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It is no joke. Metaphorical language and sense of humor in schizophrenia

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Summary

The sense of humor has a positive influence on mental and social functioning of humans by supporting interpersonal competences and effective coping with difficult situations. The aim of this study was to present research conducted to this date and concerning processing of humoristic content by people with schizophrenia in relation to cognitive deficits associated with this illness and their neurobiological background. Understanding of humor and its effective use require many linguistic and extralingustic skills, including processing of signals from social environment, such as correct recognition of emotional messages, understanding of a context of a humoristic situation, or drawing correct conclusions on a mental status of other people. An efficient use of the metaphorical language allows experiencing amusement resulting from inaccuracies, different semantic interpretations, irony, and sarcasm. A tendency for excessive concretism reflected in problems with understanding nonliteral content and semantically complex language structures, as well as other cognitive deficits observed in schizophrenia patients, frequently hinder the use of humoristic messages. Better understanding of mechanisms controlling the effective use of humor may help to develop therapeutic tools to improve the communication efficiency of schizophrenia patients, as well as positively influence their social functioning.

Key words: schizophrenia, sense of humor, social communication disorder

Introduction

Understanding of the metaphorical language and its use may be considered an issue quite distant from the subject of a sense of humor. While the metaphorical language is frequently studied separately from the context of the sense of humor, it is difficult to analyze humoristic contents in isolation from understanding of the unobvious language

with a double meaning. It is possible to understand and create jokes without a correct use of the metaphorical language, but in that case the scope of events and contents that may be found funny is limited. In such case, a situation when somebody slips on a banana peel may still appear funny, but a play on words with a funny overtone becomes unclear. This way, many occasions for joking, experiencing amusement prompted by inaccuracies, different semantic interpretations, perversity, and irony, as well as for relatively safe smuggling of contents that would be unacceptable when expressed directly, are lost.

This is a situation of people suffering from schizophrenia, demonstrating a tendency for excessive concretism. It is manifested, for example, in studies concerning understanding of proverbs, humoristic content and irony, metaphors, as well as other pragmatic aspects of the language [1–4]. Deficits in the efficient use of both metaphors and humor are frequently studied together, emphasizing a significant importance of understanding of nonliteral contents for understanding certain types of humor. The aim of this paper is to sum up the available scientific knowledge on determinants, possibilities, and effectiveness in the use of humor by schizophrenia patients.

Understanding of the metaphorical language in terms of specific mental functions

The metaphorical language and irony are frequently used in daily situations. Although correct understanding of their meaning requires significant skills and involves many mental processes, usually it is not very difficult. For example, when after reading this paper somebody says that it was "as dull as ditchwater", the recipient of this message will have no doubts what was meant by that expression.

The hidden and, at the same time, true meaning of metaphorical, ironic content can be quite distant from its literal meaning. Its correct understanding requires many, not only linguistic but also extralinguistic, skills. It is necessary to go beyond the literal meaning of the message, and to include mental states, beliefs and objectives of an interlocutor in the interpretation. For example, correct reading of ironic contents requires noticing of a discrepancy, or even a contradiction between the interlocutor's intent and the literal meaning of the message [5]. Thus, correct conclusions concerning the mental state of other people are required, that is, having 'Theory of Mind' (ToM) [6].

An ability to deal with semantic relations expressed in the language, including metaphorical relations, may be related to a distinctive and flexible pattern of hemisphere interactions, including greater involvement of the right hemisphere in processing of new metaphors [7]. Studies using methods of functional brain imaging indicate a significant importance of involvement of the right superior and middle temporal gyri in syntactic and semantic processing [8, 9]. For decades the right brain hemisphere had been considered to be 'mute', but evidence collected through the years suggests that it plays an important role in many different linguistic functions. The most widely known right-hemisphere competences are related to the speech pragmatics [10, 11], within which skills such as understanding of jokes, sarcasm, irony or indirect requests can be distinguished. These observations led to the concept that, apart from classic

left-hemisphere language-related regions, the right hemisphere plays an important role in processing of the symbolic metaphorical language. It is still unclear which extralinguistic competences are involved in this process [12].

