

## IDIOM PROCESSING IN APHASIC PATIENTS

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### ABSTRACT

The aim of the present paper is to provide insight into the issue of idiom comprehension in patients who are in the process of recovery from the syndrome of aphasia. Research in figurative language comprehension has seen a robust development in the recent decades. However, it has not been until quite recently that psycholinguists began to delve into the aspect of metaphorical language comprehension in brain damaged populations. It was observed that even though the ability to produce and understand language is recovered in the majority of patients with head trauma, the impairment of some aspects of comprehension may protract. The understanding of idioms, metaphors, similes and proverbs, due to their specific, non-literal character, has been evidenced to pose a serious problem to aphasic patients, as they fail to decipher the figurative meaning of the utterance, and, instead, tend to process the message literally (Papagno et al. 2004).

In the present study, three patients who suffered from aphasic disorder were tested for comprehension of idioms by means of two multiple choice tasks. The obtained results corroborated the hypothesis that patients who are in the process of recovery from aphasia encounter various pitfalls in the comprehension of idiomatic language. Predominantly, they exhibit an inclination to choose the erroneous, literal paraphrases of the presented idioms over their correct, idiomatic counterparts. The present paper aims at accounting for the reasons underlying such a tendency.

KEYWORDS: Aphasia; idiom; figurative language; language disorder.

### 1. Introduction

This paper will concentrate on a description of a research study on understanding idiomatic language, performed on three individuals with aphasia. To begin with, the account of the probe will include a thorough presentation and justification of the method applied, the material and the background information regarding the participants. Then, the data garnered from three case studies shall be collated and subsequently discussed. It is expected that the examination of the findings shall validate the hypothesis that idiom comprehension is impaired in aphasic patients. In this respect, the final step in the dis-

cussion will be a causal analysis of the outcome, which will be undertaken with the aim of providing feasible explanations for the results obtained.

## 2. The present research – three case studies on idiom comprehension in aphasia

A review of the results obtained in previous studies on idiom computation in aphasic population strongly implies that, among such individuals, the process tends to be disrupted. Still, the relatively insignificant number of investigations into the topic prevents neuroscientists from making any tenable conclusions. For this reason, further research studies on individuals with aphasia, as well as their continuous clinical assessment, need to be undertaken to accumulate more abundant and heterogeneous data on the subject. Accordingly, in the present project, three aphasic patients were examined for comprehension of idiomatic phrases. In order to eliminate some of the biases that were present in past studies, a special emphasis was put on the selection of material and method for testing. In the following sections, I shall describe in detail the stimuli, the paradigm, the participants and the procedure implemented in the experiment.

The aims of the present study were threefold. First of all, the experiment was intended to verify and corroborate the findings of previous research on idiomatic language processing in aphasic patients. Secondly, the cross-generic selection of the input material (ambiguous and unambiguous, compositional and non-compositional, opaque and transparent idioms) was applied to investigate whether the internal characteristics of the phrase have any bearing on the recognisability effect. Finally, I endeavoured to check to what extent the testing tool influences the obtained results. To this end, two versions of a multiple choice task were created, differing in the type of foils available for selection alongside the correct response.

## 3. Participants

The study was conducted on three patients (2 men and 1 woman) with lesions in the left hemisphere of the brain which triggered aphasic disorders. All three participants were patients of a Mental Health Centre in Poznań, where they were treated and rehabilitated due to language impairments. The mean age was 64 (range 55–77) and the mean level of education in years was 14.3 (range 12–18). The criteria for selection included the patients' right-handedness, diagnosed aphasia induced by an intracranial lesion to the left hemisphere, and the lack of visuo-auditory deficits, attested by a medical examination performed in the course of rehabilitation. Despite existing deficits in lexico-semantic processing, auditory comprehension in all the patients was determined as sufficient to grasp the instruction for the experiment. The study was performed at least six months after the onset of the aphasic disorder. Medical files of the patients were made available for inspection by the speech therapist. They provided the nosological picture of the

three cases, comprised of MRIs and CT-scans, indicating the site of the lesion, a description of early post-traumatic symptoms, and a medical diagnosis of the aphasia type. Aside from the clinical data, information on the patients' sociological and demographical background was obtained via an interview with the speech therapist. Table 1 presents demographical and clinical background of each subject.

Table 1. Demographical and clinical data of the aphasic participants of the study.

Subject	Gender	Age	Education	Lesion site	Aphasia type
S.G.	M	60	18	temporo-parietal	Anomic
M.S.	F	77	12	temporo-parietal	Anomic
W.B.	M	55	13	fronto-parietal	Transcortical Sensory

The table offers a collation of the most basic data only, since a more fine-grained presentation of each case shall be delineated now in a descriptive manner.

