A Logical Defence of Maher's Model of Polythematic Delusions

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Abstract

We proceed to describe a model for the formation and maintenance of polythematic delusions encountered in schizophrenia, which is in adequacy with Brendan Maher's account of delusions. Polythematic delusions are considered here as the conclusions of arguments triggered by apophenia that include some very common errors of reasoning such as post hoc fallacy and confirmation bias. We describe first the structure of reasoning which leads to delusions of reference, of telepathy and of influence, by distinguishing between the primary, secondary, tertiary and quaternary types of delusional arguments. These four levels of arguments correspond to a stage the nature of which is respectively instantial, inductive, interpretative at a monothematic level and interpretative at a polythematic level. We also proceed to identify accurately the fallacious steps in the corresponding reasoning. We expose then the role of apophenia in the elaboration of delusional ideas. Lastly, we describe the role played by the hallucinations in the present model.

Classically, the term of "delusion" applies to two fundamentally distinct forms: monothematic and polythematic delusions (Davies & Coltheart 2000; Bortolotti 2005). Monothematic delusions present an unique topic and are usually associated with cerebral lesions. Among the latter, one can mention Capgras' delusion (by virtue of which the patient thinks that one of his/her fellows has been replaced by an impostor), Fregoli's delusion (when the patient is persuaded that he/she is followed by one or several persons whom he cannot identify because they are dressed up) or Cotard's delusion (when the patient is persuaded that he/she is died). Conversely, polythematic delusions have numerous topics, which are most often interconnected and usually linked to psychotic disturbances. Among polythematic delusions, one can notably mention: delusion of reference, delusion of grandeur, delusion of influence, delusion of persecution, delusion of control, delusion of telepathy.

In what follows, I will set out to introduce a new, as far as I know, model of the mechanism which leads to the formation of polythematic delusions[1] met in schizophrenia. This model, which takes place in the recent development of psycho-pathological philosophy (Faucher, 2006), offers to describe the mechanism which leads, on the one hand, to the formation of delusional ideas and on the other hand, to their maintenance. In this model, delusions are the result of the patient's cognitive activity in response to a specific form of abnormal perception. Even though the corresponding reasoning appears essentially normal, it includes however the repetition of some typical errors of reasoning. This leads to consider polythematic delusions as the conclusions of fallacious arguments, worked out in response to a particular type of abnormal perception, among which one can

distinguish between primary, secondary, tertiary and quaternary delusional arguments. These four levels of arguments correspond, as we shall see it, to some functional stages the nature of which is respectively instantial (based on several instances), inductive (generalising the conclusion of each of the instances), interpretative at a monothematic level and finally, interpretative at a polythematic level.

It is worth mentioning, moreover, that the notion of delusion has important philosophical underpinnings. In particular, the understanding of delusions proves to be essential for the notions of belief (Engel 2001, Bayne & Pacherie 2005), of justification of beliefs, of knowledge, of rationality (Campbell 2001, Bortolotti 2005) and also of self-deception.

1. Cognitive models of delusions

Before describing in detail the present model, it is worth presenting the main cognitive models for delusions encountered in the literature. Some authors described then a cognitive model for delusional ideas observed in schizophrenia. As Chadwick & al. (1996) underline it, as well as Fowler & al. (1995) who set out to review these types of models, there does not truly exist a unique cognitive model for delusions, for it rather consists of a family of models.

A first cognitive model was described by Chadwick & al. (1996), who set out to introduce an application to delusions of Albert Ellis' ABC-analysis. The original model described by Ellis (1962) consists of a diagram which plays a preponderant role in the emergence of mental disorders. Ellis distinguishes thus between three types of events: A, B and C. The As (for Activating event) are external facts or events of the patient's internal life, such as thoughts or bodily feelings. The Bs (for Belief) are thoughts relating to the same events, which themselves are possibly rational in nature or not. Moreover, the corresponding cognitive process can be more or less conscious. Finally, the Cs (for Consequence) are emotional states such as anger, sadness, joy, frustration, etc. which can be of a positive or negative nature. Thus, the Cs that follow irrational thoughts are most often of a negative nature. The succession of events of type A, B and C plays a predominant role in the emergence of mental disorders: activating events trigger irrational thoughts, which themselves engender negative emotions. The type of therapy recommended by Ellis consists precisely in rendering the patient aware of this mechanism and in controlling the corresponding process. Adapting Ellis' original model to psychosis, Chadwick & al. point out thus how the As constitute events that are external or internal to the patient, the Bs are his/her thoughts and the Cs are constituted by the emotions triggered by the patient's thoughts. This specific framework allows to provide a cognitive ABC-analysis of the main types of delusions. For example, the delusion of persecution finds its origin in the external fact that the patient hears the noise of a car's horn; this triggers in the patient the thought according to which his/her enemies come to kill him/her; it follows then in the patient's a negative emotion of fright and of anxiety.

