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Figurative language impairment in aphasic patients

Zaburzenia przetwarzania języka figuratywnego w afazji

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Abstract

Purpose: The present study is a pilot test designed to verify the Figurative Language Battery that we have developed to explore figurative language skills of individuals with aphasia.
Material and methods: Eight left brain damaged patients and ten controls were tested using the battery. The battery consists of four parts, each of which focuses on a different figurative trope (idioms, metaphors, proverbs, and similes), and employs either a Multiple Choice task (choosing the correct paraphrase from among literally related and unrelated distractors) or an Oral Completion task (providing the last, missing word of the figurative phrase). Data were collected in individual sessions during which participants were asked to complete the figurative language battery.
Results: Overall, patients showed a strong literal bias in comprehending figurative expressions, i.e., they tended to interpret idioms and metaphors in a literal, rather than figurative, manner, consistent with findings reported in the literature. In addition, the obtained results confirm that the type of figurative trope significantly affects performance of individuals with aphasia. Patients performed significantly better on overlearned sequences, such as proverbs or similes, than on idioms and metaphors. Conventional metaphors were easier to understand than unconventional (novel) ones, and opaque, unambiguous idioms were easier than transparent, ambiguous ones.
Conclusions: The type of figurative trope, and possibly also the type of task, affect figurative performance of individuals with aphasia. The study carries important implications for designing diagnostic tools aiming to uncover figurative language impairment in aphasia.

Key words: aphasia, language impairment, figurative.

Streszczenie

Cel pracy: Niniejszy artykuł opisuje pilotażowe badanie Baterii Języka Figuratywnego, która została zaproponowana w celu uzyskania pełnego obrazu zaburzeń umiejętności przetwarzania języka figuratywnego przez pacjentów cierpiących na afazję.
Materiał i metody: Badaniu poddano ośmiu pacjentów z uszkodzeniem lewej półkuli mózgu i dziesięć zdrowych osób z grupy kontrolnej. Uczestnicy brali udział w indywidualnych sesjach, w czasie których proszono ich o wykonanie zadań znajdujących się w Baterii Języka Figuratywnego. Bateria składa się z czterech części, z których każda skupia się na odmiennym typie języka figuratywnego (idiomy, metafory, przysłowia oraz porównania). W baterii zastosowano dwa typy zadań: zadanie wielokrotnego wyboru (wybór poprawnej parafrazy idiomu lub metafory spośród dystraktorów zawierających parafrazę znaczenia dosłownego lub parafrazę niezwiązaną ze znaczeniem danego wyrażenia) oraz ustne zadanie polegające na uzupełnianiu brakującego fragmentu (ostatniego wyrazu) frazy figuratywnej.
Wyniki: Zgodnie z przewidywaniami i badaniami opisanymi we wcześniejszej literaturze, pacjenci przejawiali skłonność do dosłownej interpretacji języka figuratywnego, a więc do rozumienia idiomów i metafor literalnie zamiast przenośnie. Ponadto wyniki wskazują na wpływ typu języka figuratywnego na jego rozumienie przez pacjentów. Pacjenci wykonali znacznie lepiej i bardziej poprawnie część baterii poświęconą frazom zautomatyzowanym, takim jak przysłowia czy porównania, niż część zawierającą idiomy i metafory. Metafory konwencjonalne były łatwiejsze do zrozumienia niż metafory niekonwencjonalne (nowe). Idiomy nieprzezroczyste i jednoznaczne, a więc takie, które mają tylko jedną możliwą interpretację – figuratywną, były łatwiejsze do zrozumienia niż idiomy przezroczyste i niejednoznaczne, a więc idiomy mające dwie możliwe interpretacje – dosłowną i figuratywną.
Wnioski: Typ języka figuratywnego, a także prawdopodobnie typ zadania, wpływają na kompetencję figuratywną pacjentów z afazją. Badanie niesie ze sobą istot-

ne implikacje dotyczące rozwoju narzędzi diagnostycznych umożliwiających dogłębne zbadanie zaburzeń języka figuratywnego w afazji.

Słowa kluczowe: afazja, zaburzenia języka, figuratywny.

Introduction

Research conducted into the processing of figurative language by individuals with aphasia has repeatedly demonstrated that they experience difficulties with the processing of nonliteral forms of discourse such as metaphors, idiomatic expressions, proverbs or irony (e.g., Bottini et al. 1994; Brownell et al. 1990; Burgess and Chiarello 1996; Champagne et al., 2003; Eviatar and Just 2006; Joanette and Goulet 1990; Kasher et al. 1999; Kemper 1981; Lee and Dapretto 2006; Marczewska and Osiejuk 1994; Maruszewski 1970; Pąchalska 1999; Soroker et al. 2005; Van Lancker and Kempler 1987; Weylman et al. 1989; Winner and Gardner 1977; Zaidel et al. 2002). Earlier research into metaphor processing by brain-damaged patients was largely devoted to the debate concerning the validity of the so-called right hemisphere hypothesis (see e.g., Anaki et al. 1998; Burgess and Chiarello 1996; Shields 1991; Van Lancker 1997 for reviews), which has ascribed the right hemisphere a key role in processing nonliteral language. However, subsequent research failed to provide support for the right hemisphere hypothesis, demonstrating deficits in metaphor comprehension in both right hemisphere damaged (RHD) and left hemisphere damaged (LHD) patients (e.g., Gagnon et al. 2003; Nocentini et al. 2006; Rapp et al. 2004; Rapp et al. 2007; Stringaris et al. 2007; Zaidel et al. 2002). For example, Zaidel et al. (2002) administered the "Right Hemisphere Communication Battery" to left brain-damaged and right brain-damaged patients and found no difference between the two groups. Likewise, in the study by Kasher et al. (1999), both RHD and LHD patients were comparably seriously impaired in processing conversational implicatures. Nocentini et al. (2006) likewise failed to find qualitative differences between LHD and RHD patients' ability to appreciate the connotative and denotative meanings of polysemous words.