Another crucial issue is whether understanding meanings of the symbolic language depends on serial or on parallel processing. In accordance with the Gibbs' model of ready availability [13], we have no problems with understanding metaphors, provided they appear in a relevant supporting context, when the literal and abstract meanings are available simultaneously. It is suggested that abstract understanding of metaphors, such as "she was mad as a hornet" is clear, due to a dual reference of the abstract meaning of a word (in this case, hornet) to a direct subordinate category (insects) and to an *ad hoc* metaphorical category (venomous, biting) [14, 15]. Bowdle and Gentner [16] propose a hypothesis that only traditional, conventional metaphors are characterized by such dual references, while new, original metaphors are processed serially, through some comparisons and finding similarities after an unsuccessful attempt at categorization. Nevertheless, the time course of metaphor understanding is not fully understood. Empirical evidence does not clearly indicate whether metaphors are understood as fast as literal expressions and processed in parallel, or whether this process is longer due to a serial processing of their abstract meaning.

Forgács et al. [17] studied the speed of processing of conventional and original metaphors depending on the field of vision to which they were presented. Subjects were presented with appropriately selected word pairs consisting of an adjective and a noun of a metaphorical and a literal meaning, conventional and original. Both word pairs from the conventional category were processed faster and more precisely when they were presented in the right field of vision (left brain hemisphere), although metaphors were processed slower than literal expressions, and this was explained by the authors as a possible consequence of parallel access to their literal and abstract meaning. Original metaphors were processed as fast as original literal expressions, and this suggests that maybe it is not serial processing that is the most important in the process of understanding of new expressions, but the left-hemisphere semantic integration.

Dysfunctions in the use of metaphorical language in schizophrenia

Study results concerning interpretation of metaphors and irony by schizophrenia patients are not consistent, although the reports indicating problems in that area prevail. Furthermore, these studies involve different control groups, and frequently analyze different aspects of the metaphorical language; thus, in consequence, comparison of available conclusions is difficult [18].

Some studies show a discrepancy between understanding of irony and of metaphors in this group of patients. Although a correct interpretation of both means of expression depends on understanding of the figurative language, yet problems may be visible solely in understanding of metaphors, and only during the acute illness episode [2]. On the other hand, the research of Mitchley et al. [19] showed that schizophrenia patients at the chronic stage of illness have specific problems with understanding irony involving direct reading of nonliteral messages when compared with non-psychotic

psychiatric patients. During the illness remission, the researchers did not note any differences between the above-mentioned groups. Langdon et al. [3] reached similar conclusions, associating problems with interpretation of nonliteral messages with currently experienced schizophrenia symptoms. At the same time, they emphasize differences between the two groups of patients – those presenting with positive and with negative symptoms. The positive symptoms are clearly correlated with dysfunctions in understanding irony, while the negative ones are associated with dysfunctions in understanding metaphors.

Amongst studies exploring possible discrepancies between different aspects of the figurative language, the thoroughly planned study by Mossaheb et al. [20] clearly stands out. These authors included many different tasks using metaphors, including proverb tests, metaphor paraphrasing tasks, and the metaphoric triads task. The aim of the study was to determine possible quantitative differences in processing of the figurative language between patients with schizophrenia spectrum disorders, and healthy subjects from a control group. The results indicated dysfunctions in the clinical group in recognizing and paraphrasing of conventional metaphors and generating original metaphors. They also confirmed a relationship between these deficits and exacerbation of negative symptoms.

Generally, problems with understanding of the metaphorical language and double meanings are not surprising at the acute or the chronic stage of that illness, but what happens during remission? This was a question asked by Mo et al. [5]. They compared the results of 33 schizophrenia patients during remission with 22 results of healthy subjects. It was found that the ability to understand metaphors and irony was poorer in the ill than in the healthy subjects. The results also did not change when IQ was verified. The results indicate deficits in ToM as a reason for poorer understanding of nonliteral language, and that these deficits are maintained also during remission of the symptoms. The results obtained in studies of Herold et al. [21] were partly different, as they noted clear problems with a correct understanding of irony in schizophrenia patients in remission, while their ability to understand metaphors was the same when compared to a control group of healthy subjects.