The first patient, S.G., was a 59-year-old right-handed male, whose native language was Polish. Premorbidly, he did not speak any foreign languages. He had eighteen years of formal education. He was diagnosed with a malignant brain tumour. The CT scan and MRI revealed that it was localised in the left temporoparietal lobe. Shortly afterwards the tumour was resected. As a result of the surgical intervention, S.G. has been suffering from language disturbances. After surgery, he remained fluent, his speech was devoid of agrammatism, and his auditory comprehension was completely spared. The language problems surfaced only when the task required naming objects. S.G. reported and noticed to be unable to name objects, frequently reporting the tip of the tongue phenomenon and using circumlocutions. In the aftermath of a medical and psycholinguistic assessment performed by the language therapist, S.G. was diagnosed with anomic aphasia. Indeed, his symptoms as well as the site and the character of the lesion are congruous with the overview of this type of aphasia described by Fabbro (1999: 45).

Language therapy was introduced two months after the surgery and had been continued for the next four months, up to the point when the present study was conducted. At the time of the present experiment, the patient was at the age of 60, and six months had passed since the removal of the tumour.

Patient Two, M.S., aged 77, was a native speaker of Polish, who did not know any other languages. She received twelve years of formal education. At the age of 74, the patient suffered ischemic stroke, which affected the temporoparietal region of the left cerebral hemisphere. CT scans and MRI examination displayed extensive superficial-and-deep lesions impinging on both cortical and subcortical structures. A thorough medical assessment revealed chronic circulatory disorder located in the cerebrum. In the aftermath of the stroke, M.S. experienced mild cognitive impairment, which was later resolved with natural recovery and in the course of psycho- and pharmacotherapy.

Two years after the first incident, the patient was again afflicted with a stroke of the same etiology. The site of the damage was convergent with the locus of the first ischemia. A post-stroke observation of the patient bore witness to major language dysfunctions, due to which language therapy was indicated. On the basis of the pathological symptoms observed, M.S. was diagnosed with anomic aphasia. She was able to comprehend auditory and visual input and her spontaneous language production did not deviate from the norm, as it was both fluent and grammatically well-formed. However, as far as repetition was concerned, the patient experienced grave difficulties, tended to distort sounds and stutter. The ability to perform a naming task was also observed to be compromised. In my view, these symptoms indeed allocate M.S. to the syndrome of anomic aphasia.

Language therapy was assumed seven months after the second stroke and, according to the therapist, generated encouraging results. At the time of the present study, the patient was in the ninth month of the therapy. M.S. was 77 years old and it had been sixteen months since the second ischemic stroke.

The third patient was W.B., a 55-year-old male, whose native language was Polish. Similarly to the remaining two subjects of this study, he did not know any foreign languages. Nearly three years prior to the time of the current experiment, the patient sustained extensive ischemic stroke in the left parietal lobe. Additionally, a CT scan demonstrated disseminated cortical atrophy mainly localised within temporal lobes. The severity of language disruption symptoms observed shortly after the onset of the disease was very substantial. W.B. exhibited major comprehension deficits, while his verbal output was practically non-existent. Due to such a harsh condition, language therapy was administered to the patient immediately upon his release from hospital. The subject had been attending therapy sessions systematically for over two and a half years. The therapist underscored that W.B. had made a tremendous progress over the course of the attended sessions. This was indeed evidenced in tangible results of regularly performed language testing. The patient regained speech comprehension, even though he still exhibited problems in processing written language, due to difficulties in discriminating between letters. According to the therapist, he scored relatively well on a sentence completion task and an object naming task, albeit an action naming task proved to be considerably hampered.

The overall picture of pathological changes traceable in W.B. yielded a diagnosis of transcortical sensory aphasia. It needs to be emphasised, though, that whereas the damage to the parietal lobe was inflicted as a result of an ischemic stroke, the temporal lobe was affected by a dementive disorder of an undetermined etiology.

Three healthy individuals with no history of cranial trauma were included in the study in the capacity of a control group. Each control participant was thoroughly selected to match their brain-damaged counterpart along the most vital variables. I paid heed especially to sociological factors, such as age, level of education, knowledge of foreign languages and social status. The controls were requested to perform the same test that was earlier administered to the individuals with aphasia. The data obtained of-

ferred an opportunity to juxtapose the scores of the healthy individuals with the data collected from the language-impaired patients.

