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## A case of "Borrowed Identity Syndrome" after severe traumatic brain injury

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### Summary

**Background:**

It is well known that traumatic brain injury often changes the way the patient perceives reality, which often means a distortion of the perception of self and the world. The purpose of this article is to understand the processes of identity change after traumatic brain injury.

**Case Report:**

We describe progressive deterioration in personal identity in a former physician who had sustained a serious head injury (1998), resulting in focal injuries to the right frontal and temporal areas. He regained consciousness after 63 days in coma and 98 days of post-traumatic amnesia, but has since displayed a persistent loss of autobiographical memory, self-image, and emotional bonds to family and significant others. Qualitative 'life-story' interviewing was undertaken to explore the mental state of a patient whose subjective, "first person" identity has been disengaged, despite the retention of significant amounts of objective, "third person" information about himself and his personal history (though this was also lost at a later stage in the patient's deterioration).

Identity change in our patient was characterized by a dynamic and convoluted process of contraction, expansion and tentative balance. Our patient tends to cling to the self of others, borrowing their identities at least for the period he is able to remember. Identity is closely connected with the processes of memory.

**Conclusions:**

The results will be examined in relation to the microgenetic theory of brain function. The brain mechanisms that may account for these impairments are discussed. Findings from this study have important implications for the delivery of person-focused rehabilitation.

**key words:**

**identity disturbances • process studies • person-focus rehabilitation**

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## BACKGROUND

The traditional approach to disorders consequent to brain injury centers on the description of concrete symptoms that be shown to correlate significantly with injuries to particular brain regions. This approach began with the pioneering works of Broca [1] and Wernicke [2], and has continued in much contemporary work in neuropsychology [3–5]. A.R. Luria [6] tried to go beyond merely listing the particular symptoms observed, introducing the idea of the "basic defect," i.e. a single underlying disorder that is presumably causing the manifold observable difficulties the patient manifests in performing the tasks involved in a neuropsychological examination. Thus a basic defect in phonemic hearing would affect performance in all tasks involved with that function, such as verbal memory, word repetition, reading, writing, etc., while performance should be unimpaired in tasks that do not require phonemic hearing. Only in this way would it be possible, in Luria's view, to describe a syndrome characterized by a particular set of disorders following a specific brain lesion.

Luria's approach was certainly a step forward, both in the better understanding of the nature of the symptoms observed in a particular patient and in conducting more effective therapy. Yet Luria's approach was only able to explain some of the symptom changes observed in a patient during the process of recovery. It does not provide an explanation for the appearance of clinically distinct syndromes over the course of progressive deterioration, as observed in many post-TBI patients. One such patient will be described in the present report, with particular emphasis on some unusual disorders of personal identity in a former physician who sustained a serious brain injury due to a car accident in 1998. The injury resulted in focal injuries in the frontal and right temporal areas and coma lasting 63 days. The real purpose of this paper, however, is to explore the mind of a patient whose identity has been disrupted, and who has experienced the loss of his self image and relations with his immediate surroundings.

## CASE REPORT

This case study follows patient PA from the age of 43 at the time of injury until his current age of 54 years. The patient is a board-certified gynecologist and obstetrician. Prior to the accident, he was the head of the OB-GYN department in a provincial hospital in southern Poland. He was married with three children, currently ranging in age from 13 to 26 years. The oldest daughter finished the Academy of Fine Arts in 2009 and is making a career as a painter. There were some problems with the marriage after his wife discovered that he had had a lover, who, as reported by his family and the lover herself, he had claimed to regard as the love of his life.

In November 1998, the car PA was driving struck a tree when he swerved to avoid a head-on collision. He incurred multi-organ injuries, including a very severe TBI. He remained conscious for a short period of time immediately after the accident, however, and his memory concerning the event itself seems to be intact as of this writing. An intracranial hematoma developed immediately after admission to hospital, and the patient lost consciousness. His Glasgow Coma

Scale score 24 hours after the accident was 3, the lowest possible. He remained in a coma for 63 days, but was not operated; his post-injury amnesia lasted 98 days.

Neuroimaging (Figure 1) shows damage mainly in the right hemisphere, most significantly affecting:

- the gyrus rectus;
- the frontal lobe, especially the precentral orbital gyrus;
- the lower frontal gyrus;
- the lower, central and upper temporal gyrus.

When first examined by the authors in January 1999, the patient was found to be suffering from:

- hemiparesis;
- sleeping problems, including narcolepsy, occasional parasomnia and nightmares;
- mild post-traumatic aphasia, with naming problems;
- anosognosia;
- executive dysfunction;
- inability to perform activities of daily living (ADL);
- bouts of aggressiveness;
- visuospatial disorientation;
- identity disturbance (does not recognize himself, does not remember his name);
- autobiographical memory disturbance;
- prosopagnosia (confuses close relatives, does not recognize his children or extended family members).

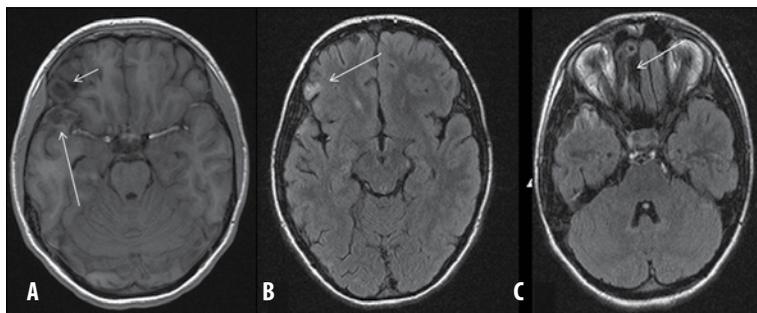
Initial signs of misidentification were observed in February 1999. These included:

- inaccurate spatial orientation with confabulation, e.g. the clinic was identified as a garage and he was a mechanic;
- loss of the feeling of personal identity (the patient complained that he did not know who he was, despite the absence of objective symptoms of global amnesia);
- abrupt changes in personal habits and routines (including smoking and drinking);
- loss of personal history, social roles, and lifestyle.