Giora et al. (2000) have suggested that increased complexity or relative low salience of linguistic items rather than metaphoricity *per se* might be better predictors of the RH activity. The salient meaning of a word or an expression is defined as its "lexicalized meaning, i.e., the meaning retrievable from the mental lexicon rather than from the context" (the Graded Salience Hypothesis, Giora 1999, p. 919). According to this view, processing nonsalient figurative expressions, such as novel (poetic) metaphors or nonconventionalized types of figurative language, like sarcasm or irony, should involve initial activation of their more salient literal meanings, followed by a reinterpretation process which is the domain of the right hemisphere. In keeping with those predictions, Giora et al. (2000) found differential effects of right and left brain lesions on understanding salient conventional metaphors and nonsalient sarcasm in RHD and LHD patients. In line with the Graded Salience Hypothesis, controversial results obtained in cerebral activation studies might be explained by the differential salience of the stimuli they employed. For example, whereas some studies (e.g., Bottini et al. 1994) used more complex metaphorical expressions and required participants to make plausibility judgments about them, thus resulting in greater activation of the RH, other studies (Lee and Dapretto 2006; Rapp et al. 2004) employed familiar, conventional metaphors, whose meaning might be more lexicalized and retrieved as a unit, and so they demonstrated higher LH activations. Increased activation of the RH in an effort to process nonsalient meaning and more complex semantic information is called for while computing relations between the elements of a novel figurative expression. On the other hand, retrieval of lexicalized conventional metaphors mainly engages the LH, consistent with the imaging studies showing that the left inferior gyrus and left temporal regions are involved in lexical access (see, for example, Eviatar and Just 2006; Lee and Dapretto 2006; Rapp et al. 2004; Stringaris et al. 2007). In addition, right hemisphere damage has been linked to subsequent impairment in the processing of affective prosody, including deficits in emotional expression and comprehension (see Gurański et al. 2008 for extensive review); whereas lesions in the left hemisphere have been shown to cause disturbances in acoustic parameters of speech sounds, such as desynchronization of vowel formants (Podemski et al. 2006;

see also Jodzio and Nyka 2008 for summary of deficits following left and right hemisphere damage, and Pąchalska et al. 2001 for differences in mental image processing between right- and left-brain damaged patients).

A number of studies into figurative language in aphasia have focused on idiom comprehension (e.g., Cacciari et al. 2006; Nenonen et al. 2002; Papagno et al. 2006; Tompkins et al. 1992). Those studies generally show a marked bias towards a literal interpretation of idioms by individuals with aphasia, even when the idiom is literally implausible (Papagno and Genoni 2003, 2004; Papagno et al. 2004; Papagno et al. 2006). In addition, results obtained from a number of aphasia idiom studies (e.g., Papagno et al. 2004; Papagno and Caporali 2007) point to the fact that the level of difficulty in idiom comprehension differs across the different dimensions along which idiomatic expressions vary. One of these dimensions is transparency, which is defined as the degree to which the meaning of the idiom can be derived from the phrase. Accordingly, transparent idioms will be those whose figurative meaning can be inferred from the analysis of their constituents (e.g., *play with fire*), while opaque idioms are those whose meaning cannot be guessed (e.g., *kick the bucket*). Idioms also differ in terms of their ambiguity, in that for ambiguous idioms both their literal and figurative interpretations are plausible, e.g. *break the ice*, whereas for unambiguous idioms only the figurative interpretation is possible, e.g. *by the skin of one's teeth*. Transparent and ambiguous idioms have been shown to be more difficult to interpret for individuals with aphasia than opaque and unambiguous ones (Papagno et al. 2004; Papagno and Caporali 2007). However, the results are not unanimous (e.g., see Papagno et al. 2006; Papagno and Genoni 2004), and many studies have looked into just one type of idiom (e.g., Cacciari et al. 2006; Papagno et al. 2006).

Research into metaphor processing with aphasic and healthy populations has generally revealed that comprehension of novel (unfamiliar, poetic) metaphors involves a greater cognitive effort than the processing of familiar, conventional metaphorical expressions (e.g., Faust and Mashal 2007; Gagnon et al. 2003; Giora et al. 2002; Mashal et al. 2005; Mashal et al. 2007; Rapp et al. 2004, 2007; Schmidt et al. 2007; Stringaris et al. 2006, 2007; Tartter et al. 2002). While idioms and metaphors have been the major focus of research, some studies have reported results pertaining to proverbs. For example, in the study by Ulatowska et al. (2000) proverb comprehension was preserved in aphasia (see also Chapman et al. 1997; McFarling et al. 1982).