A second cognitive model of delusions was put forth by Brendan Maher (1974; 1988; 1999). Maher did suggest that delusions are the result - in the context of schizophrenia of paranoid subtype - of a broadly normal interpretation of the abnormal phenomena undergone by the patient (hallucinations, loss of audition, impairment in the intensity of perception, etc.). According to Maher, it is not therefore by his/her reasoning that the patient differs from a normal individual, but by his/her own altered perceptions. Delusional ideas are thus conceived of as a response to abnormal and emotionally disturbing phenomena experienced by the patient. Such disturbing phenomena lead the patient to search an explanation, which is at the origin of the delusional construction. According to Maher, the patient's intellectual process is a product of normal reasoning and does not differ significantly from the one which is shown in every individual, or even in every scientist, when confronted with an unexplained phenomenon: “It is the core of the present hypothesis that the explanations (i.e. the delusions) of the patient are derived by cognitive activity that is essentially indistinguishable from that employed by non-patients, by scientists and by people generally.” (Maher 1974, 103). By normal reasoning, Maher means here a basically logical reasoning, but which occasionally includes some errors of reasoning of a common type. It is worth mentioning here that Maher's model has led to several objections. Above all, this model was criticised on the grounds that it did not allow to account for the fact that delusions can also develop

in seemingly normal conditions (Chapman & Chapman 1988). Secondly, it was objected to Maher's model (Davies & Coltheart 2000, p. 8) that it did not explain how delusional beliefs are adopted and maintained in spite of their implausible nature. It is worth mentioning lastly that an important philosophical problem emerges within Maher's model. It is what Pascal Engel termed the "paradox of delusions" (Engel 2001), and that can be formulated as follows: if the delusional construction is underlain by essentially normal reasoning and therefore by rationality, how it is possible to explain that the delusions' conclusions are so manifestly wrong and contrary to evidence. The present analysis takes place in such context, and aims thus at proposing a solution to this paradox of delusions.

While Maher's conception mentions abnormal perception as a unique factor at the origin of delusional ideas, another approach, notably put forth by Martin Davies and Max Coltheart (2000, 2001), describe two factors in the genesis and the maintenance of delusions. The first factor resides, as well as for Maher, in abnormal perception. And the second factor resides, according to Davies and Coltheart, in the patient's disability to reject a hypothesis given its incoherent and implausible nature with regard to the patient's rest of knowledge. Davies and Coltheart criticises thus Maher's model by notably pointing out that it does not allow to provide an account of the maintenance of delusions, even though their conclusion turns out to be completely implausible.

It is worth also mentioning a third type of cognitive model, which stresses that several cognitive biases (Garety & al. 2001) can be observed in the thinking mode of patients suffering from schizophrenia. Among these biases is the patient's tendency to *jump-to-conclusions* (Garety & Hemsley 1994). Experimental studies (Fear & Healy 1997; Garety & al. 1991) showed thus that patients had a more marked tendency than others to conclude very fast, starting from a limited group of information at their disposal. A second type of cognitive bias is an *attribution* or *externalist bias* which consists for the patient to attribute an external motive to events of a negative type which he/she undergoes. The patient favours then arbitrarily an external reason with regard to an internal and personal motive, when he/she sets out to determine the origin of an event which relates to him/her. Such conclusion notably results from the work of Bentall & Kaney (1989), and Kaney & al. (1989), who noticed that patients suffering from delusions of persecution were more prone than normal individuals to attribute both an external cause to negative events which they undergo and an internal motive to positive events which concerned them. This type of cognitive bias is also related to an *attentional bias*, which was noticed (Bentall & al. 1989; Kaney & al. 1989) in patients suffering from schizophrenia of paranoid subtype, who demonstrate as well a more marked tendency than others to turn their attention to menacing elements, among a group of stimuli, especially if the latter are related with themselves. Lastly, Aaron Beck (2002) also underlined how the reasoning of patients suffering from schizophrenia revealed an *egocentric bias*. This type of cognitive bias leads the patient to relate most external events with the elements of his/her personal life. Noise, sounds, smells, and generally facts and external phenomena, are thus bearing for the patient a hidden or explicit meaning, and which concerns him/her directly.