#### 4. Material

At the initial stage, a battery of a hundred and four Polish idioms, both decomposable and non-decomposable, was gathered. The phrases were rather diverse in terms of their semantic characteristics, which led to grouping them into six categories: transparent ambiguous, transparent unambiguous, opaque ambiguous, opaque unambiguous, incorrect transparent and incorrect opaque. The number of items in each group ranged from 12 to 27. There were no constraints imposed on the syntactic features of the phrases. The majority of idioms followed the Verb + Noun Phrase pattern (*wziąć byka za rogi* ‘take the bull by the horns’; *mieć czyste ręce* ‘have clean hands’; *igrać z ogniem* ‘play with fire’), however there were individual examples of other structures too, for instance an Adverbial Phrase (*na chybił trafil* ‘at random’) and a Verb Phrase (*wyjść za mąż* ‘get married’).

It is worth mentioning that the past studies did not utilise such diversified idiomatic input. The selection of such a wide array of phrases in the present experiment stemmed from the objective to examine if the recognition of an idiom’s correct, non-literal meaning varies according to internal characteristics of the phrase. As Cacciari et al. (2006: 1306) contended, “it cannot be excluded that different processing mechanisms might be involved in processing different types of idioms”. In accordance with this hypothesis, my prediction is that opaque and incorrect idioms will be less likely to be understood literally than the transparent items, because in the latter case, literal paraphrases may profoundly distract the patient due to their seeming plausibility.

For each idiom, three paraphrases, constituting respectively the idiomatic interpretation, the literal interpretation and an unrelated foil containing the basic word from the idiom, were created. To provide an example, in the case of the idiom *wziąć byka za rogi* ‘take the bull by the horns’, the idiomatic paraphrase was *podjąć wyzwanie* ‘accept the challenge’, the literal interpretation was *chwycić zwierzę za rogi* ‘take the animal by the horns’, and the unrelated foil with the basic word from the idiom was *zobaczyć byka* ‘to see a bull’.

In order to facilitate the selection of 60 idioms with the most apt and accurate paraphrases for the actual experiment with aphasiacs, a pretesting procedure was performed. Ten language-unimpaired subjects, all of whom were native speakers of Polish and students of the M.A. programme in English at Adam Mickiewicz University in Poznań, were requested to rate the paraphrases assigned to each of the 104 idioms. For idiomatic and literal paraphrases, they were supposed to assess their accuracy on a 1–5 scale, where 1 meant ‘spurious’ and 5 meant ‘very accurate’. As for the idiomatic paraphrases, the procedure allowed to test two variables simultaneously – familiarity with the idiom itself and accuracy of the devised idiomatic interpretation. The ratings of the literal in-

terpretations served solely to check if the invented paraphrases sounded accurate and plausible. In the case of the unrelated paraphrases with one word from the idiom, the participants were instructed to rate their relatedness to the idiomatic phrase, also using a 1–5 scale, where 1 meant ‘completely unrelated’ and 5 meant ‘very related’. Each of the three groups of paraphrases, containing 104 items, was rated in separate sessions, with the view to avoid confusion among the participants of the task. The mean score for the idiomatic targets was 4.47, with a range from 1.875 to 5. In the case of the literal paraphrases, the mean score amounted to 4.31, with a range from 2.75 to 5. The unrelated strings, in turn, gathered a mean score of 1.53, with a range of 1 to 3.28.

The rating scores gathered in the pre-test conducted to the choice of idioms for the experiment. Two variables were taken into account in the process of the final selection of input. The rating scores of relevant paraphrases constituted the first variable. It is vital to emphasise at this point that the current study utilised two multiple choice tasks, which required different stimuli. The choice of idioms for Task 1 was contingent on the scores obtained only by the idioms’ idiomatic and literal paraphrases, while the scores for the unrelated foils were irrelevant. On the other hand, the idioms selected for Task 2 were those whose idiomatic and unrelated paraphrases scored the highest, whereas the results for the literal interpretations were extraneous. The other variable accounted for when selecting the stimuli was an equal distribution of idioms from the six idiomatic categories mentioned at the beginning of this section. To ensure that each category of idioms was evenly represented, I chose five items from each group for each of the tasks, paying heed to the scores from the rating pre-test. Hence, in total, the experimental input comprised sixty idioms, thirty tokens per task, along with paired paraphrases.