At that time he was able to recognize (i.e. name) some personal items (e.g. keys, comb, toothbrush), but denied that they belonged to him. Later in his recovery, he was able to name objects relevant to his past, e.g. cigarettes, a bottle of cognac, but did not recognize these items as being connected with his previous experience.

We learned from an interview with his wife that on the day of the accident a major marital crisis had occurred, resulting from the patient's infidelity. His wife had discovered that PA intended to go to a party with his lover. After a fierce quarrel he eventually backed down, and went with his wife instead; however, during the trip there was a sudden change in the situation on the road, and PA drove into a tree while passing a delivery truck. His wife did not suffer any serious injuries, because PA at the very last moment before the collision steered the car in such a way so as to take on himself the full force of the impact.

The patient's mother is of the opinion, and has often repeated it, that the cause of the accident was the hysterical behavior of her daughter-in-law. The truth is that her son had always driven much too fast and recklessly; PA has loved sports cars since childhood, and dreamed of taking part in car rallies.



**Figure 1.** MRI scan of PA's brain, performed four months post injury. (A) Axial SE T1 sequence: malacia in the right lower frontal gyrus (short arrow) and lower temporal gyrus (long arrow). (B) Axial FLAIR sequence: hyperintense gliotic lesion, right lower frontal gyrus (arrow). (C) Axial FLAIR sequence: atrophy and malacia, right gyrus rectus (arrow).

Very significant changes in his habits and behavior were noted in the 6 months following his arousal from coma. Prior to his accident he had been a vegetarian, a smoker, a moderate drinker, a known wit, who enjoyed social intercourse and parties. Following the injury, he had no recall of this lifestyle and personal history. At the same time PA exhibited symptoms of mirror sign, and a few months later of Capgras Syndrome, which included suspicion and confabulations regarding his wife and children (whom he called imposters), denial that he even knew his erstwhile lover, and even denial of his dog (who seemed not to recognize him when he returned home, and barked at him). However, facial recognition of public figures was preserved. Below are some examples of the patient's problems:

#### Mirror sign

A physiotherapist named Jacek was helping PA stand in front of a full-length mirror:

Therapist (Th): Who is that, Peter? Who do you see there?

PA: *I don't know. Oh my God! That monster is staring at me [shouting].*

Th: And who else do you see in the mirror?

PA: *I don't know, but maybe Jacek, I think you said so, isn't that right?*

Although he was not able to recognize himself in the mirror, he recognized and gave the name of the therapist. He also remembered his own name when asked. Ten minutes after this incident, however, he did not remember that he had been standing before a mirror or what the therapist's name was.

#### Denial of the family

Another feature of the disorder was denial of the family. Here is an extract from an interview with the patient in the presence of his parents, his wife and his oldest daughter, who was 19 at the time:

Th: You are pleased that you've been visited by your family, aren't you?

PA: *Me? Of course not! I don't have a family. I don't know these people. My family was all killed in an accident.*

Th: And...

PA: *I don't know these people. They are body doubles... doubles of my entire family or I don't know [shouting]!*

This seems a very clear case of Capgras syndrome [7]. Neuropsychologists and psychiatrists have known for nearly 100 years that a small number of psychiatric patients become profoundly suspicious of their closest relationships, often

cutting themselves off from those who love them and care for them. They may insist that their spouse is an impostor, that their grown children are body doubles; that a caregiver, a close friend, even the entire family is fake, a duplicate version.

#### Denial of the lover

Another symptom we observed during this period was denial of the extra-marital relationship (supposedly "the love of his life"). Upon being visited by his former girlfriend in the hospital, he displayed complete non-recognition.

L: How are you feeling, darling? [attempts to kiss him]

PA: *Don't kiss me [shouting]!. I don't know you!*

After one hour the therapist asked him about the visit (which had been arranged by PA's mother).

Th: So, you have been visited by your girlfriend?

PA: *That hag is supposed to be my lover?*

Th: She's a beautiful woman, isn't she?

PA: *Perhaps I could consider that woman beautiful, yes... I would regard her as beautiful, she is about 40, isn't she? No girlfriend of mine could be so old! Besides, I've never had a lover.*

Although PA did not recognize his lover, a few minutes later in conversation he suddenly stated that it was not permissible for a physician to enter into such a close relationship with a patient – even though no one had yet said to him that the woman who was claiming to be his lover had previously been his patient, and in fact the subject of conversation had already changed. This might suggest that he recognized her as a former patient (which in point of fact is true), but not as his lover. On the other hand, his wife is also a doctor, so his "pangs of conscience" might be related to his marriage, though that seems rather far-fetched. It is nearly impossible to establish, in his cognitive state, to what extent his failure to acknowledge his lover is repressed guilt, and to what extent it should be called amnesia, or confusion.

About half an hour after his lover had left the room, the patient asked the therapist, "Aren't you... *hmm... my fiancée or something... she must be somewhere, but I don't know where she is and nobody can find her.*"

It is possible that he was remembering the unpleasant conversation with his fiancée and was somehow looking for her to make things right. Some traces may have been maintained in his memory, then, of his feelings for this woman, and these memories were activated, with a marked delay, by the visit of his girlfriend. In his state of cognitive confusion he misidentified his therapist as his lover, but the emotional memory indicating that the lover had been lost was essentially correct.