The aim of the study reported here was to pilot test a Figurative Language Battery that we have been developing to comprehensively examine figurative language skills of individuals with aphasia, and specifically to look at various figurative tropes. The study described here is the first pilot test conducted using the battery, as we are still extending it and planning to include also other figurative language tropes along with a more extensive range of tasks. The Figurative Language Battery consists of four parts, each of which focuses on a different figurative trope (idiom, metaphor, proverb, simile) and employs either a comprehension task which taps patients' metalinguistic knowledge or a production task which relies on automatic processing. A comprehension, metalinguistic task is a multiple choice test, which requires identification of a correct paraphrase of an idiomatic or metaphorical expression from among a range of competing, inappropriate alternatives. In turn, a production task consists in the completion (i.e., providing the last, missing word) of an unfinished figurative expression (simile or proverb), presented orally. Overall, the study aimed to explore whether individuals with aphasia would display literal bias in interpreting figurative language and whether they would therefore be more likely than control participants to understand idioms and metaphors in a literal, rather than figurative manner. Given previous research (e.g., Ulatowska et al. 2000), we also wanted to find out whether highly automatized and overlearned sequences, such as proverbs and similes, would be easier than idioms or metaphors for participants with aphasia. In addition, since previous research has shown that comprehending idiomatic expressions in aphasia is affected by such idiom characteristics as their transparency and ambiguity, we wanted to verify whether those factors would influence participants' performance. Finally, we wanted to explore whether metaphor conventionality (i.e., how well known, familiar, and institutionalized the metaphor is in a language) would affect the ease of its interpretation. The following research questions were formulated:

1. Will participants with aphasia display literal bias in their interpretation of figurative language, i.e., will they tend to interpret idioms and metaphors literally, rather than figura-

tively, as compared to the control group, in a multiple choice idiom and metaphor comprehension task?
2. Will participants show less impairment on the highly overlearned, automatic sequences, such as proverbs and similes, as compared to idioms and metaphors?
3. Will participants' performance in the multiple choice idiom test vary as a function of idiom transparency/opaqueness and ambiguity?
4. Will participants' performance in the multiple choice metaphor test vary depending on metaphor conventionality?

Material and methods

Participants

Eight left brain damaged patients (two women and six men, native speakers of Polish), mean age 58.7 (range 35 to 60) and mean educational level 14.5 (range 12-17) agreed to take part in the study. The study was approved by the institutional review board supervising the outpatient clinic in Poznan, Poland, from which the patients were recruited. Selection criteria included right handedness, aphasia following a vascular lesion in the left hemisphere, at least a three-month post-injury period, completion of secondary education (at least 12 years of education), and comparable performance on a diagnostic sentence and word comprehension test administered routinely by the outpatient clinic to test the degree of patients' language impairment. The diagnostic test consists of lexical and grammatical parts, the former testing patients' comprehension of words in isolation (matching a word with a picture or synonym), while the latter tests the ability to understand syntactically complex sentences (matching sentences with their paraphrases). Four patients suffered from mixed motor-sensory aphasia, two were diagnosed with sensory aphasia, and two with motor aphasia. In addition, ten controls (five men and five women) matched for educational background and age (average age: 56.7; range 34-70; mean educational level 14.7) were recruited to complete the figurative battery. All the participants signed a consent form and were free to withdraw from the experiment at any moment.

Materials and procedure

Participants were given a four-part figurative language test. Part One was a multiple choice (MC) test presented on the computer screen and testing comprehension of Polish idiomatic expressions. Twenty-four idioms were selected for the test, varying along the dimension of transparency and ambiguity. Out of the 24 idioms, twelve were transparent (e.g., *play with fire*) and twelve were opaque (e.g., *kick the bucket*). Six of the transparent idioms were ambiguous, in the sense that they could plausibly be interpreted literally (e.g., *add fuel to the fire*), and the other six were unambiguous, in that they could only have a figurative interpretation (e.g., *to be somebody's right hand* [*to be very helpful*]). Out of the 12 opaque idioms, six were ambiguous (*to bite something* [*to figure it out*]) and six unambiguous (*to give up the ghost* [*to pass away*]). Opacity/transparency and ambiguity were established in a prior norming study conducted in a group of 120 healthy adult native speakers of Polish (aged 20-35), who rated 100 Polish idioms taken from *Słownik frazeologiczny współczesnej polszczyzny* (*Phraseological Dictionary of Contemporary Polish*; Bąba and Liberek 2002). Participants were instructed to perform an idiom rating task, which consisted of rating ambiguity (literal plausibility) and transparency of each idiomatic phrase on a scale from 1 to 7, where 1 indicated that an idiom was ambiguous or transparent and 7 that it was unambiguous and opaque. The ambiguous idioms chosen for the Figurative Language Battery had a mean rating of 2.9 (range 1.0-3.0) and the unambiguous ones had a mean rating of 6.2 (range 5.0-6.9). The transparent idioms selected for the Battery had a mean rating of 2.7 (range 1.1-2.9) and the opaque ones had a mean rating of 5.3 (range 5.1-7.0).