Finally, it is worth mentioning a cognitive model which sets out to define accurately the nature of delusions, by especially emphasising the fact that the latter do not constitute beliefs in the usual sense or, possibly, constitute beliefs of a special type. Such model made the subject of recent developments (Sass,1994; Young, 1999; Engel, 2001; Stephens & Graham, 2006) tending to question the classical definition of delusions, based on abnormal belief.

2. Apophenia

I will now endeavour to describe the present model and to expose accurately the mechanism which leads to the formation and maintenance of delusional ideas. In Maher's model, delusions constitute a cognitive development elaborated by the patient in response to abnormal perception. The present model inserts itself within such conception: polythematic delusions constitute then conclusions of fallacious arguments worked out by the patient, in response to a particular type of abnormal perception: apophenia. Finally, although the reasoning which leads to delusions proves to be fallacious, it can however be considered as normal, because it includes errors of reasoning which turn out to be very common.

Before describing the structure of reasoning which leads to polythematic delusions, it is worth considering preliminarily the apophenia. One finds then mention, especially in the observations made by some patients in remission relating their psychotic experience (Stanton & David 2000), of a very specific feeling, which can be characterised as a *feeling of interconnection* with the ambient world. Such feeling is not felt in normal conditions and truly presents a bizarre nature. Schneider had already (1930) pointed out how in an individual suffering from schizophrenia, a meaningful interconnection was created between facts that are internal to the patient and external events ("Meaningful connections are created between temporary coincident external impressions ... or perceptions with thoughts that happen to be present, or events and recollections happening to occur in consciousness at the same time"). Isabel Clarke (2000) also mentions in the patient a very particular feeling of fusion and of universal interconnection ("an exhilarating feeling of unity and interconnectedness"). Brundage (1983) also evokes a phenomenon of the same nature which manifests itself by a particular feeling of connection with all events that occur in the surroundings ("there is a connection to everything that happens") as well as the feeling that the slightest things have a meaning ("every single thing means something"). It appears then that the patient experiences a strong feeling of interconnection between on the one hand, his/her internal phenomena and on the other hand, the external phenomena.

The role of such feeling of interconnection was recently underlined notably by Peter Brugger (2001). Brugger terms then *apophenia* the tendency to see connections between objects or ideas which are a priori without any relationship ("the propensity to see connections between seemingly unrelated objects or ideas") and attributes the creation of this term to K. Conrad (1958). In the present context, one can consider a slightly more restrictive definition of apophenia, for it suffices here to characterise apophenia as the feeling in the patient that there is a narrow relationship between his/her internal phenomena (thought, feelings, emotions, acts) and external phenomena.

One can notice here that Maher does not mention explicitly apophenia when he enumerates abnormal perceptions which are susceptible of being experienced by the patient. However, he mentions a phenomenon which appears as closely related to apophenia. Among the abnormal perceptions undergone by the patient, Maher mentions indeed (Maher 1999) that it can consist, for example, of the fact that the patient perceives as salient some normally insignificant sensory data, of unrecognised defects in the sensory system of the patient such as a loss of audition, of temporary impairments in the intensity of perception, of hallucinations, of difficulties of concentration of neurological origin, etc. Maher includes then among abnormal perceptions the fact that the patient perceives as salient some ordinarily insignificant sensory data, what can be considered as closely related to apophenia.

At this step, it is worth describing more accurately the cognitive mechanism which, in relation with apophenia, leads to the formation of polythematic delusions. This will allow to cast more light on the role and the nature of apophenia itself.