## Denial of the dog

One of the most interesting aspects of PA's problems with autobiographical memory is his complete denial of having ever had a dog, when before the accident he and the dog had been extremely close. This constitutes a first in reported cases of a similar nature.

T: Is this your dog? [in the presence of his pet, a dachshund, who is barking at him. Apparently, the dog does not exhibit positive feelings towards the patient here and now].

PA: *Nothing of the kind! A lump of fur like that! I don't own a dog. I wouldn't want such a rubbishy thing! I'm afraid of this dog. It wants to bite me!*

PA was able to recognize public figures, but during this period he was watching an excessive amount of television, and had become interested in politics only after the accident. It is quite possible, however, that these faces of public figures constitute islands of episodic or autobiographical memory, which excludes any assumption that his disturbances might be linked to difficulties in facial recognition *per se*. After being shown pictures of two important Polish politicians he stated:

*"... here is the President and the Prime Minister... they have power... It's them who changed the calendar... and everyone thinks that I'm 40 when I'm really 20..."*

## Identity misidentification

This last utterance showed another important characteristic of PA's mental state, namely, the problems with identity. Not only was he unable to state his age, but he reacted with anger to an attempt by the therapist to specify his true identity, which is illustrated by the following conversation:

Th: Who are you?

PA: *Who am I? I don't know! Perhaps you could tell me?*

Th: You are a doctor – a gynecologist.

PA: *No! I'm too young to be a doctor.*

Th: How old are you?

PA: *Probably 7 or 8 years old.*

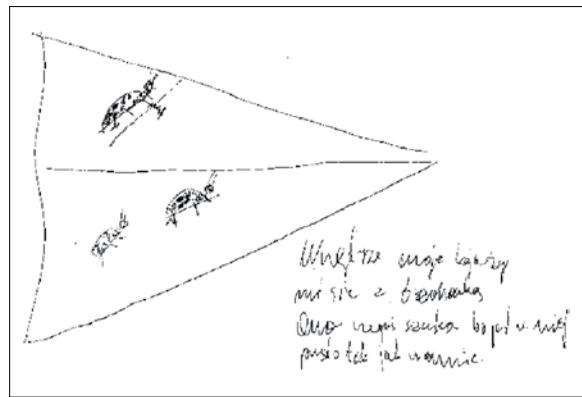
It was eventually established that he possessed some murky recollections of childhood up to the age of eight. At that time he had dreamed of becoming a car mechanic, and now he sometimes claimed to be one. He also vaguely remembered his first year at school, but from the age of eight. He complained that he felt lost. This can be noted in his commentary accompanying his drawing of a ladybug (Figure 2):

*"My inner self reminds me of a ladybug. It's obviously looking for something because she feels foggy and empty... LIKE ME... everything has to be searched for".*

The loss of identity was accompanied by delusions, which is illustrated by the following utterance:

*... the government has not only changed the money and I can't recognize it, but also the calendar to avoid paying the life annuity... they added 30 years to the established calendar and as a result I am supposed to be 45 years old, but really, I'm 25. They want to get rid of me. I'm scared.*

He would often change his stated age depending on the person with whom he found himself in contact.



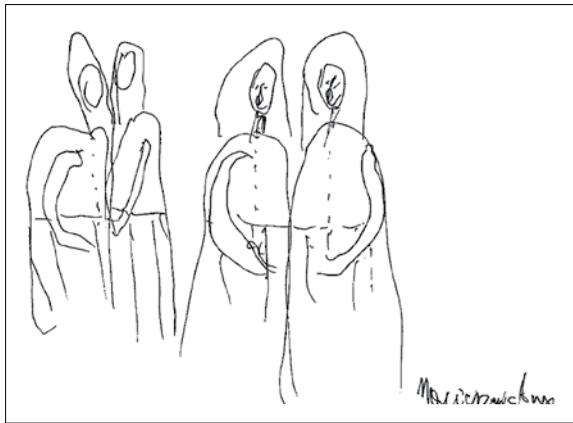
**Figure 2.** Patient's drawing representing himself as a ladybug. The patient's inscription reads as follows: "My insides remind me of a ladybug. She's looking for something, because it's empty inside her, like it's empty inside me."

Over time PA began to develop an "auto-Fregoli" syndrome. His lack of a personal sense of identity made him borrow the identity of others. Below are presented examples of some of the more interesting identities assumed by PA:

- When he was on the ward with a patient named Andrzej, who had global amnesia and maintained that he was a six-year-old clone, PA began shouting that the doctors had cloned him, too, and that now he was a six-year-old monster.
- When he was on the ward with a 19-year-old patient named Jurek, who had had a knee operation, he shouted that he couldn't walk because he had had a knee operation and would have to use a wheelchair; he also maintained that his name was Jurek.
- When PA met Zbyszek, a 29-year-old art therapist, he took the brushes from him and refused to give them back. He shouted that he had to paint a picture in the open because he had to earn a living. He answered to the name Zbyszek and claimed to be 29 years old.
- When a 20-year-old hairdresser was cutting his hair, he took her scissors from her and refused to give them back. He shouted that she could not take away his means of livelihood.
- When the young chaplain of the physiotherapy department, whom the patient had taken a liking to, was distributing communion on the ward, PA took his Bible, which had been left for a moment on the table, and refused to give it back. He shouted that they wanted to steal the Bible from him and that he would have nothing to pray from.