## 5. Tests and procedure

Capitalising on the views that the technique of testing harbours the potential to exert profound impact on the results of the experiment, in the current study the selection of the experimental method was very thorough. As a consequence of the recent criticisms of various testing paradigms used in the past experiments on aphasiacs, including the string-to-picture matching task and oral definition task (Cacciari et al. 2006; Papagno and Caporali 2007), these methods were rejected. Instead, I decided to utilise two multiple choice comprehension tasks. Task 1 consisted of a set of thirty idioms, comprising an equal number of items from the six idiomatic categories. Each idiom was paired with three target phrases matched for length and syntactic form: an idiomatic paraphrase, a literal paraphrase and an unrelated foil phrase. Task 2 also encompassed a battery of thirty idiomatic expressions, different from the ones chosen for Task 1, but selected evenly from the same prefabricated groups of idioms. In this multiple choice test, the target phrases attached to the idioms were: an idiomatic paraphrase, an unrelated foil containing the basic word from the idiom and an incidental filler phrase. In both tasks, the order of options was randomised. The rationale behind a dual experimental design

was that comparison of two sets of data might demonstrate whether the testing modality and the selected stimuli have any bearing on the outcome of research.

The two tasks used an impoverished context for the presentation of idioms, with the view to minimise the need to process the string syntactically, as this procedure is likely to be disrupted in subjects with cranial trauma, raising the risk of skewing the data. The pernicious effects of an elaborate context in examining brain-damaged population were underscored in various studies, including Qualls et al. (2004) as well as Papagno and Caporali (2007).

The actual examination of the three aphasic patients, S.G., M.S., and W.B., was performed during their language therapy sessions. Each patient was tested individually and performed both tasks during one session. At the beginning of the experiment, the subjects were instructed in Polish that they would be presented with a range of phrases whose meaning was non-literal, along with three matched expressions for each string. The participants' task was to choose the option that seemed to them the most semantically related to the target idiom. The examiner presented the idioms followed by the available choices auditorily, once or twice, depending on the need. Additionally, at the same time, the patients had the idiom and the options presented on the screen. The aim of such a double exposure to the stimulus was to ensure that the working memory of the participants was not preoccupied with the necessity to memorise the idiomatic phrase and the paired expressions, as this could adversely affect the processing of meaning. The same procedure and the same material were used to examine the three healthy controls.

## 6. Results

On the basis of the considerations presented thus far, three hypotheses can be put forward for experimental verification. Firstly, I predict that the aphasiacs will be impaired on idiom comprehension when compared to healthy controls, showing a tendency to comprehend idiomatic phrases literally. Secondly, the modality of testing is expected to exert influence on the final outcome of the study. It was shown in previous research (Papagno et al. 2004; Cacciari et al. 2006) that in the case of brain-damaged individuals the availability of a literal interpretation of an idiom works as a strong bias in favour of this meaning. Therefore, the absence of a literal option in Task 2 should be mirrored in higher scores obtained by the language-impaired subjects on this task, when juxtaposed with the outcome of Task 1. Finally, aphasic subjects will experience more trouble when trying to access correct meanings of some categories of idioms, especially the transparent ones, as opposed to other categories, such as the incorrect and opaque items.

An analysis of the data gathered from the three aphasic patients yielded results testifying to a differential level of impairment of idiomatic language understanding in each case. In all probability, such a state of affairs stems from the fact that the nosological pictures of the three considered cases differ significantly from one another. It is vital to

stress that, even though patients S.G. and M.S. were diagnosed with the same type of aphasia, the differences between the pathogeneses of their disorders precludes the possibility of discussing them together. Indeed, the holistic treatment of the three sets of data would be methodologically abortive. Hence, in this section, the results will be presented individually for each case, and only afterwards some comparative remarks shall be made.

## 7. Patient S.G.'s results

The patient performed relatively well, but, still, in comparison with the matched controls, his comprehension was moderately impaired. A discrepancy was exhibited in the scores in the two tasks. In Task 1, where literal, idiomatic and unrelated interpretations were available, S.G. produced 22 out of 30 (73.3%) correct responses. The control participant chose 29 out of 30 (96.7%) correct responses, failing to provide an answer for the remaining trial due to unfamiliarity with the idiom. S.G. obtained much better scores in Task 2 than in Task 1, choosing 28 out of 30 (93.3%) correct responses. The performance of the healthy control in this task was flawless, with 100% of appropriate choices. The results are shown in Table 2.