Hemisphere asymmetry in semantic processing is quite well documented. The left hemisphere specializes in a narrow, conventional (fine) semantic coding, involving activation of a limited semantic network consisting of a small number of closely related ideas. On the contrary, the right hemisphere specializes in unconventional, wide ranging (coarse) coding that activates extensive, dispersed formations of conceptual associations [22, 23]. Zeev-Wolf et al. [24], referring to the fine-coarse model of semantic processing, proposed a hypothesis that schizophrenia patients are characterized by a reverse pattern of hemisphere involvement in semantic coding. 17 schizophrenia patients and 30 subjects from a control (neurotypical) group were examined, and they were presented with four types of expressions: (1) literal, (2) conventional metaphors, (3) unrelated words, and (4) original metaphors. In tests involving recognition of traditional metaphors and unrelated words, activity of the left hemisphere predominated in the control group, while the right hemisphere was more active in the ill subjects. Furthermore, the schizophrenia patients were less precise in evaluation of literal ex-

pressions, unrelated words, and traditional metaphors, when compared to the evaluation of original metaphors. The results of these studies indicate that schizophrenia patients present with a reverse model of lateralization of semantic coding, thus, they depend on an unconventional (coarse) processing to a larger extent. For this reason, even simple conversations are non-standard for them, and force them to continuously search for new meanings, and predispose them to create original, frequently strange expressions. Such behaviors can in turn have a secondary negative influence on their ability of a conventional use of the language, and lead to linguistic dysfunctions, as well as impede their daily interpersonal communication.

There are behavioral indicators available, confirming problems with understanding the nonliteral language by schizophrenia patients [1, 2]; however, to this date the number of conducted studies concerning metaphorical understanding and employing neuroimaging techniques is scarce [25, 26]. Mashal et al. [27] assumed that if there was an extensive body of evidence confirming occurrence of right hemisphere communication dysfunctions in schizophrenia [28], and yet many reports suggested that processing of original metaphors involves the right hemisphere [29, 30], then a study analyzing processing of original metaphors by schizophrenia patients would be of particular interest. For this purpose, they designed an experiment using functional magnetic resonance imaging (fMRI). Subjects (12 patients and 12 subjects from a control group) were stimulated with four types of word pairs: (1) literal, (2) conventional metaphors, (3) original metaphors, and (4) unrelated words. Then each of them performed a multiple choice test evaluating a correct understanding of metaphors. The questionnaire contained 30 word pairs, including 10 of each conventional, original and nonsense metaphors. Questionnaire analyses showed that patients had more problems with understanding of conventional and original metaphors when compared to healthy subjects. It was proven that in schizophrenia patients, the right precuneus is involved in the linguistic processing. This may suggest that activation of the right posterior parietal region helps to compensate deficits in understanding of metaphors; although it is equally probable that deficits in understanding of metaphors are caused by an increased activity in this region of the brain.

The study by Kircher et al. [25] on neuronal correlates of metaphor processing with the use of fMRI, included 12 schizophrenia patients and the same number of subjects in the control group. Each subject was presented with 30 metaphors and 30 literal sentences written on a grey background, and the baseline brain activity was evaluated by presenting 15 projections of a grey background only. After reading each sentence quietly, the subjects had to evaluate whether its meaning was positive or negative. When reading the metaphors, a weaker activation in the posterior cortex regions of the right temporal lobe and more pronounced changes in the signal within the left inferior frontal gyrus in the area located 3 cm more dorsally than in subjects from the control group, were observed in the schizophrenia patients. Further analyses showed that the intensified tendency for concretization of thinking, as evaluated on *the Positive and Negative Syndrome Scale* (PANSS), was negatively correlated with activation in the inferior frontal lobe. As a component of a large neuronal network involved in the language processing, the left inferior frontal gyrus and the medial temporal gyrus are

of a crucial importance for concretization of thinking in schizophrenia. In the studied subjects from both groups, a stronger activation of the left inferior temporal lobe was noted when reading metaphors, compared to literal sentences, but the schizophrenia patients also involved the right temporal lobe when performing this task. The inferior frontal gyrus and the superior temporal gyrus are regions crucial in schizophrenia neuropathology. Their dysfunctions underlay clinical symptoms of concretism reflected as disrupted understanding of nonliteral content and semantically complex language structures.