3. Formation and maintenance of delusional ideas

In the present context, the reasoning that leads to delusional ideas is considered as a specific case of fallacious argument, i.e. as reasoning the conclusion of which is not logically justified by its premises, which are worked out in response to a particular type of abnormal perception: apophenia. In general, this type of reasoning leads to an erroneous conclusion. But it can happen very exceptionally that the resulting conclusion turns out to be true (for example if a patient suffering from schizophrenia with delusion of persecution was mistakenly spied on notably because he/she had been confused with a high diplomat). Another feature of the type of fallacious reasoning which leads to polythematic delusions is that it includes errors of reasoning of a normal type, i.e. very common. Finally, it is worth pointing out that in spite of their patently false conclusion, the task which consists in diagnosing accurately the fallacious steps in the reasoning which leads to delusional ideas proves to be far from easy.

The fallacious reasoning which leads to polythematic delusions presents a particular structure, as we will see it, within which it is worth distinguishing several functional steps, which take place successively within the elaboration of delusions ideas: primary, secondary, tertiary and quaternary

steps. The primary step, first, is of an instantial nature, in the sense that it is based on some instances. The secondary step presents an inductive nature, which proceeds by generalisation of the conclusions resulting from each of the preceding instances. And the tertiary step is of an interpretative nature at a monothematic level. Finally, the quaternary step has an interpretative function, but this time at a polythematic level. The distinction of these four *successive* steps is of interest in the understanding of the mechanism which leads to the formation of delusional ideas, for it allows to describe its intrinsic structure, at the level of both its formation and maintenance. On the other hand, as we shall see it later, cognitive therapy of psychosis can apply differently to each of these specific steps.

In what follows, we shall especially be concerned with delusional ideas of reference, of telepathy, of influence and of grandeur, which correspond to polythematic delusions commonly met in schizophrenia. It is also worth mentioning that the corresponding model can be easily extended to other types of delusional ideas, especially to thought-broadcasting delusions or delusions of persecution. At this stage, it worth drawing a distinction between the mechanism which leads to the formation of delusional ideas, and the one which concurs to their maintenance.

3.1 Formation of delusional ideas

Classically, one distinguishes in schizophrenia the following types of delusions: delusion of reference, delusion of influence, delusion of control, delusion of telepathy, delusion of grandeur, delusion of persecution. The present model will set out first to describe the mechanism which leads to the formation of these main types of delusions, by setting out to introduce a reconstruction of the specific cognitive process in a patient at the beginning of psychosis.

Let us begin with delusions of *reference*. Let us consider the following argument, which leads the patient to conclude that television speaks about him/her, and therefore to delusional ideas of reference (T_1 and T_2 denote here two successive temporal positions, with a very short time interval between T_1 and T_2; the symbol $\therefore$ denotes the conclusion; and R is taken for *reference*):

(R1) in T_1 I was drinking an aperitif
(R2) in T_2 the presenter of the show said: “Stop drinking!”
(R3) $\therefore$ in T_2 the presenter said: “Stop drinking!” because in T_1 I was drinking an aperitif
(R4) in T_3 I was upset and anxious
(R5) in T_4 the presenter of the show said “Stop stressing”
(R6) $\therefore$ in T_4 the presenter of the show said “Stop stressing!” because in T_3 I was upset and anxious
(R7) in T_5 I was smoking a cigarette
(R8) in T_6 I heard the presenter saying “That is not good !“
(R9) $\therefore$ in T_6 the presenter said “That is not good !” because in T_5 I was smoking a cigarette
(R10) in T_7 I felt fine and lucid and I was relaxed
(R11) in T_8 the presenter of the show said: “We are in great form!
(R12) $\therefore$ in T_8 the presenter said “We are in great form!” because in T_7 I felt fine and lucid and I was relaxed
(R...) ...
(R13) $\therefore$ the presenters of the shows speak according to what I do or what I feel
(R14) $\therefore$ television speaks about me

One can distinguish within the structure of this reasoning several parts the function of which turns out to be specific. These different parts correspond respectively to *primary* delusional arguments (it consists of the steps (R1)-(R3), (R4)-(R6), (R7)-(R9) and (R10)-(R12)), to *secondary* delusional arguments (the steps (R3), (R6), (R9), (R12) and (R13)) and *tertiary* delusional arguments (the steps (R13) and (R14)). It is worth considering in turn each of these arguments. Let us begin with *primary* delusional arguments, that correspond to an instantial step, in the sense that it is made up of several different instances. *Primary* delusional arguments are constituted here by four different instances, i.e. the steps (R1)-(R3), (R4)-(R6), (R7)-(R9) and (R10)-(R12). These four primary

delusional arguments lead the patient to conclude that at a given time, the TV presenters spoke according to his/her acts or to what he/she felt.