All these temporary acquired identities were based on situational stimuli: the identities borrowed by this patient are content-specific. It is also important to state that these identities have a temporal frame: for acquired identities, approximately 1–2 hours, which seems to be a factor of the maximum duration of his episodic memory. He would momentarily associate himself with an object or person which in some way attracted his attention, though what motivation there was for this particular object or person remains unknown, when other "opportunities" were ignored. The individuals selected were never older than their late 20s, and not infrequently they were children.

Of importance is the fact that after an hour (or sometimes two) PA would forget about his newly adopted identity, and



**Figure 3.** A therapeutic drawing made by PA (the task was to draw something from childhood), which he entitled "Maternity." Note that he has drawn two pairs of pregnant women, clearly making them into doubles. This is not because of double vision.

again did not really know who he was. Sometimes he accepted his true identity, as suggested by a researcher. However, in general he would protest, and present himself as a car mechanic.

PA's identity disturbances are persistent. The patient still does not know who he is. He continues to ascribe to himself the identity of those with whom he comes into contact. He believes that his family all died in an accident, but does not show any emotional reaction to this. He complains that he loves no one and no one loves him. He is totally alone, but he has no clear recognition of his situation. After reading about Cotard's delusion, a rare psychiatric syndrome in which people consider themselves to be dead, he consequently claimed that he was just such a case and was in fact dead, or perhaps reincarnated [8].

It came as a surprise, however, to discover, 3 years after the accident, that his medical knowledge was very well preserved. After meeting a TBI patient who had been pregnant and had lost her child, he advised her in a very professional way, and told her what drugs she could take for the depression that had developed following the loss of the child. In a thematic picture completed half an hour later concerning his most important memories from childhood, he drew four pregnant women (Figure 3) and entitled the picture "Maternity"; he later stated:

*"They could have been my patients. But I can't really recall whether I had such patients. When I think about it I see a black hole, such a void".*

He was also able to recognize and describe the ultra sonogram of a baby shown to him by his daughter, commenting:

*"... it's a baby in ultrasound 3D ... it could be in the 29<sup>th</sup> or 30<sup>th</sup> week of pregnancy. Do you think it's that old? It looks very healthy!"*

Yet he protested with anger when his daughter said that this was his grandson, crying:

*"... Oh no! Don't try and pull the wool over my eyes! I can't be a grandfather because I don't have any children. My whole family died in an accident."*

Moreover, he was able to give details of gynecological operations, but was extremely surprised to find that he could do so. He did not remember studying medicine, but was able to recognize the university building. This reflects a discrepancy between well-preserved medical knowledge and the lack of autobiographical memory. He had no recollection of having obtained a medical diploma even when it was shown to him, claiming that what he was seeing must have been counterfeit.

At the same time he proved to have preserved semantic memory, while autobiographical memory appeared to be lost. Thus he stated that people had children:

*"to develop a so-called procreative family, to maintain the human species, to pass on their genes."*

Yet he denied having children of his own, even when he was presented with their pictures:

*"... These are children, but not mine. I'm 18 years old. I'm too young to have children, right? It's not my blood and genes these children are carrying."*

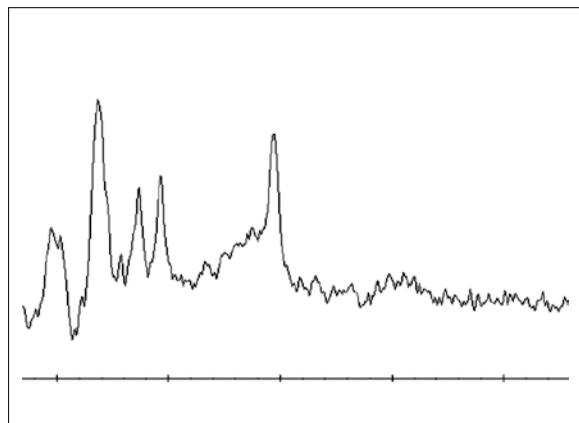
### Chronic status and ongoing rehabilitation

PA has been under neuropsychiatric and neuropsychological observation for 10 years, from January 1999 to June 2009. Treatment was based on a comprehensive model, including neuropsychological rehabilitation. In neuropsychological testing we found the following symptoms:

- traces of aphasia with minor naming difficulties;
- minor problems with the production of syntactically correct sentences;
- working memory problems and severe learning problems (PA does not remember anything longer than a few minutes at the most), especially with delayed memory tasks;
- severe problems with autobiographical memory (the patient remembers very little about his life before the accident);
- persistent disturbances of actuators, e.g. the patient soaps himself in the shower and then leaves the bathroom, entering the living room naked in the presence of his children;
- features of frontal lobe syndrome;
- persistent identity impairment (PA does not recognize himself in the mirror or in photographs, though he knows his name).
- a steady decline in his IQ, as measured by the Polish version of the Wechsler Adult Intelligence Scale – Revised;
- features of "temporal syndrome" (altered consciousness);
- a high level of anxiety;
- inability to perform activities of daily living;
- bizarre behavior, with an apparent inability to conform to social norms (especially laughing or shouting at inappropriate moments, e.g. during church services).

In this context it is perhaps significant that the metabolic changes in PA's brain, measured by HMRS, are at present close to the spectrum seen in fronto-temporal dementia (FTD) [9,10]. Figure 4 shows a statistically significant drop in NAA concentration, and also in the relative NAA/Cr concentration.