Each idiom was embedded in a neutral sentence (e.g., *My uncle kicked the bucket*) and paired with three possible interpretations. One of them was a paraphrase of the figurative meaning of the idiom (e.g., *My uncle died*). The second was a literal distractor, which paraphrased the literal meaning of the idiom (e.g., *My uncle struck the pail with his foot*), and the third was an unrelated distractor which did not refer to the literal meaning of any of the words making up an idiomatic phrase (e.g., *My uncle got very nervous*). Each sentence, along with its three possible paraphrases (randomized for each item), was presented as a slide in a power point presentation and read out loud by the experimenter. The participants were instructed that they are going to see phrases used metaphorically which do not mean what they literally say and were provided with a few examples of idioms along with

their figurative interpretations. They were then asked to choose the option which best paraphrased the meaning of the sentence. They could spend as much time as they needed thinking about the answer. They indicated their answer either by pointing to the right option (a, b, or c) on the screen or by saying the paraphrase out loud.

Part Two was also an MC test with metaphors varying along the dimension of conventionality (conventional vs. unconventional). Altogether there were 30 metaphors, half of which were conventional (e.g., *These friends have common roots*), and half were unconventional (e.g., *His eyes were dancing* [*He was happy/in good mood*]). Conventionality was verified in a prior norming study performed by 20 adult native speakers of Polish with no language impairment, in which they were asked to evaluate a pool of 60 metaphoric sentences on a 5-point scale, from the most conventional (1 indicating that they have heard or seen a metaphor very often) to the least conventional (5 indicating that they have rarely or never seen the metaphor before). Metaphors were categorized as conventional if their mean conventionality rating was 1.0-2.0 ($M = 1.5$) and as unconventional if their mean rating ranged from 2.5 to 5 ($M = 3.90$). The procedure in the MC metaphor test was identical to that of Part One.

Part Three was an oral completion test, consisting of 24 common Polish similes (e.g., *He is as stupid as a shoe* [*very stupid*]). Participants heard the simile read out loud by the experimenter and were supposed to provide the last, missing word, which was not pronounced. Part Four was also an oral completion test, with 27 familiar Polish proverbs to be completed. As in the simile test, the experimenter read out loud the proverb without the last word and the participant was asked to listen and provide (i.e., say out loud) the missing element. Familiarity of the similes and proverbs employed in Part Three and Four was verified in a norming study conducted on a group of 25 healthy adult native speakers of Polish (aged 23-66), all of whom had a similar educational background to that of the patients and controls participating in the study.

The participants were tested individually in a session that lasted approximately twenty-five minutes. The order of presentation of each of the four parts was counterbalanced. Participants' answers were noted down by the experimenter, who was not involved in reading the stimulus materials and providing instructions. In a debriefing session, patients' and controls' familiarity with all the figurative stimuli used in the test was verified and any questions concerning the experiment were fully addressed.

Design

To determine if there is literal bias in patients' interpretation of figurative expressions, a mixed ANOVA was conducted, with Group (Patients vs. Controls) as a between-subjects variable and Type of Trope (Idiom vs. Metaphor) and Error Type (Literal vs. Unrelated) as a within-subjects variable. In addition, separate analyses were conducted on the patients' correct responses and error data to find out the effect of type of figurative language on their performance. For the idiom data, we looked at the number of literal and unrelated errors as a function of Idiom Transparency (Transparent vs. Opaque) and Idiom Ambiguity (Ambiguous vs. Unambiguous). For the metaphor part of the battery, we looked at the number of literal and unrelated errors as a function of Metaphor Conventionality (Conventional vs. Unconventional). Finally, since proverbs and similes were tested with an oral completion task, which elicited either correct responses or failure to respond altogether, no error data were analysed; instead we calculated means of corrected responses for both figurative tropes.

Results

Literal bias in the performance of patients with aphasia

For each item in the multiple choice idiom and metaphor test, the number of incorrect literal and unrelated responses (errors) provided by individuals with aphasia and healthy controls was calculated and entered into 2 (Group: Patients vs. Controls) × 2 (Type of Trope: Idiom vs. Metaphor) × 2 (Error Type: Literal vs. Unrelated) ANOVA. The data from the simile and proverb tests were not entered because no error type could be distinguished in those sets, with the participants either providing the right missing word or failing to do so altogether. The few incorrect alternatives that they did offer failed to be consistently either literally related or unrelated to the missing target. A robust main effect was found for Type of Error in the analysis by subjects ($F1$ (1, 16) = 29.7; $p < 0.000$) and items ($F2$ (1, 46) = 5.50; $p < 0.05$). In addition, two-way interactions between Type of Error and Group ($F1$ (1, 16) = 29.7; $p < 0.000$); and Type of Error and

Table 1. Percentages of correct and incorrect (literal, unrelated, and don't know) responses in the idiom and metaphor MC tests obtained for patients and controls

Type of answer	Idioms		Metaphors	
	Patients	Controls	Patients	Controls
Correct (figurative paraphrase)	59.4%	98.7%	52.2%	97.67%
Incorrect (literal)	20.3%	0.88%	23.3%	1.33%
Incorrect (unrelated)	20.3%	0%	22.2%	0.67%
Don't know	0%	0.42%	2.3%	0.33%

Type of Trope ($F1$ (1, 16) = 16.68; $p < 0.05$); and a three-way interaction between Type of Trope, Type of Error and Group turned out significant in the subject analysis ($F1$ (1, 16) = 16.68; $p < 0.05$). In the item analysis, interaction between Type of Error and Group ($F2$ (1, 46) = 4.40; $p < 0.05$) turned out significant as well. Performance of participants with aphasia and healthy controls in the idiom and metaphor tasks is summarized in Table 1.