Let us consider now the following stage (R13), which constitutes the conclusion of a *secondary* delusional argument, and is of a different nature. Its premises are the conclusion (R3), (R6), (R9), (R12) of the four previous instances of primary delusional arguments of reference. The patient generalises from the latter to the conclusion that the TV presenters speak according to what he/she is doing or to what he/she is feeling. The overall structure of this type of secondary delusional argument is then as follows:

(R3) in T_2 the presenter of the show spoke according to what I was doing
(R6) in T_4 the presenter of the show spoke according to what I was feeling
(R9) in T_6 the presenter of the show spoke according to what I was doing
(R12) in T_8 the presenter of the show spoke according to what I felt
(R...) ...
(R13) ∴ the presenters of the shows speak according to what I do or feel

On can then term *inductive* this type of secondary delusional argument because it has the form of an *enumerative induction*, where the patient constructs his/her conclusion by generalising, in an inductive way, from the conclusions of several instances of primary delusional arguments. Thus, secondary delusional arguments correspond to a step the nature of which proves to be *inductive*.

At this stage, it is also worth mentioning the third step, which leads to delusion of reference. It consists of the tertiary delusional argument of reference, constituted by steps (R13) and (R14), the premise (R13) of which being the conclusion of the secondary delusional argument of reference:

(R13) ∴ the presenters of the shows speak according to what I do or feel
(R14) ∴ television speaks about me

In such argument, the patient takes into account the conclusion of the inductive step that the presenters of the shows speak according to his/her acts or to his/her internal state, and interprets it by concluding that television speaks about him/her. It consists, as we did see it, of a step the function of which is merely *interpretative*, in the sense that it aims at making sense of the inductive conclusion which results from the secondary delusional argument. Tertiary delusional arguments are therefore the product of an interpretative step, which situates itself at a monothematic level (here, the specific topic is that of delusion of reference).

A structurally identical mechanism leads to delusional ideas of *telepathy*. Several instances of primary delusional arguments of influence lead first the patient to conclude that his/her own thoughts are at the origin of acts that are accomplished by other persons. By an inductive step, the patient is then led to the conclusion that people act according to his/her thoughts. Finally, in an interpretative step, the patient concludes that other people can read his/her thoughts (or that they can hear them). It consists there, in the patient's mind, of an attempt at explaining the very disturbing conclusion which results from the inductive step according to which other persons act according to his/her thoughts.

The same mechanism also engenders the formation of delusional ideas of *influence*. In that case, several instances of primary delusional arguments of influence lead the patient to conclude that his/her own thoughts are at the origin of annoyances caused to other persons. An inductive step leads then the patient to the conclusion that people react negatively in function of his/her thoughts. Finally, an interpretative step leads the patient to conclude that he/she perturbs and disturbs other people.

Moreover, such mechanism leads to the formation of delusional ideas of *control*. They find their origin in the instances of primary delusional arguments of control. Such instances have the same structure as that of the instances of primary delusional arguments of reference, of telepathy or of influence, with however this difference that the temporal order of both types of events - internal and external, with regard to the patient - is now reversed. Within the primary delusional arguments

of reference, of telepathy or of influence, an internal event with regard to the patient *precedes* an external event, whereas it is the opposite with regard to a primary delusional argument of control: the external event precedes then the internal event. Thus, several instances of primary delusional arguments of control lead the patient to conclude inductively that some external events have an effect on his/her thoughts, his/her emotions or his/her acts. The interpretative step leads then the patient to think that he/she is controlled by external beings or objects such as robots or a satellite.