At the same time there is a statistically significant growth in the concentration of mI, as well as the relative mI/Cr



**Figure 4.** The HMRS Spectrum – Patient PA (below-normal NAA peak, above normal ml peak)

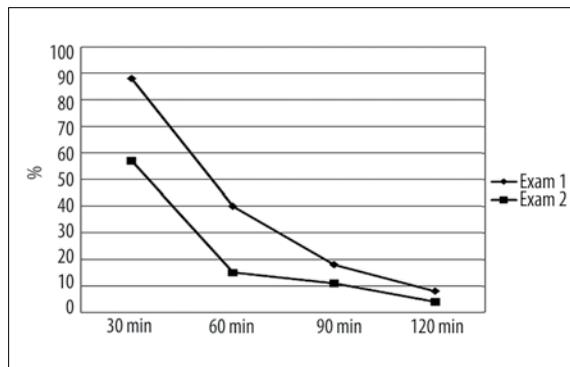
concentration. Another important indicator is the relative relation of the NAA/mI concentrations; this value shows a statistically significant drop when compared to age- and gender-matched norms. It should be added here that the localization of pathological changes in the case of the spectrum obtained from patient PA is similar to that of patients with FTD. In PA's case, however, these changes are localized chiefly in the right frontal lobe, and not bilaterally, as in the typical FTD patient.

#### The collapse of family ties

Memory disturbances cannot totally explain forgotten family ties [11–13]. Prior to the accident, PA's family had relatively normal family ties, though the bond between the patient and his wife was strained by the fact that he had a lover. Now the patient does not remember that he has loved anyone, and his family feels baffled by his strange behavior. His wife, his children, and his parents say he is quite a different man than he used to be. They say it is difficult to have warm feelings towards a man who is so quarrelsome, rude, and irresponsible. They feel his presence as a stranger among them. Moreover, the bonds that united and bound the remaining members of the family to each other have also collapsed, or have been seriously shaken.

It is also plausible that the dissociation of PA's identity may be caused, at least to some extent, by his premorbid personality traits. Interviews with his family have revealed that his mother was a dominant person who used to make all her sons to act in accordance with her will despite their own wishes. We learn that PA dreamed of being a car mechanic but he became a doctor as his mother had wished. It is of interest to note that being a car mechanic is one of his adopted personalities now. It was also noted that the patient's attitude towards his mother underwent considerable changes. He is disobedient and shouts at her, though she shows no emotional reaction to this kind of behavior. It may be concluded, then, that she was always a self-disciplined cold mother, and this – as we know – may lead to a number of emotional disorders in the child. In fact, childhood trauma is believed to be one of the causes of Dissociative Identity Disorder [14].

Another significant trait of PA's personality was his tendency to lie. First of all he had a number of love-affairs, which



**Figure 5.** Recollection of a given event in the neuropsychological examination of short-term memory in patient PA.

meant he had to make various stories to hide this from his wife and family. Moreover, his wife reports that he tended to tell small lies to his friends just "to make life more interesting," to use his own words. Naturally, this does not explain the nature of PA's disorders, but they cannot be explained solely by memory disturbances as well, though memory, especially autobiographical memory, certainly plays an important role in integrating one's concept of self.

At the same time, both linguistic functions and acquired knowledge (including medical skills) have remained intact to a considerable degree. It is worth noting here that these are functions that do not concern PA personally. In other words, he has lost mainly the emotionally loaded information, which may explain – at least to some extent – his emotional reactions to suggestions concerning his true personal relations.

#### Short-term memory

PA's memory disorders include not only autobiographical memory, but also short-term memory. Some deficits were apparent on standardized memory tests, based on recall after 20-30 minutes of filled delay, but we observed clinically that he seemed unable to recall anything at all 2 hours after the event occurred. In order to measure this, we designed a simple experiment, which consisted in choosing a particular event that occurred during the ordinary hospital day (e.g. a visitor, a meal, a physiotherapy session or the like), and then asking PA what he remembered immediately after the event, and then again at four time points: 30 minutes, 60 minutes, 90 minutes, and 120 minutes. This experiment was repeated 6 times during PA's hospitalization at the Cracow Rehabilitation Centre in summer of 2003, and again in the summer of 2004. The amount of information recalled immediately after the event was treated as 100% for baseline, and the amount of recall at subsequent time points was calculated in terms of information units.

As shown in Figure 5, the intensity of the effect achieved when PA records a given event in memory diminishes rapidly over time, in comparison to the effect that accompanied the event itself. The magnitude of the negative effect exceeds the dimensions of the positive effect. Considering the automatic scaling on the graph, the differences at a time of storage of 1.5 hours appear to be slight, but these differences – like the others – are statistically significant.

Two examples follow:

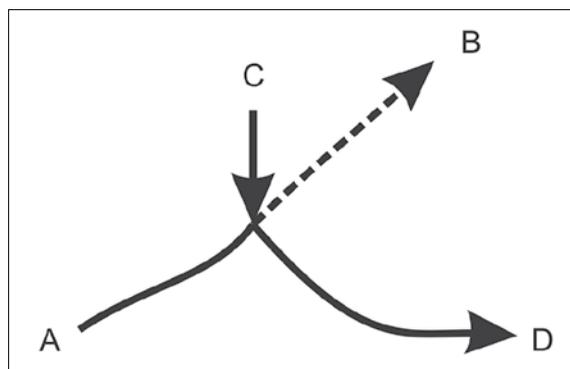
On one occasion, according to hospital schedule, PA was sent to kinesitherapy for 2 hours. When he returned to the ward, we asked PA what had happened, and he gave a reasonably full account of the exercises he had been through, which coincided in all essentials with the physiotherapist's report. When asked for the same information 30 minutes later, some details were missing, but the essentials were in place. At one hour, however, he remember only the last half-hour of exercises, and insisted that he had been there only half an hour. His account at 90 minutes was extremely sketchy, and there were some confabulations. At two hours, he denied that he had ever been in physiotherapy. He did remember that he had already been asked several times for that information, but became agitated that we were pestering him about something that never happened. He began to express indignation that no one had remembered to take him to kinesitherapy, and all attempts to convince him that he had actually been there met with an increasingly aggressive reaction.