A quantitative analysis of the data gathered from aphasiac S.G. demonstrates impairment in idiom comprehension when compared with the control group. In order to gather more information, an in-depth investigation of the type of mistakes committed by the patient was undertaken. It was revealed that among the eight errors detected in Task 1, four were literal and four were unrelated. More interestingly, all the literal mistakes concerned idioms belonging to the same category of transparent ambiguous strings. This result corroborates my hypothesis that this type of idiomatic expressions would turn out to be more difficult for individuals with aphasia than the other kinds of idioms. In the case of phrases such as *Nie igraj z ogniem* 'Don't play with fire', or *Wziął byka za rogi* 'He took the bull by the horns', both literal and idiomatic interpretations are feasible; however the latter ones are more salient. For this reason, the literal option should be suppressed in the process of recognition, but, as expected, in subjects afflicted with brain damage, the language impairment propels the choice of the literal foil. Not surprisingly, the same pattern was observed with the phrase *On ma czyste ręce* 'He has clean hands', which seems even more unmanageable for an aphasiac, since both its literal and idiomatic interpretations are very salient, especially in a context-free presentation.

While the presence of literal errors is not unexpected, the equal number of unrelated mistakes in Task 1 must be much more puzzling. The choice of the foil *Pozwolił się oszukać* 'He let someone deceive him' in reference to the idiomatic stimulus *Zaserwował nam to w pigułce* 'He put it in a nutshell' suggests deficits in understanding of the input, especially as the idiom is unambiguous, that is, it cannot be interpreted in a literal fashion. A similar situation was observed with the remaining three incorrectly



processed idioms, whose meaning should be easily derived, because of their belonging to the category of incorrect unambiguous strings. To illustrate the claim with an example, the selection of *Miał kwitek na to co kupił* 'He had a receipt for what he bought' in response to *Komputery to dla mnie chińszczyzna* 'Computers are Greek to me' suggests a lack of understanding of the meaning of the stimulus.

The fact that S.G. performed better in Task 2, where the idiomatic interpretation was accompanied by two foils only, comes as no surprise. As it was hypothesised, the absence of a literal choice in the multiple choice test facilitates the choice of the correct response. The lack of interference from the seemingly feasible literal meaning is additionally reinforced by semantic inadequacy of the two remaining phrases paired with the idiomatic target. These two factors seem to be sufficient to enable the subject to decipher the meaning of the idiomatic string, leading to the choice of an appropriate response. Still, the two mistakes committed by S.G. in Task 2 signal a certain amount of disruption in semantic processing. However, it needs to be underscored that in both cases where an error was made, the subject chose an unrelated foil containing the basic word of the idiom. It thus seems that in these instances even the remote relatedness of the available paraphrase to the form of the idiomatic target confused the patient. To provide an example, S.G. chose the option *Dużo jadł* 'He was eating a lot' in response to the idiom *Jadł jej z ręki* 'He ate out of her hand'.

The investigation of the results obtained from the patient corroborated all three hypotheses put forward prior to conducting the study. Firstly, the comprehension of idiomatic language was impaired in the aphasiac when juxtaposed with the matched healthy subject. Secondly, some idiomatic stimuli, especially transparent ambiguous strings, triggered more erroneous responses than other groups of idioms. Thirdly, the absence of literal paraphrase in Task 2 resulted in fewer mistakes produced by the brain-damaged participant.

## 8. Patient M.S.'s results

The patient's comprehension was severely impaired when compared with the matched control. Furthermore, the scores obtained in Task 1 and Task 2 were significantly different, in that the performance in the former task was much worse than in the latter. In Task 1, M.S. produced a total of 17 out of 30 (56.7%) correct responses. In contrast, the controls made 100% of correct choices. The rate of appropriate choices in Task 2 was considerably higher for this individual, reaching 27 out of 30 trials (90%). Similarly to the first task, the control participants scored 100% correct responses. The data are collated in Table 2.

The comparison of the two sets of scores clearly elucidates compromised comprehension of idiomatic language in this individual. A qualitative appraisal of the data evinces congruence with the pattern generally observed in the aphasic population, namely, an inclination to process idioms literally. The remainder of the faulty responses

in this task was unrelated. When it comes to the type of idiomatic expressions that were misinterpreted as literal strings, four out of eight were classified as transparent ambiguous. This observation is in accordance with the outcome of the analysis of the first patient's responses. M.S. made identical errors in the case of the strings *Nie igrzaj z ogniem* 'Don't play with fire', *Wziął byka za rogi* 'He took the bull by the horns' and *On ma czyste ręce* 'He has clean hands'. Apart from these errors, the patient also mistakenly interpreted two transparent unambiguous idioms, namely *Ona ma dobrze poukładane w głowie* 'She has things well arranged in her head', meaning 'She is reasonable', and *To się nie mieści w głowie* 'It doesn't fit into one's head', meaning 'This is unbelievable'. The two remaining erroneous responses of the literal kind concerned incorrect opaque phrases, including *Uczciwość jest na wagę złota* 'Honesty is as costly as gold', meaning 'Honesty is very rare', and *Komputery to dla mnie chińszczyzna* 'Computers are Greek to me'. The fact that these four items were processed in a literal fashion is rather baffling, since these kinds of idioms are not feasible for literal interpretation. Hence, their compromised comprehension is symptomatic of severe computational deficits.