Finally, it is worth specifying the role played by *quaternary* delusional arguments. The premises of the latter arguments are conclusions of tertiary delusional arguments. Quaternary delusional arguments are more general arguments, which present, as well as tertiary delusional arguments, an interpretative nature. But unlike tertiary delusional arguments which turn out to be interpretative at a monothematic level, quaternary delusional arguments are interpretative at a polythematic level. They indeed take into account jointly the conclusions of tertiary delusional arguments of reference, of telepathy, of influence, etc. by striving to make sense, *globally*, of them and to interpret them. The reasoning below constitutes then a quaternary delusional argument leading to ideas of *grandeur*:

(R15) television and the media speak about me
(T16) people can read my thoughts
(I17) I influence other people's behaviour
(18) ∴ I am someone exceptional
(19) ∴ I am an extraterrestrial

At a quaternary level, the patient takes then into account the different conclusions resulting from tertiary delusional arguments, the function of which is interpretative at the level of a given delusional topic and attempts this time to interpret the set constituted by the latter. The resulting conclusion constitutes veritably, for the patient, an overall theory the function of which is to make sense and to explain all the abnormal phenomena which he/she experiences.

3.2 Maintenance of delusional ideas

It is worth considering now the mechanism which leads to the maintenance of delusional ideas. Let us place ourselves at the level of secondary delusional arguments which, at the level of the formation of delusional ideas, are of an inductive nature. Consider then especially the form that take secondary delusional arguments of reference, at the stage of the maintenance. At this step, the conclusion (R13) which results from secondary delusional arguments, in virtue of which the presenters of the shows speak according to what the patient makes or feels, was already established at the stage of the formation of delusional ideas. And the corresponding reasoning takes then into account a new instance of primary delusional argument (R20) of reference, in the following way:

(R20) in T_{100} the presenter of the show spoke according to what I was doing
(R21) ∴ this confirms that television speaks according to what I do

On can notice here that the inductive generalisation (R13) was already established at the stage of the formation of the secondary delusional argument, and that the new instance of primary delusional argument constitutes then, in the patient's mind, a case of *confirmation* of the latter generalisation. As we can see, the role of the new instance of primary delusional argument is to confirm and therefore to reinforce, at the stage of the maintenance, a generalisation which was already established at the previous stage of the formation of delusional ideas.

4. Analysis of delusional arguments

At this stage, it is worth analysing in detail the structure of the type of reasoning which has been just described, in order to identify accurately the fallacious steps and to determine the role played

by apophenia. Let us consider in turn primary, secondary, tertiary and quaternary delusional arguments. Let us scrutinise first the following instance of primary delusional argument of telepathy, which manifests itself at the level of the *formation* of delusions:

(T1) in T_1 I thought of Michael "What an idiot!"
(T2) in T_2 I heard Michael shout
(T3) ∴ in T_2 I heard Michael shout because in T_1 I thought of him "What an idiot!"

It appears here that the two premises (T1) and (T2) constitute genuine facts and therefore turn out to be true. Conversely, the conclusion (T3) that concludes to the existence of a *relation of causality* between the two consecutive facts F_1 (in T_1 I thought of Michael "What an idiot!") and F_2 (in T_2 I heard Michael shout) is it justified? It appears not. Indeed, both premises are only establishing a relation of *anteriority* between the two consecutive facts F_1 and F_2. And the conclusion (T3) which deducts from it a *causality* relationship turns out therefore to be too strong. The corresponding reasoning presents then a fallacious nature. The corresponding error of reasoning, which concludes to a relation of causality while there is only a simple relation of anteriority, is traditionally called *post hoc fallacy*, according to the Latin sentence "Post hoc, ergo propter hoc" (thereafter, hence because of it). This is a very common type of fallacious reasoning, which is notably at the root of many superstitions (Martin 1998; Bressan 2002). David Hemsley (1992) notably mentions such type of reasoning in clinical observation: "A patient of the present author, recalling his psychotic experiences noted that the co-occurrence of two events often led immediately to an assumption of a causal relationship between them". Finally, one can notice that in the context of *cognitive distortions*, the type of error of reasoning corresponding to post hoc fallacy can be considered a specific case of *arbitrary inference*.