On another occasion, nearly a year later, he was visited one day by his wife, who spent an hour with him on a day when she usually was unable to come see him. Immediately after she left, he gave a reasonably full account of the event, which his wife later verified as substantially accurate. Within half an hour, he remembered only that his wife had "probably" been there, though he expressed uncertainty as to whether this had not happened the day before. At 90 minutes he remembered that someone had been there, but not who. At two hours he was insisting that he had been alone all day, with no visits.

Thus memory traces of emotionally laden material, both positive and negative, tend to diminish and disappear completely after a period of two hours. This would not be especially surprising, if the material forgotten consisted of a list of random numbers or words, or even a story read aloud by an examiner, as in most standard memory tests. In fact, however, PA forgets everything that happens to him, no matter how much it matters to him. Moreover, he does not remember that he has forgotten something, a state which occurs only in medium-to-late stages of dementia. This means that both long-term and short-term memory are severely disturbed.

## DISCUSSION

What makes the case described above nearly unique is the progression of symptoms, which seem to cover an entire spectrum of memory disturbances. At any given moment, the mosaic of PA's memory deficits and retained capacities could be accounted for in the familiar terms of classical neuropsychology, as a set of disturbances resulting from damage to a particular module or memory system (short-term, long-term, episodic, semantic, and so forth). If PA were to be included in a large group study of severe TBI patients, his scores at any given moment would enable him to be assigned to a sub-group without any particular difficulty. The problem is that if the same tests were administered only a few months (or even weeks) later, he would just as easily be assigned to another, quite different group, at a moment when he seems to have regained some aspects of memory, while losing his grip on something he had previously had under control.



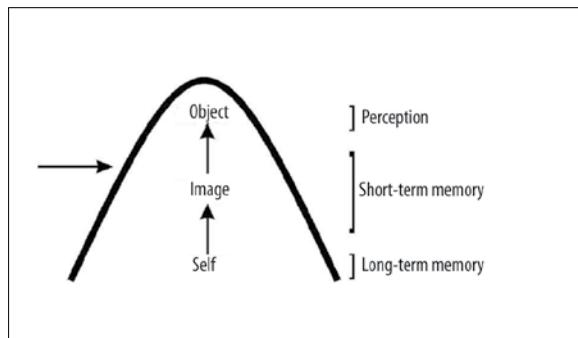
**Figure 6.** A schematization of changes in trajectory caused by a sudden event

Yet it does not suffice merely to superimpose a "typical" neurodegenerative process on a "typical" focal lesion to produce a picture resembling PA's symptoms. Though it is not impossible that FTD is developing in PA's brain independently of the TBI, this would be a most remarkable coincidence, and in any event the course of both diseases would certainly be profoundly affected by the presence of the other. In order to understand PA's case properly, it is essential to look at what has happened to him, not as "status post," i.e. a particular event (cause, i.e. the accident) with its various sequelae (effect, i.e. the symptoms), and not even as a disease, where the onset of illness (the cause) is assumed to set in train a cascade of events (the symptoms), but rather as a process (the patient's life as a whole), whose course has been radically altered by an event. This is illustrated by Figure 6.

For the present purposes, let segment A-B represent the course of PA's life, where A represents the starting point and B the goal to which PA aspires. The appearance of a strong external force (C, here representing the accident) pushes the vector in a different direction, to his current status, represented as D. What is most important here is that the vector C-D is not simply the result of the direction and strength of C, but rather the effect of C on the original vector A-B.

The fluctuation of syndromes observed in PA can be best explained by microgenetic theory. The syndrome described here results from the unfolding of the lower layers of the process of becoming, from core (self) to perception (world), which frames the mind/brain state. Consciousness is the relation of early to late or depth to surface in this process [15,16]. Visual and verbal imagery, including conceptual or intentional feeling, arise at intermediate phases, so long as an external world is realized. The arrow in Figure 7 represents sensation acting on the phase of imagery to externalize and adapt the state to the physical world. The phase-transition is non-temporal until it terminates. The mind/brain state and immediate present develop in a fraction of a second, replaced by overlapping states.

As mentioned in the introduction by Brown and Pachalska [17], a traditional approach to symptoms observed after brain lesions does not provide an explanation for the change observed in clinical syndromes in the course of recovery or deterioration. It provides support for the explanation of the symptom according to microgenetic theory.



**Figure 7.** The transition, or process of becoming, from core (self) to perception (world) frames a mind/brain state. Consciousness is the relation of early to late or depth to surface in this process. Visual and verbal imagery, including conceptual or intentional feeling, arise at intermediate phases, so long as an external world is realized. The arrow represents sensation acting on the phase of imagery to externalize and adapt the state to the physical world. The phase-transition is non-temporal until it terminates. The mind/brain state and immediate present develop in a fraction of a second, replaced by overlapping states [15].

