragmatically when confronted with the scalar expression "some" than controls.

2. Experiment 1

2.1. Method

2.1.1. Participants

Two groups of participants took part in the study. The patient group consisted of 25 adults diagnosed with schizophrenia according to DSM-IV by an experienced psychiatrist. All patients were outpatients. The second group, the control group, was matched to the patient group with respect to age and educational level (see Table 1). All participants were of Dutch literacy and provided written informed consent.

Table 1
Characteristics of the two groups in Experiment 1.

	Patient group ($N = 25$)	Control group ($N = 25$)
	Mean (STD)	Mean (STD)
Age (in years)	49.29 (8.97)	50.93 (9.72)
Education level	%	%
Primary school	8	0
Lower secondary school	12	16
Higher secondary school	48	40
Higher education	24	36
University	8	8
Gender male	52	36

2.1.2. Procedure and study material

We used a binary statement-evaluation-task. Each participant received one of two equivalent stimulus sets each of which contained 20 statements.

Half of the statements were underinformative through the use of "some" and could lead to SIs. These statements always took the form "some <exemplar> are <category>", e.g. "Some oaks are trees" (Bott and Noveck, 2004; De Neys and Schaeken, 2007). Participants were asked to judge them as either true (logical) or false (pragmatic). Participants also evaluated 10 filler items (containing "some" or "all"). They were either clearly true (4 items, e.g. "All parrots are birds") or clearly false (6 items e.g. "Some poplars are fish") and allowed us to verify whether participants were attentive and able to correctly perform the task. The 20 statements were bundled in random order in booklets that displayed one sentence per page.

2.1.3. Statistical analysis

To test our hypothesis, we compared the number of pragmatic answers between both groups with a one-sided Mann-Whitney-*U* test. A two-sided Mann-Whitney-*U* test was used to compare both groups with respect to the number of correctly answered filler-items. Within-group comparisons were performed with a Wilcoxon signed-rank-test.

Additionally, we verified whether participants remained consistent in their response to the underinformative items, i.e. whether they stuck to either pragmatic or logical answers. Participants who chose the same response for at least 7 of the 10 target statements were considered consistent. They were then classified as either consistently pragmatic (at least 7 pragmatic answers) or consistently logical (at least 7 logical answers). A chi-square test of independence was used to test whether the prevalence of these categories differed between study groups.

2.2. Results

In the control group, participants gave an average of 7.2 (STD = 4.1, Median = 10) pragmatic responses. This number was lower in the patient group in which an average of 4.6 (STD = 4.7, Median = 1) pragmatic responses was given. This difference was marginally significant ($Z = -1.58$, $p = 0.0568$). Patients thus tend to derive fewer SIs than controls.

Overall, participants were consistent in their response to underinformative statements (Table 2) for all of them chose the same response alternative for at least 7 of the 10 target items. However there was a clear difference between patient and control group ($\chi^2(1) = 5.33$, $p = 0.021$). The control group was rather homogeneous since the vast majority of control subjects (76%) were classified as consistently pragmatic. The patient group on the other hand could be divided into two groups of comparable size with approximately half of them (56%) classified as consistently logical and the other half (44%) as consistently pragmatic.

The results of the within groups comparisons are in line with those of the consistency analysis. In the patient group, pragmatic (45.6%) and logical (54.4%) answers occurred with comparable frequency whereas pragmatic responses (72.4%) were significantly more frequent than logical ones (27.6%; $Z = -2.12$, $p = 0.017$) in the control group.

Participants made few mistakes in responding to the filler items with the patients even making fewer errors (2%) than the controls (6%; $Z = 2.48$, $p = 0.014$).

Table 2
Number (%) of patients and controls with a consistently pragmatic or logical response pattern.

Group	Consistently pragmatic	Consistently logical
Patients	11 (44%)	14 (56%)
Controls	19 (76%)	6 (24%)

Please cite this article as: Wampers, M., et al., Patients with psychosis struggle with scalar implicatures, Schizophr. Res. (2017), http://dx.doi.org/10.1016/j.schres.2017.08.053