Moreover, M.S. made a significant number of unrelated errors, which further confirms grave impairment of figurative language understanding. What is particularly perplexing, the strings which yielded unrelated responses are highly familiar items, including *On kopnął w kalendarz* 'He kicked the calendar', corresponding to the idiom *to kick the bucket*, *Nie udawaj Greka* 'Don't pretend to be Greek', meaning 'Don't play the fool' and *On stoi nad grobem* 'He has one foot in the grave'. For these idioms, the subject chose these paraphrases respectively: *Pojechał na wakacje* 'He went on holiday', *Nie słyszę tego* 'I cannot hear that', *Gra w karty* 'He is playing cards'. As it can be noticed, there is no correspondence whatsoever between the meaning of the idiomatic strings and the choices indicated by this individual. Thus, it appears that language processing is severely dysfunctional in this individual.

The patient's performance in Task 2, where the literal option was non-existent, witnessed a significant improvement in comparison with the scores in Task 1. Such a state of affairs once again substantiates the assumption that the presence of a literal foil in a comprehension task strongly biases the choice of an aphasiac individual. Among the three erroneous responses produced by M.S. in Task 2, one was an unrelated foil with the basic word of the idiom and the remaining two faulty choices were the unrelated ones. All of the misinterpreted idioms belonged to the category of incorrect transparent phrases. As this type of idiomatic phrases resists any interpretation other than figurative, their erroneous recognition once again testifies to the severity of the aphasiac's language dysfunction.

Curiously, throughout the procedure of testing, when presented with the options to choose from, the patient repetitively endeavoured to combine all three strings in an attempt to produce a logical story. This tendency persisted even though the instruction for the task was repeated several times in the course of the examination. It thus seems that the subject experienced insuppressible urge to search for links between the autonomous

utterances. Undoubtedly, such disorder might have had a profound bearing on the outcome of the task.

The analysis of this patient's case substantiated the conjectures underlying the current research. M.S. exhibited strong impairment of idiom processing, choosing numerous incorrect responses of both literal and unrelated variety. The discrepancy between the scores in Task 1 and Task 2 supports the claim that the modality of testing may notably affect the results.

#### 9. Patient W.B.'s results

The third individual was severely impaired on idiom comprehension when contrasted with the matched controlled subject, and with the other two individuals with aphasia. Like these individuals, W.B. performed significantly better on Task 2 than on Task 1.

Task 1 manifested a very strong bias towards literal understanding of idiomatic stimuli. The subject chose only 13 out of 30 (43.3%) idiomatic targets, as opposed to 16 literal foils (53.33%). For one of the idioms, the unrelated paraphrase was selected, constituting a statistically insignificant percentage (3.33%). Unlike W.B., the matched control participants' performance in the task was error-free. Conversely, in Task 2 the results of the examination were quite similar for both participants. The individual with aphasia interpreted correctly 26 out of 30 (86.7%) idiomatic tokens. In turn, the control subject attained 100% accuracy. Table 2 gathers the data for W.B. and the control group.

The results obtained from the two participants, when juxtaposed, unravel the extent of dysfunction of idiomatic language computation in the brain-damaged patient. The percentage of erroneous answers in Task 1, combined with the uniformity of their nature, since all of them are literal, provides rather tangible evidence that the data are not random. The errors were quite evenly distributed across five out of the six categories of idioms. In accordance to my prediction, the most poorly comprehended group were transparent ambiguous strings, among which four out of five stimuli triggered misinterpretation. Apart from the expressions already enumerated in the description of the previous cases, W.B. committed an error in computing the meaning of *Przyparli go do muru* 'They drove him up the wall', even though the literal meaning is less salient than the idiomatic one.