Patients made significantly more literal errors than healthy controls, both in the MC idiom test ($t(7) = 4.91$; $p < 0.005$), and in the MC metaphor test ($t(7) = 4.61$; $p < 0.005$). In addition, patients made overall significantly more literal than unrelated errors ($t(7) = 4.84$; $p < 0.005$), whereas the control group did not differ with regard to the types of errors produced.

Performance in proverb and simile versus idiom and metaphor parts of the Battery

We next looked at how patients' and controls' performance varied depending on the type of trope in the figurative battery. Since the number of test items varied in the language battery for each figurative trope, correct responses obtained in the MC and Oral Completion tests were converted into percentages (see Table 2).

Overall, patients performed significantly worse than controls ($t(7) = 4.45$; $p < 0.0005$) in the MC idiom and metaphor part of the battery. Likewise, patients' results in the Oral Completion proverb and simile task were significantly worse than those of the control group ($t(7) = 3.15$; $p < 0.05$). Patients' performance in the proverb test was significantly better than in any of the remaining tests: ($t(7) = 2.73$; $p < 0.05$) for proverbs vs. idioms ($t(7) = 3.2$; $p < 0.05$) for proverbs vs. metaphors, and ($t(7) = 3.17$; $p < 0.05$) for proverbs vs. similes. On the other hand, the performance of controls was unaffected by the type of task and highly comparable across conditions. Since results from the control group were unaffected by the Type of Trope, the remaining analyses investigating the effect of idiom and metaphor type on figurative comprehension were carried out only on the patients' data. These are reported in the following sections.

Effects of idiom type

In order to verify the claim that type of idiom affects aphasic patients' figurative comprehension, separate analyses were conducted on the results obtained for idioms varying along the dimension of transparency and ambiguity. The mean number of correct responses obtained by the aphasic patients was 4.5 out of 12 for transparent idioms (range 0-9) and 7.0 out of 11 (range 2-11) for opaque idioms. 2 (Idiom Transparency: Transparent vs. Opaque) × 2 (Error Type: Literal vs. Unrelated) ANOVA revealed a significant main effect of Idiom Transparency ($F1$ (1, 7) = 13.18; $p < 0.01$; $F2$ (1, 10) = 6.12; $p < 0.05$) and of Error Type ($F1$ (1, 7) = 13.83; $p < 0.01$; $F2$ (1, 10) = 12.99; $p < 0.005$), as well as a significant interaction between Transparency and Error Type ($F1$ (1, 7) = 18.02; $p < 0.01$; $F2$ (1, 10) =

Table 2. Percentages of correct and incorrect responses on the simile and proverb test obtained for patients and controls

Type	Similes		Proverbs		Metaphors		Idioms	
of answer	Patients	Controls	Patients	Controls	Patients	Controls	Patients	Controls
Correct	65.62%	93%	83.4%	99.26%	52.2%	97.67%	59.4%	98.7%
Incorrect (or missing)	34.38%	7%	16.6%	0.74%	47.5%	2.33%	40.6%	1.3%

5.38; $p < 0.05$). Transparent idioms elicited significantly more literal errors ($M = 5.63$) than unrelated errors ($M = 2.00$; $t(7) = 4.10$; $p < 0.005$) and significantly more literal errors than opaque idioms ($M = 2.25$; $t(7) = 4.62$; $p < 0.005$) (see Table 3 for summary of the data obtained for various idiom types).

Turning now to idioms varying with regard to ambiguity, the mean number of correct responses was 4.13 out of 12 for ambiguous idioms (range 1-7) and 8.0 out of 12 (range 1-15) for unambiguous ones (see Table 3). A 2 (Idiom Ambiguity: Ambiguous vs. Unambiguous) × 2 (Error Type: Literal vs. Unrelated) ANOVA revealed a major effect of Idiom Ambiguity in the subject analysis ($F1$ (1, 7) = 7.36; $p < 0.01$) and of Error Type by both subjects and items, ($F1$ (1, 7) = 18.02; $p < 0.005$; $F2$ (1, 10) = 5.88; $p < 0.05$), as well as a significant interaction between Idiom Ambiguity and Error Type in the analysis by subjects ($F1$ (1, 7) = 7.20; $p < 0.05$). Ambiguous idioms elicited significantly more literal errors ($M = 4.00$) than unrelated ones ($M = 0.25$; $t(7) = 5.79$; $p < 0.005$).

Effects of metaphor type

A summary of the mean numbers of literal and unrelated errors for metaphors varying along the dimension of conventionality is provided in Table 4.

A 2 (Conventionality: Conventional vs. Unconventional) × 2 (Error Type: Literal vs. Unrelated) ANOVA was next conducted on the error data. The two-way interaction between Conventionality and Error Type ($F1$ (2, 14) = 11.06; $p < 0.05$) was statistically significant in the subject analysis. Conventionality of metaphor affected patients' performance in such a way that unconventional metaphors elicited significantly more literal ($M = 3.88$) than unrelated errors ($M = 2.50$; $t(7) = 2.43$; $p < 0.05$), whereas for conventional metaphors means of both error types did not differ significantly.