Hypotheses explaining disrupted understanding of metaphors in schizophrenia

Problems with processing the symbolic language observed in schizophrenia patients were traditionally associated with excessive concretism [31]. However, some researchers postulated that it is a tendency of these patients for excessively abstract interpretation of proverbs that results in so frequent understating of a message in a way deviating from the sender's intent [32]. Other authors suggest that problems with abstract thinking in schizophrenia are of more general nature [33].

Faust and Kennet [7] presented a hypothetical model of semantic memory network states, using terms such as 'Rigidity', 'Chaos' and 'Integration' to describe it. These authors postulate that semantic memory network states are located on a continuum between rigidity and chaos. Here, the left hemisphere is associated with an excessive rigidity of the semantic memory, while the right hemisphere, with a chaotic and excessively flexible semantic memory state, is on the opposite end of this system. A number of other states associated with semantic creativity are located between these two extreme states. Effective semantic processing is achieved due to a balance between semantic rigidity and chaos, which is possible due to interhemispheric communication. However, disruptions in balanced and integrated patterns of interhemispheric interactions, e.g., excessive dominance of one hemisphere over the other, may lead to an extreme rigidity or semantic chaos, resulting in a departure from semantic integration, thus impairing processing of linguistic metaphors. Problems experienced by schizophrenia patients are explained by the excessive activity of the right brain hemisphere, leading to semantic chaos.

Michell and Crow [28] also explain disruptions in linguistic processing as resulting from excessive activation of right hemisphere regions corresponding to regions of the left hemisphere cortex crucial for the language. They prove that these functional changes mean the loss of reversed activity lateralization in brain regions associated with individual components of the linguistic processing.

Role of humor and a sense of humor in schizophrenia

Studies on the sense of humor in healthy subjects indicate its positive influence on mental and social functioning. Humor helps to reduce the levels of fear and emotional tension, strengthens the sense of a personal control over events, and supports an approach to difficult situations as to a stimulating challenge, and taking of constructive

and effective coping strategies. Furthermore, the sense of humor has a positive influence on social functioning, and, by increasing interpersonal attractiveness, it helps to strengthen bonds and develop intimacy of a relationship, increases a sense of belonging and group cohesiveness, and leads to an increase in kindness and social support [34, 35]. However, to benefit from advantages associated with humor, an individual needs a relevant effectiveness of mental processes, including ability to appropriately recognize emotional messages or understand a meaning of humoristic situations. Competences of this kind are frequently deficient in patients with psychoses [36, 37].

In previous studies on the sense of humor in schizophrenia patients, researchers most frequently focused on their ability to distinguish and understand comic contents and react to them with amusement. The researchers use tasks differing in a type of humor, sensual modality involved in recognition of humoristic content, a level of task complexity, or in involvement of verbal functions and ToM. The most commonly used tools are comic strips, sometimes supported with verbal content. General conclusions reached by researchers are consistent and indicate poorer recognition and understanding of humoristic content by schizophrenia patients when compared to mentally healthy subjects [37–42]. However, there are differences in reports concerning the use of specific mental mechanisms enabling a complete understanding of humoristic content by the patients. For example, Tsoi et al. [43] indicate decreased abilities to recognize humor, with simultaneously maintained sense of humor. Ivanova et al. [44] emphasize that patients have problems not only with perception of humoristic contents but also with an ability to appreciate them, and thus, to express amusement in response to them. Other authors pay particular attention to problems with understanding messages with ironic content and allusions included in jokes [42, 45]. Falkenberg et al. [39] confirm deficits concerning appreciation of humor, at the same time noting the maintained ability to use humor as a coping strategy. In this respect, many authors focus on specific nature of humoristic contents preferred by schizophrenia patients. Patients' preference for jokes saturated with aggressive and sexual motifs indicates their potential role in reduction of sexual tension and negative emotions, such as anger [34, 46].

The available reports do not include data on expression of humor by schizophrenia patients, including creation of humoristic contents, jokes, or spontaneous reaction to comic situations. Also the number of results of studies on evaluation of effectiveness of therapeutic models using humor as a factor improving social functioning of patients is scarce.