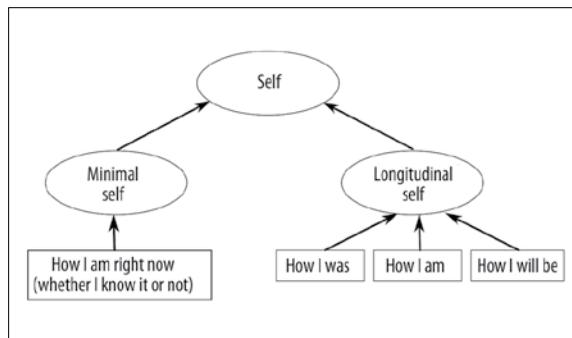
This case raises the question of the origin of:

- stability, whenever the world and mind are in constant change;
- the nature of identity: is it continuous?

According to Marcia [18] there are four phases in the process of forming an identity:

- In diffuse identity the self is vaguely defined and ill-formed. There is no way even to ask the question, "Who am I", let alone answer it. The first person singular does not exist, either as a grammatical function or as a psychological category, only a kind of primordial chaos of undifferentiated being [19,20].
- In mirror recognition, the individual recognizes her/himself only in others, especially parents. The individual plagiarizes a self perceived as being their own self. There is no chance for making independent choices that would not be consistent with the choices made by the significant other, whose reflection is one's own self.
- In deferred identity, the maturing self becomes aware of its otherness, and at the same time of its incompleteness, which it strives to fill with selected contents. There is an attempt to distance oneself from the previous points of identification, replacing them with new ones, as teenagers rebel against their parents and begin to identify themselves with other kinds of groups.
- In mature identity there is a delicate balance maintained between a sense of belonging and a sense of one's own uniqueness, between continuity and change.

These phases are typically presented as phases in human development over one's lifespan, but in the case of our patients it is possible to see each of them emerging after coma through all four phases. In akinetic mutism and the phases that follow, the patient shows no willful behavior in spite of possessing a working nervous system, central and peripheral, primarily because there is no consciousness that action as such exists or is possible.



**Figure 8.** The interconnections among the self and the minimal and longitudinal self.

Our case shows that a self is not a persistent object but a recurrent state. Hume (1740/1967: Book I, Part IV, Section VI) [21] questioned the existence of identity, which he believed to be an illusion, and so he could not account for the sense of identity over time [22].

James [23] as well as Whitehead [24] were of the opinion that identity was due to an overlap of mental states. Self has to be created in each moment, and this creative process leads to a more dynamic way of thinking about the mind and brain [25].

Microgenetic theory provides an account of the process of creating the self [26–34]. It emphasizes the span of neural time (in microseconds in the case of a healthy adult) that on the one hand enables continuity of the self, and on the other buffers it from falling apart [35–37]. The way the self is structured is shown in Figure 8. There is a minimal self, the irreducible core, whose existence is necessary in order for the organism to be an organism, and not merely a collection or colony of cells [38]. We feel this minimal self in our most fundamental biological/mental state, the awareness of being "right here right now" and having some kind of experience. A longitudinal self arises when memory allows the discrete moments of "minimal self" time to be bundled in larger units, making it possible not only to feel one's existence in the present moment, but also to conceive of that existence in the past and imagine it continuing into the future.

The case of PA demonstrates that the minimal self can persist, stranded in the moment, without the privilege of mental time travel that episodic memory affords. An integrated longitudinal self, however, requires alignment of one's current mental state and enduring semantic knowledge of personal traits, goals, beliefs, and values. It requires seamless access to the episodic memory of past and present selves that ground semantic self knowledge and infuse it with emotional meaning.

In other words, a person whose identity is stable needs to be:

- conscious;
- aware of past, present, and future;
- able to perceive her surroundings;
- able to access her memories;
- able to operate with reasons, i.e. conceive several options, select one of them as better than the others, and realize it;

- capable of making decisions;
- responsible for at least some of her own behavior.

Unfortunately, all those conditions are not present in the patient described here, which resulted in the gradual loss of the sense of personal identity. His case, however, allows one to draw a hypothesis on the way the self has to be buffered in order to protect it from disintegration.

The process of insulating the self is secured due to the expansion from the core self into the subjective "I", then the formation of an object world distinct from the "I", which thus preserves its integrity and identity through time – or at least for some segment of time.

There is a paradox in all this, which is that the subjective self, having created an objective world and separated itself from it, at the same time becomes conscious of itself as an object. The "I" can conceive of, evaluate, look at, analyze, interpret the "me", the self seen by the subject as an object among other objects. This distinction between the "I" and the "me" makes possible not only introspection, but also social thinking, the ability to conceive of oneself as a human object among other human objects, without losing the "I" – or at least without the necessity to lose it, though the risk is certainly there.

The distinction between "I" and "me" is more on the order of actual and potential than *knower* and *known* [39]. The *knowing* self – the minimal "I" at the threshold of consciousness - knows that which develops out of it. The subliminal "me" that remains beneath as the potential for the 'I' is implicit, unconscious and inaccessible. It represents, or is part of, the tacit knowledge of the individual, what the person knows or has the capacity (competence) to know, and it gives rise to the conscious self, to thought and action. The known self is not actually known, it is felt, intuited, sought after. It participates covertly in thought, but is not ultimately revealed.