Table 3. Mean numbers of incorrect literal and unrelated responses for transparent vs. opaque and ambiguous vs. unambiguous idioms in the aphasia group. SDs are provided in parentheses next to each value

Type of idiom	Literal response	Unrelated response
Transparent idiom	5.63 (3.19)	2.0 (1.19)
Opaque idiom	2.25 (1.66)	1.38 (0.90)
Ambiguous idiom	4.0 (1.9)	0.25 (0.36)
Unambiguous idiom	3.88 (2.85)	3.13 (2.29)

Table 4. Mean numbers of incorrect literal and unrelated responses to conventional and unconventional metaphors; SDs are provided in parentheses next to each value

Type of metaphor	Literal response	Unrelated response
Conventional	2.90 (0.75)	3.25 (1.32)
Unconventional	3.88 (1.43)	2.50 (0.92)

Discussion

In line with the previous research (e.g., Cacciari et al. 2006; Papagno and Caporali 2007; Papagno et al. 2006; Papagno and Genoni 2003, 2004; Papagno et al. 2004), the study reported here found a marked literal bias in aphasic patients' performance (Research Question 1). Patients made significantly more errors overall than healthy controls and provided significantly more erroneous literal than unrelated responses. Controls performed at the ceiling and the errors they made were evenly distributed between literal and unrelated categories. Papagno et al. (2004), Papagno et al. (2003) and Papagno and Caporali (2007) have suggested that a dysfunction of the language suppression mechanism (Gernsbacher and Robertson 1999) might be the major cause of problems in figurative language comprehension in clinical populations (see also Champagne-Lavau and Joanette 2009; Iakimova et al. 2010; Schettino et al. 2010; Titone et al. 2002). If the mechanism of suppression does not aid the language processing system in inhibiting the irrelevant literal meaning, figurative comprehension becomes a difficult task, especially when context lacks the relevant cues that might help in rejecting the plausible literal interpretation. Some of such cues suggesting the necessity to reject the literal meaning of idioms might be their opaqueness or unambiguously figurative meaning. Accordingly, upon encountering opaque and unambiguous idioms, the language comprehension system quickly rejects an incorrect literal interpretation and retrieves the idiom's figurative meaning. On the other hand, when faced with ambiguous idioms with a plausible literal interpretation and transparent meaning, aphasic patients experience difficulty in constructing the metaphorical interpretation and often fail to suppress the inappropriate literal sense.

With regard to our Research Question 2, the type of trope and possibly also the type of task

were shown to significantly affect patients' performance. As demonstrated in previous studies (e.g., Hillert 1999, 2004; Klepousniotou and Baum 2005), an oral production task of finishing an incomplete simile or proverb turned out to be less demanding than a multiple-choice idiom and metaphor task. While the former demands retrieval of highly automatized and overlearned sequences and hence relies more on automatic processing, the latter taps explicit knowledge and requires the engagement of the suppression mechanism to deal with competing interpretations. More specifically, multiple choice tasks can be viewed as explicit since they rely on a conscious selection process, where the competing distractor (literal) stimuli need to be rejected and the correct response monitored. These findings are in agreement with the previous research (e.g. Hillert 2004; Leonard and Baum 2005; Papagno et al. 2004; Tompkins et al. 1992) which demonstrated marked differences in aphasic patients' performance as a function of task automaticity. Since, however, our Figurative Battery tested proverbs and similes with an oral completion task, and metaphors and idioms with a multiple choice task, we cannot tease apart the effects of the type of trope from the effects of the task type as such. We are currently expanding the battery to include an MC segment also for proverbs and similes, and an oral completion segment for idioms and metaphors, so that in future studies we can address the issue of both the effects of type of figurative trope and type of task on figurative performance in aphasia. Successful performance of participants with aphasia in proverbs found in the current study is consistent with the results reported by Ulatowska et al. (2000).

Turning to our Research Question 3, similar to the results reported by Papagno et al. (2004) and Papagno and Caporali (2007), we found support for the claim that transparent and ambiguous idioms pose more difficulty for the language comprehension system than opaque and unambiguous idioms. By offering a plausible literal interpretation, ambiguous idioms require an extra processing effort and are thus more likely to elicit literal paraphrase errors than unambiguous ones. Clearly, the presence of such cues as opaqueness and unambiguously figurative-only interpretation seems to enhance the activity of the language suppression mechanism and to ensure more efficient inhibition of inappropriate literal meanings.

Finally, with regard to the effect of metaphor conventionality on the patients' performance (Research Question 4), conventional, well-known phrases turned out to be easier to comprehend and less likely to be interpreted literally than unconventional ones. Since the meaning of well-known and highly conventionalized metaphors is well established in the language user's mental lexicon, a familiar metaphorical interpretation becomes immediately available upon encountering the conventional metaphor, which allows quick suppression of the inappropriate literal meaning. On the other hand, when processing unconventional metaphors, the literal meaning is the first that comes to mind (see, for example, Giora 1999; Giora et al. 2000).

Conclusions

Overall, the study described in the present paper showed the necessity to consider both the type of figurative trope and possibly also the type of task in investigating figurative language impairment in aphasia. Because of the small sample used, comparisons across patients with a different type of lesion (mixed motor-sensory versus sensory versus motor aphasia) were not possible, but future studies should take this factor into account as potentially modulating figurative performance in aphasic individuals. More research with an expanded figurative language battery and larger populations of participants, counterbalancing both the degree of task automaticity and the type of figurative trope, is needed to shed more light on factors determining figurative performance in aphasia.