A slightly lower number of mistaken choices concerned opaque ambiguous and opaque unambiguous idioms, reaching the level of three foils out of five possible. The patient exhibited compromised processing of such salient idiomatic meanings as *On kopnął w kalendarz* 'He kicked the calendar', a form parallel to *He kicked the bucket*, *Stawał na głowie* 'He was standing on his head to do something', *Znowu okazja przeszła mu koło nosa* 'He missed a chance that was under his nose again' or *Mam cały dom na głowie* 'I have the entire house on my head', meaning 'I'm responsible for running the house'. What is worth pointing out, the contention that the proper meaning of

incorrect opaque idioms is relatively easy to recognise was confirmed once again, as only one out of five items in this group yielded literal response.

When analysing the data from Tasks 1 and 2, it needs to be emphasised that W.B. consistently rejected unrelated options. In the former task, he chose the unrelated foil only once, whereas in the latter experiment, the subject completely ignored unrelated strings. As a matter of fact, the aphasiac was misled four times by the unrelated foils, but in all cases these were the strings remotely linked to the idiom, since they contained its basic word. It is difficult to account for the reasons why as many as four mistakes appeared, but it cannot be excluded that the patient was simply unfamiliar with the presented idioms. The fact that in the case of the token *Nieładnie tak stroić się w cudze piórka* 'It is ugly to deck oneself out in borrowed plumes', W.B. selected the foil *Nieładnie jest gromadzić piórka* 'It is ugly to collect plumes', which is structurally very similar to the idiom, may lend credence to the hypothesis that the patient did not know the idiom, and hence chose the response structurally affined to the stimulus. Misinterpretations of the residual items, including *On jadł jej z ręki* 'He was eating out of her hand' and *To jest burza w szklance wody* 'This is a storm in a teapot', seem to stem from the disruption of understanding as such, rather than unfamiliarity with the strings, which are commonly used.

The case of W.B. explicitly bears out the claim that aphasiacs fail to understand idioms. Moreover, the high number of literal errors vividly testifies to the inclination of brain-damaged individuals to misconceive such phrases. Finally, the disparities of results on the two tasks once again validate the assertion that the type of tests utilised in examination of patients with head trauma may sway the upshot of the study.

## 10. The overall results

The three case studies provide preliminary insights regarding the ability of individuals with aphasia to compute idiomatic language. Even though the type and severity of comprehension impairment varied from case to case, the general outcome of the experiment indicates that in all three individuals, irrespective of the site of the lesion and the type of aphasic disorder, the understanding of idioms was undermined.

Due to the diversity of factors that triggered aphasia in the three subjects discussed in this study, the results cannot be summed up and considered holistically. That is why only some overall comments can be made in reference to the tendencies that were observed to occur repetitively across the three cases.

Table 2 clearly demonstrates that the mildest impairment was observed in patient S.G., who produced a total of 10 errors in two experimental tasks. Patient M.S., in turn, was more impaired than S.G., because the amount of mistakes reached 16 items out of 60 trials. Undoubtedly, of the three studied subjects, W.B. experienced the most severe dysfunction of idiomatic language processing, committing 21 misinterpretations. The reasons for such a heterogeneous upshot can be numerous; however the distinct pathogeneses of

Table 2. Collated results for three case studies.

Subject	Task 1 correct	Task 2 correct	Literal errors (Task 1)	Unrelated errors (Task 1+2)
S.G.	22 (73.33%)	28 (93.33%)	4 (13.33%)	6 (10%)
Controls	29 (96.66%)	30 (100%)	1 (3.33%)	0
M.S.	17 (56.66%)	27 (90%)	8 (26.66%)	8 (13.33%)
Controls	30 (100%)	30 (100%)	0	0
W.B.	13 (43.33%)	26 (86.66%)	16 (53.33%)	5 (8.33%)
Controls	30 (100%)	30 (100%)	0	0

cerebral trauma observed in the probed individuals most likely constitute one of the most crucial determinants. Adhering to this assumption, it thus seems that aphasia induced in the aftermath of the removal of a brain tumour, as it was in the case of S.G., causes the least transparent figurative language dysfunction. Of the two remaining instances, which are akin to each other in terms of etiology, both surfacing after an ischemic stroke, the case of W.B. is more prolific in errors. This comes as no surprise, since the patient was also diagnosed with cortical atrophy of the temporal lobe, an ailment that must have impinged on his ability to understand meaning of figurative expressions.

While the comparative analysis of the data demonstrates certain differences in terms of quantity of mistakes, their qualitative appraisal brings more uniform observations.