Reasons for problems experienced by schizophrenia patients in reception of humor

The possible reasons for reduced abilities of schizophrenia patients to recognize and appropriately react to humor include a wide range of cognitive deficits, for example: executive dysfunctions [40, 43], anomalies in concentration and attention shifting, and a reduced level of verbal fluency [38], or disturbance of auditory-verbal, semantic and working memory [37]. The second important direction of studies focuses on a relation between ToM functioning and recognizing and distinguishing of humor. It appears

that the type of jokes can be of importance when patients' ability to understand them is considered. Slapstick jokes are specific, physical jokes showing funny behaviors and situations, understanding of which does not require the use of ToM (for example, a fall in a consequence of slipping on a banana peel). On the other hand, jokes using ToM (ToM jokes) require an analysis of a situational context and mental states of the characters to notice their hidden intents, beliefs or designs (e.g., handing of an umbrella to a person verbally abused by other person) [41]. Ironic jokes represent a specific category of jokes associated with an efficient use of ToM. Understanding of irony requires an efficient recognition of speaker's intentions to avoid interpreting irony as a mistake. Formulation of ironic contents requires such use of an indirect message that it would not be understood as a lie [45].

Results of studies indicate differences in outcomes of tasks performed by schizophrenia patients, depending on the use of slapstick or ToM jokes [41, 42] but also depending on a level of saturation of material used in the study with a verbal factor [41, 47]. In general, patients better understand jokes that are specific than those that require the use of ToM. However, it should be emphasized here that results of some studies are not so unambiguous, as it could be suspected on a basis of knowledge on importance of ToM in understanding of social situations and its deficits in schizophrenia patients.

Gallagher et al. [48], using slapstick and ToM jokes, demonstrated a significant relationship between mentalization abilities and an activity of the medial prefrontal cortex. Although they studied healthy subjects, yet the obtained results can indirectly explain ToM deficits and associated problems with interpretation of humor by ill subjects when disruptions in frontal functions in schizophrenia patients are considered.

On the other hand, Marjoram et al. [41] came to a conclusion that schizophrenia patients have significantly more problems with understanding jokes, regardless of their saturation with ToM content when compared to the control group. Although both subjects in the study and in the control group were less efficient when performing tasks involving ToM, yet that difference in the group of schizophrenia patients was significantly higher. Hence, the authors' conclusion that low results of the study subjects should be associated with deficits in ToM, and not only with problems with understanding humor. The study did not confirm that ToM deficits in schizophrenia patients can be directly associated with age, sex, IQ, linguistic disorders, or – what is most surprising – with exacerbation of positive schizophrenia symptoms

Stratta et al. [45] used the comic strips from the study of Gallagher et al. [48] and the research paradigm of Marjoram et al. [41], but their conclusions from that study differ from the previous ones. They demonstrated a significant negative relationship between outcomes of tasks involving ToM and positive symptoms. These results are consistent with earlier studies of Corcoran and her teams [42, 49]. Furthermore, the authors suggest that schizophrenia patients do not exert sufficient cognitive effort in tasks requiring understanding of overtone and drawing conclusions concerning mental states of other people. Taking into account the fact that the problem was more pronounced in people with a high score on the PANSS scale, a hypothesis was proposed that it may result from attention disorders.

On the basis of rational conclusions, some researchers assumed that current exacerbation of psychopathological symptoms would represent the most important factor influencing the ability to understand and appropriately react to humoristic contents. This was confirmed, among others, by Bozikas et al. [38] by demonstrating a reduced ability of schizophrenia patients in noticing and appreciating humor presented in a graphic form, and correlation of the relevant results with exacerbation of positive and negative illness symptoms evaluated with the PANSS scale. Also Corcoran et al. [42, 49], noticed a significant influence of the current exacerbation of schizophrenia symptoms on abilities to understand humor. At the same time, these authors proved that understanding of humor in patients currently not presenting with psychopathological symptoms was similar as in mentally healthy people.

The above-mentioned relationship was not always found. In the study of Polimeni and Reiss [40], problems with appropriate evaluation of humor did not depend on exacerbation of clinical symptoms, while Falkenberg et al. [39] suggest that the decreased ability of schizophrenia patients to react to humor may actually result from concurrent depressive symptoms and not from the underlying illness.