References

1. Anaki D, Faust M, Kravetz S. Cerebral hemispheric asymmetries in processing lexical metaphors. Neuropsychologia 1998; 36: 691-700.
2. Bąba S, Liberek J. Słownik frazeologiczny współczesnej polszczyzny. Wydawnictwo Naukowe PWN, Warszawa 2002.
3. Bottini G, Corcoran R, Sterzi R, et al. The role of the right hemisphere in the interpretation of figurative aspects of language. A positron emission tomography activation study. Brain 1994; 117: 1241-1253.
4. Brownell HH, Simpson TL, Bihrle AM, et al. Appreciation of metaphoric alternative word meanings by left and right brain-damaged patients. Neuropsychologia 1990; 28: 375-383.
5. Burgess C, Chiarello C. Neurocognitive mechanisms underlying metaphor comprehension and other figurative language. Metaphor Symbolic Activity 1996: 11: 67-84.
6. Cacciari C, Reati F, Colombo MR, et al. The comprehension of ambiguous idioms in aphasic patients. Neuropsychologia 2006; 44: 1305-1314.
7. Champagne-Lavau M, Joanette Y. Pragmatics, theory of mind and executive functions after a right-hemisphere lesion: different patterns of deficits. Journal of Neurolinguistics 2009; 22: 413-426.

8. Champagne M, Virbel J, Nespoulous JL, Joanette Y. Impact of right hemispheric damage on a hierarchy of complexity evidenced in young normal subjects. Brain Cogn 2003; 53: 152-157.
9. Chapman SB, Ulatowska HK, Franklin LR, et al. Proverb interpretation in fluent aphasia and Alzheimer's disease: implications beyond abstract thinking. Aphasiology 1997; 11: 337-350.
10. Eviatar Z, Just MA. Brain correlates of discourse processing: an fMRI investigation of irony and conventional metaphor comprehension. Neuropsychologia 2006; 44: 2348-2359.
11. Faust M, Mashal N. The role of the right cerebral hemisphere in processing novel metaphoric expressions taken from poetry: a divided visual field study. Neuropsychologia 2007; 45: 860-870.
12. Gagnon L, Goulet P, Giroux F, Joanette Y. Processing of metaphoric and non-metaphoric alternative meanings of words after right- and left-hemispheric lesion. Brain Lang 2003; 87: 217-226.
13. Gernsbacher MA, Robertson RR. The role of suppression in figurative language comprehension. Journal of Pragmatics 1999; 31: 1619-1630.
14. Giora R. On the priority of salient meanings: studies of literal and figurative language. Journal of Pragmatics 1999; 31: 919-929.
15. Giora R, Zaidel E, Soroker N, et al. Differential effects of right- and left-hemisphere damage on understanding sarcasm and metaphor. Metaphor and Symbol 2000; 15: 63-83.
16. Gurański K, Słotwiński K, Podemski R. Prozodia mowy w niedokrwiennym udarze mózgu. Udar Mózgu 2008; 10: 96-103.
17. Hillert D. On processing lexical meanings in aphasia and Alzheimer's disease: some (re)considerations. Brain Lang 1999; 69: 95-118.
18. Hillert DG. Spared access to idiomatic and literal meanings: a single-case approach. Brain Lang 2004; 89: 207-215.
19. Iakimova G, Passerieux C, Denhičre G, et al. The influence of idiomatic salience during the comprehension of ambiguous idioms by patients with schizophrenia. Psychiatry Res 2010; 177: 46-54.
20. Joanette Y, Goulet P. Right hemisphere and verbal communication. Springer-Verlag, New York 1990.
21. Jodzio K, Nyka WM. Zaburzenia językowe oraz mowy w praktyce ogólnolekarskiej. Forum Medycyny Rodzinnej 2008; 2: 14-22.
22. Kasher A, Batori G, Soroker N, et al. Effects of right- and left-hemisphere damage on understanding conversational implicatures. Brain Lang 1999; 68: 566-590.
23. Kemper S. Comprehension and the interpretation of proverbs. Journal of Psycholinguistic Research 1981; 10: 179-198.
24. Klepousniotou E, Baum SR. Processing homonymy and polysemy: effects of sentential context and time-course following unilateral brain damage. Brain Lang 2005; 95: 365-382.
25. Lee SS, Dapretto M. Metaphorical vs. literal word meanings: fMRI evidence against a selective role of the right hemisphere. Neuroimage 2006; 29: 536-544.
26. Leonard CL, Baum SR. Research note: The ability of individuals with right-hemisphere damage to use context under conditions of focused and divided attention. Journal of Neurolinguistics 2005; 18: 427-441.
27. Marczewska H, Osiejuk E. Nie tylko afazja... O zaburzeniach językowych w demencji Alzheimera, demencji wielozawałowej i przy uszkodzeniach prawej półkuli mózgu. Energeia, Warszawa 1994.
28. Maruszewski M. Mowa a mózg. PZWL, Warszawa 1970.
29. Mashal N, Faust M, Hendler T. The role of the right hemisphere in processing nonsalient metaphorical meanings: application of principle components analysis to fMRI data. Neuropsychologia 2005; 43: 2084-2100.
30. Mashal N, Faust M, Hendler T, Jung-Beeman M. An fMRI investigation of the neural correlates underlying the processing of novel metaphoric expressions. Brain Lang 2007; 100: 115-126.
31. McFarling D, Rothi LJ, Heilman KM. Transcortical aphasia from ischaemic infarcts of the thalamus: a report of two cases. J Neurol Neurosurg Psychiatry 1982; 45: 107-112.
32. Nenonen M, Niemi J, Laine M. Representation and processing of idioms: evidence from aphasia. Journal of Neurolinguistics 2002; 15: 43-58.
33. Nocentini U, Kahlaoui K, Roberts P, et al. Processing of denotative and connotative alternative meaning of words after left- and right-hemispheric lesion. Brain Lang 2006; 99: 100-101.
34. Papagno C, Caporali A. Testing idiom comprehension in aphasic patients: the effects of task and idiom type. Brain Lang 2007; 100: 208-220.
35. Papagno C, Curti R, Rizzo S, et al. Is the right hemisphere involved in idiom comprehension? A neuropsychological study. Neuropsychology 2006; 20: 598-606.
36. Papagno C, Genoni A. The role of syntactic processing in idiom comprehension. Brain Lang 2003; 87: 73-74.
37. Papagno C, Genoni A. The role of syntactic competence in idiom comprehension: a study on aphasic patients. Journal of Neurolinguistics 2004; 17: 371-382.
38. Papagno C, Lucchelli F, Muggia S, Rizzo S. Idiom comprehension in Alzheimer's disease: the role of the central executive. Brain 2003; 126: 2419-2430.
39. Papagno C, Tabossi P, Colombo MR, Zampetti P. Idiom comprehension in aphasic patients. Brain Lang 2004; 89: 226-234.
40. Pąchalska M. Afazjologia. PWN, Warszawa-Kraków 1999.
41. Pachalska M, Talar J, Brodziak A, MacQueen BD. Disturbances of mental image processing in post-stroke patients with left and right hemisphere damage. Med Sci Monit 2001; 7: 716-724.
42. Podemski R, Słotwiński K, Gurański K i wsp. Wpływ niedokrwiennego uszkodzenia dominującej półkuli mózgu w obszarze jąder podstawy na zmienność akustycznych parametrów mowy. Udar Mózgu 2006; 8: 16-21.
43. Rapp AM, Leube DT, Erb M, et al. Neural correlates of metaphor processing. Brain Res Cogn Brain Res 2004; 20: 395-402.
44. Rapp AM, Leube DT, Erb M, et al. Laterality in metaphor processing: lack of evidence from functional magnetic resonance imagining for the right hemisphere theory. Brain Lang 2007; 100: 142-149.
45. Ryglewicz D, Milewska D. Epidemiologia afazji u chorych z udarem mózgu. Udar Mózgu 2004; 6: 65-70.
46. Schettino A, Lauro LR, Crippa F, et al. The comprehension of idiomatic expressions in schizophrenic patients. Neuropsychologia 2010; 48: 1032-1040.
47. Schmidt GL, DeBuse CJ, Seger CA. Right hemisphere metaphor processing? Characterizing the lateralization of semantic processes. Brain Lang 2007; 100: 127-141.
48. Shields J. Semantic-pragmatic disorder: a right hemisphere syndrome? Br J Disord Commun 1991; 26: 383-392.
49. Soroker N, Kasher A, Giora R, et al. Processing of basic speech act following localized brain damage: A new light on the neuroanatomy of language. Brain Cogn 2005; 57: 214-217.