As the summary of the results concentrating on the types of mistakes made by the aphasiacs elucidates, the number of unrelated errors is rather consistent across all three cases, ranging from 8.33% to 13.33%. This means that the probability of the patients' selecting their answers at random is minimal. In turn, the participants produced a disproportionate number of literal errors, ranging from 13.33% to 53.33%. Such an outcome, however, does not undermine the result, but, rather, it is indicative of a differential impact of aphasic disorder on the patients' ability to suppress the choice of literal meanings. Once again, there is a certain degree of correlation between the etiology and the extent of cerebral lesion and the number of literal faults. In S.G., whose lesion was surgically induced and circumscribed to a relatively small area, the incidence of errors is the lowest. At the other end of the continuum, there is W.B., whose cerebral damage is rather extensive, as it encompasses the regions mutilated in the aftermath of the stroke, as well as sites described to be abnormally atrophied.

## 11. General discussion

Two multiple choice tasks were utilised in the present research to test idiomatic language computation in patients diagnosed with aphasia. The tasks differed along the lines of the options made available for the selection, in that one of the tasks contained literal interpretations of the idiomatic string and the other task disposed of such an op-

tion. The general conclusion drawn from the current study is that the processing of idiomatic strings in clinical population is compromised. More importantly, the impairment of understanding was evidenced to be differentially distributed among the patients, whose performance was unsteady in relation to the matched controls. Several determinants might have contributed to such an effect, among which the pathology of cerebral trauma was hypothesised to be essential.

Another pattern which emerged from the analysis of the data is the preponderance of literal errors over unrelated mistakes. Several modes of explanation have been provided to account for this tendency in Cacciari et al.'s (2006: 1311) study. The authors posit that the idiom recognition mechanism can be impaired in patients with brain damage, who fail to recognise the figurative nature of the expression. On the other hand, it is hypothesised that the failure of an inhibition mechanism is responsible for the choice of an erroneous literal interpretation, which should normally be subdued once there is enough contextual input to recognise the expression as idiomatic. Stuss et al. (1994, as quoted in Cacciari et al. 2006: 1311) provide an alternative explanation, blaming the bias towards the literal interpretation of an idiom on the selection and monitoring mechanisms, which might collapse in the event of encountering two or more competing and equiprobable meanings. Each of these theories sounds plausible, however none of them has ever been substantiated with tangible evidence. For this reason, the actual neural substrate culpable of the selection of erroneous literal option shall remain in the realm of speculation and conjecture.

The following conclusion ensuing from the present experiment calls attention to the method of experiment administration. The dual testing procedure employed in this study proved to be of paramount importance, since the results of the two experiments differed significantly. As it was signaled in previous research (Papagno et al. 2004; Cacciari et al. 2006), depending on the engagement of different modalities governed by the activity of the brain, such as auditory comprehension, visual encoding, creative thinking, inference making, the obtained score may fluctuate. I endeavoured to broaden the outlook on the issue by demonstrating that even within the scope of one type of testing procedure, namely a multiple choice comprehension task, discrepant results can be gathered depending on the options made available for selection.

Finally, having applied a divergent testing material comprised of six categories of idioms, I strove to investigate if the internal characteristic of an idiomatic string affects the ease of recognition of its meaning. The three sets of data that were garnered, allowing the validation of the hypothesis that transparent ambiguous idioms are the most troublesome for individuals with aphasia, since their computation was most frequently terminated in an erroneous choice.

## 12. Conclusion

The review of past research pertaining to the topic of idiom comprehension among individuals with aphasia served as a benchmark for the description of an experiment that

I designed and conducted on three patients diagnosed with aphasic disorder. The present study corroborated the previous results, in that the ability of individuals with aphasia to comprehend idioms is disturbed. As expected, these individuals exhibited a tendency to compute the meaning of idiomatic stimuli literally. Other, no less important findings, highlighted the effect of testing method on the upshot of the experiment. Indeed, the elimination of a literal option in one of the experimental tasks improved the performance of the subjects. Similarly, the selection of material for the study proved to be equally vital, since the internal characteristic of an idiomatic phrase affected the ease of understanding. This conclusion ensued from the fact that the individuals with aphasia tended to experience more interpretative difficulties when encountering transparent idioms, whose literal interpretation was remotely feasible, than in the case of being presented with an opaque idiom paired with a semantically unlikely literal paraphrase.

The foregoing results are consistent with findings that are being reiterated in psycholinguistic literature (Papagno et al. 2004; Cacciari et al. 2006), but by no means do they yield any definite conclusions regarding the processing of idiomatic expressions by individuals with aphasia, or exhaust the topic. In the future, it would be advisable to test the hypotheses put forward in this study on a more diversified clinical group, since an examination of further clinical cases could harbour the potential to unveil the intricacies of idiom comprehension in aphasic populations, serving to a better understanding of the problem.

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