Neuronal correlates of reduced competences to understand humor

To this date, the number of neuroimaging studies concerning processes of humor processing in schizophrenia is low. The first were studies of Marjoram et al. [50] in which 24 first and second degree relatives of schizophrenia patients were studied. fMRI was employed in the research paradigm, and the material included visual jokes requiring the use of TM as well as those not including this factor. Although the subjects did not have schizophrenia, a significant reduction in precortex activity during processing of TM jokes was demonstrated in them when compared to healthy subjects from the control group.

Adamczyk et al. [51], in the study using fMRI, evaluated cortex activity in 20 subjects diagnosed with chronic schizophrenia during processing of stories ending with a punchline. Using a procedure of Chan et al. [52], they selected 60 stories, of which 20 ended with a funny punchline, 20 were nonsensical, and 20 were neutral, and this set-up partly reflected three stages of humor processing. The neural processing patterns were related to the task faced by the subjects. In the case of an unsolvable process of discovering incongruities in a meaning of nonsensical puns, a reduced activation was noted in the posterior part of the superior temporal lobe of the right hemisphere in schizophrenia patients. In the puns requiring solving of incongruities contained in funny punchlines, low activity was observed within the dorsal-medial regions of the medial and the superior frontal gyri on the left. General conclusions from the study indicate hypoactivation of frontal and temporal regions as neuronal substrates of disorders in humor processing in schizophrenia.

Therapeutic interventions using humor

The sense of humor belongs to internal resources effectively supporting coping with difficulties and positively influencing functioning in various areas of life. It is also one of desirable defense mechanisms enabling fulfillment of drives in a safe, socially acceptable way [36, 53].

While the studies on effects of humoristic interventions in patients that are somatically ill or suffer from disorders associated with chronic stress are relatively popular, the effectiveness of this type of interventions in groups of schizophrenia patients is rarely evaluated. Nevertheless, the results of these scarce studies encourage implementation of therapeutic programs developing sensitiveness to humor, as well as effectiveness of noticing and using humor [36]. Conclusions drawn so far indicate, among others, a positive influence of therapy using humor and/or laughter to reduce the intensity of psychopathological symptoms [54], an increase in the self-assessment, and improved cooperation with medical personnel [55], an increase in a sense of social support from medical personnel [56], an increase in criticism of illness, readiness to create a therapeutic alliance, and reduction of destructive behaviors [57], and a reduction in intensity of symptoms of anxiety and depression, a reduction in levels of aggression, and an increased readiness to provide support to each other [34, 54, 56]. In randomized controlled studies, Cai et al. [58] demonstrated an improvement in a mental condition of schizophrenia patients following 10 sessions of humor skill training. The effects were visible as a reduction in intensity of depression, anxiety and negative symptoms on the PANSS scale. The study covered a small group of subjects (15 people), but in the authors' opinion the results are sufficiently convincing to assume that humor skill training sessions can be of importance for development of coping skills in schizophrenia patients. Not all studies clearly indicate such positive effects, and their frequent fault is a lack of an appropriate control group [59].

Conclusions

One of the most significant symptoms of schizophrenia are problems with making and maintaining satisfying social relations. It is assumed that these difficulties are secondary to affective processes' disorders and cognitive deficits concerning noticing and processing of signals from the social environment [36]. Similar dysfunctions appear to underlie difficulties with understanding and appropriate reaction to humor as well as with using it. Considering the psychopathology of schizophrenia and conclusions from the studies on recognition of humor, as well as effectiveness of intervention with its use, a hypothesis can be proposed that an intended introduction of humor into therapeutic interventions strengthens and develops this resource, being one of the most important internal resources and, at the same time, representing an effective defense mechanism for ill people. At the same time, the use of interventions employing humor should have an extensive rehabilitating effect, because humor involves many different cognitive, affective and interpersonal processes. Thus, a study concerning influences of the therapeutic humoristic interventions not only on the effective use of humor

and metaphorical language but also on formation of interpersonal relations and social functioning of patients appears to be of particular interest.

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