50. Stringaris AK, Medford N, Giora R, et al. How metaphors influence semantic relatedness judgments: the role of the right frontal cortex. Neuroimage 2006; 33: 784-793.
51. Stringaris AK, Medford NC, Giampietro V, et al. Deriving meaning: Distinct neural mechanisms for metaphoric, literal, and non-meaningful sentences. Brain Lang 2007; 100: 150-162.
52. Tartter VC, Gomes H, Dubrovsky B, et al. Novel metaphors appear anomalous at least momentarily: evidence from N400. Brain Lang 2002; 80: 488-509.
53. Titone D, Holzman PS, Levy DL. Idiom processing in schizophrenia: literal implausibility saves the day for idiom priming. J Abnorm Psychol 2002; 111: 313-320.
54. Tompkins CA, Boada R, McGarry K. The access and processing of familiar idioms by brain-damaged and normally aging adults. J Speech Hear Res 1992; 35: 626-637.
55. Ulatowska HK, Sadowska M, Kadzielawa D, et al. Linguistic and cognitive aspects of proverb processing in aphasia. Aphasiology 2000; 14: 227-250.
56. Van Lancker D. Rags to riches: our increasing appreciation of cognitive and communicative abilities of the human right cerebral hemisphere. Brain Lang 1997; 57: 1-11.
57. Van Lancker DR, Kempler D. Comprehension of familiar phrases by left-but not right-hemisphere damaged patients. Brain Lang 1987; 32: 265-277.
58. Weylman ST, Brownell HH, Roman M, Gardner H. Appreciation of indirect requests by left and right brain-damaged patients: the effect of verbal context and conventionality of wording. Brain Lang 1989; 36: 580-591.
59. Winner E, Gardner H. The comprehension of metaphor in brain-damaged patients. Brain 1977; 100: 717-729.
60. Zaidel E, Kasher A, Soroker N, Batori G. Effects of right and left hemisphere damage on performance of the "Right Hemisphere Communication Battery". Brain Lang 2002; 80: 510-535.