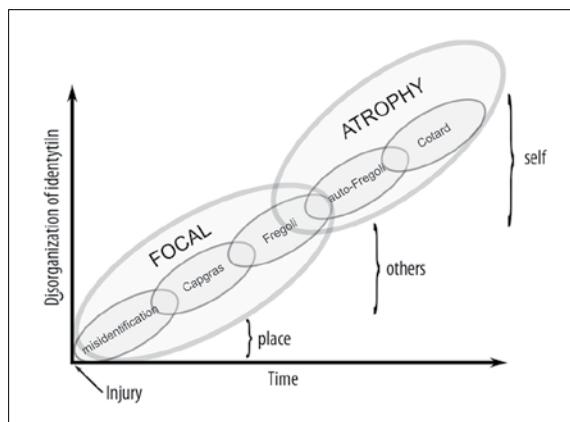
### Variability of syndromes

The changes that have occurred in the clinical picture of PA's mental status are perplexing. He has passed through a mosaic of disturbances, which resulted in a continuous deterioration of his identity:

- Misidentification (person and place);
- Capgras syndrome for person(s);
- Capgras for environment;
- Capgras for the arm (asomatognosia);
- Frégoli syndrome for person(s);
- Frégoli for environment;
- Delusional reduplication (without misidentification) of self or other persons;
- Loss of identity (Cotard's syndrome, the delusion of being dead).

As illustrated in Figure 9, time has played an important role in the process of PA's continuous deterioration. In fact, he has completely lost orientation in his surroundings, and his attempts to discover his true identity have ceased.

In a recent publication, the first author of the present study has described these changes in self-identity, which include



**Figure 9.** Development of syndromes in patient PA over time.

many, if not most, of the syndromes of impaired recognition of self and others described in the literature [40,41]. The problem of personality and the self-concept can be approached, from the standpoint of pathology, in terms of patterns of transition from one symptom-complex to another in the same individual, and not as isolated defects in particular individuals within a population. Disorders of the self cannot be localized to separate brain areas, but constitute a spectrum in the process through which personality is preserved and sustained. The case described here provides convincing evidence that the stability and identity of the self depends, not on the association of discrete components, but on a recurrent process that maintains the self-concept over time, in aging, through sleep, and in the course of changing life events.

### Time, perception, and self

As noted elsewhere by the first author of the present study [41,42] the basic components of identity, those that can be weakened or destroyed by brain damage, are the following:

- **coherence**, that is, the idea that being oneself makes some kind of sense, that the parts which make up the whole fit together, at least in a general way;
- **unity**, that is, the requirement that fundamentally there is one self in one body, despite the complexity of its structure;
- **continuity**, that is, the requirement that the coherence and unity of identity last as long as life itself lasts, from birth to death, despite the natural tendency to break life down into periods (epochs, eras).

It turns out that one of PA's problems is the loss of the feeling of time, due mainly to the disturbances of autobiographic memory [43]. MacQueen [39] has suggested that when speaking of that type of memory we concentrate on "auto-", and forget about the original meaning of "biography." The ancient Greek word *bios* meant "life," and *grapho* meant "to write." Our autobiography is therefore essentially a story, composed of the events of our own life, and is therefore narrative in its very nature. It is not, however, an orderly and exhaustive story that includes literally all the events of our life, but rather a kind of sketch made up of only those events which are of importance to us. As a rule these are emotionally loaded events, as well as those which proved to be of vital consequence for our future. In this respect autobiographic

memory is more like a play or a film, in which significant events (episodes, scenes, moments) are combined in a way to form a comprehensive and continuous story. The story gains its coherence due to the logical sequence of events, where the viewer is left to assume or infer a logical sequence from one event to the next. In the case of the autobiography (understood here as a mental construct, not a literary genre), such a sequence of events is ensured by our memory. Thus identity problems in TBI patients should hardly be surprising. Even if the sequence of symptoms presented by PA seems unique, the complaint that one is "a different person" after the injury is not [41,42].

This means that both long-term and short-term memory are severely disturbed. In consequence, he lives only in the present, since both past and future have ceased to exist for him. As pointed out by Brown [43], the past is an essential component of the feeling of the present, which develops out of the immediate state revived in the present moment, while the future does not exist other than as an idea, or a feeling of the surge forward to the present [30]. No wonder PA has lost his sense of self, as he has no elements to refer to.

To make matters worse, he also encounters difficulties in evaluating the surrounding world, which is blurred and difficult to comprehend. It is worthy to remind here that we create our picture of current reality on the basis of our previous knowledge and experience [40], and PA has lost an access to them. According to microgenetic theory the primary activity of mind is to 'chunk' experience into private and public objects or events [27–29]. In other words, we are able to perceive (or recognize) only those objects and events that correspond to models created in our mind by experience. The models sculpt a complex reality into meaningful and comprehensible wholes [44]. As Brown [15] puts it: "The inner connectedness of the world is not its ostensible relatedness in the world, but its formative trajectory in the mind/brain." (p. 251).

## CONCLUSIONS

PA is not able to "chunk" his experience, to create meaningful units out of the continuous flow of stimuli he is confronted with. Hence, the world around him is chaotic and incomprehensible, and he is an observer, whose only function is to react to situations he does not understand. In consequence he has no means to form his self-awareness. Only his core self, acting at the limbic, unconscious level is intact. This is reflected in his emotional reactions to any attempt to make him realize who he really was, as well as reactions to music he formerly liked. In a way, there is a regression to a former state of consciousness, which may also explain why he has stopped smoking and drinking: after all, these are not the activities of the boy he believes himself to be.

Acting on the limbic level explains also his inability to control his emotions and his inappropriate social behaviors. But most disastrous is the fact that he has lost his identity, since he has no elements to rely upon. Hence, he tends to cling to the self of others, borrowing their identities at least for the period he is able to remember.

Additional problems are created by frontal lobe dysfunction, which makes it difficult – if not impossible – for PA to assemble the disparate pieces of his foggy world.

## Acknowledgment

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