Let us also proceed to analyse the type of reasoning which underlies secondary delusional arguments, and that presents at the stage of the *formation* of delusional ideas, as we did see it, the following inductive structure:

(T22) in T_2 Michael spoke according to my thoughts
(T23) in T_4 the neighbour spoke according to my thoughts
(T24) in T_6 the radio presenter spoke according to my thoughts
(...)
(T25) ∴ people act according to my thoughts

Such type of reasoning appears prima facie completely correct. It consists here of a reasoning based on an inductive generalisation, in which the patient simply builds a more general conclusion from several instances. Such reasoning is completely correct, for its conclusion can be considered as true, inasmuch as its premises are true. However, a scrutiny reveals that the patient only takes into account here a limited number of instances, i.e. those instances that are based on the concordance of both premises, at the stage of primary delusional arguments. The patient then directs his/her attention exclusively to those instances that include two premises of which the internal event (premise 1) and the external event (premise 2) turn out to be concordant and render thus plausible a relation of causality. The corresponding turn of mind can be described as a *concordance bias*. In effect, the patient does not take into account at this stage those instances which could possibly be composed of two discordant premises. The latter are likely to come under two different forms. An instance of the first form is as follows:

(T1) in T_1 I thought of Michael "What an idiot!"
(26) in T_2 Michel was quiet

And an instance of the second form is :

(27) in T_1 I didn't think of Michael
(T2) in T_2 I heard Michael shout

In these two types of cases, one can notice a discordance between the two premises, which goes directly contrary to the idea of causality between the two events. As we see it finally, the flaw in the patient's reasoning resides essentially in the fact of only taking into account those instances where the concordance between an internal event and an external event renders plausible a causality relationship. But if the patient had taken into account at the same time the concordant and the discordant instances, he/she would have been led to conclude that the concordant instances represent only a small part of the set constituted by the class of relevant instances, and are only therefore the result of a random process. In such context, as we see it, the concordant instances in fact constitute but mere coincidences.

If one places oneself now at the stage of the *maintenance* of delusional ideas, one can observe the presence of a mechanism of the same nature. At the stage of the emergence of delusional ideas, secondary delusional arguments present, as we did see it, an inductive nature. On the other hand, at the stage of the maintenance of delusional ideas, the latter come under the form of arguments which lead to the confirmation of an inductive generalisation. Consider then the following instance, where the conclusion (T25) according to which people act according to the patient's thoughts results from a secondary delusional argument and was already established at the stage of the formation of delusional ideas:

(T28) in T_{100} my sister spoke according to my thoughts
(T29) ∴ this confirms that people act according to my thoughts

This type of argument appears completely valid, for the conclusion results directly from its premises. However, the latter argument is also at fault by default, for it does not take into account some premises, which turn out to be as much as relevant as the instance (T28). As we can see, the error of reasoning consists then in taking only into account those instances which confirm the generalisation (T25), while ignoring those instances which disconfirm the latter. Hence, this type of argument reveals a *confirmation bias*, i.e. a tendency to favour those instances which confirm a generalisation, whereas it would be necessary to take into consideration at the same time those which confirm and those which disconfirm it. One can notice however that such type of cognitive bias presents a very common nature (Nickerson 1998, Jonas et al. 2001).

It is worth considering, third, tertiary delusional arguments. Consider then the following tertiary delusional argument of telepathy (a similar analysis also applies to tertiary delusional arguments of reference and of influence):

(T30) ∴ people act in function of my thoughts
(T31) ∴ people can read my thoughts (people can hear my thoughts)

One can notice here that if premise (T30) is true, then the conclusion (T31) constitutes a credible explanation. This type of argument presents then an interpretative nature and the conclusion (T31) according to which people can read the patient's thoughts appears finally plausible, inasmuch as it is considered as true that people act according to his/her thoughts. As we can see, such argument is motivated by the patient's concern of explaining and of interpreting the disturbing generalisation which results from the repetition of the many concordant above-mentioned instances.

Finally, the following quaternary delusional argument aims, in the same way, at making sense of the conclusions which result from the conjunction of conclusions of different tertiary delusional argument:

(R15) television and the media speak about me
(T16) people can read my thoughts
(I17) I influence people's behaviour
(18) ∴ I am someone exceptional

(19) ∴ I am an extraterrestrial

As we can see it, the conclusion (18) results here directly from the three premises (R15), (T16) and (I17) and the corresponding reasoning which leads the patient to conclude that he/she is someone exceptional can also be considered as valid. On the other hand, the conclusion (19) appears here too strong with regard to premise (18).

Given what precedes, it appears that a number of steps in the reasoning which leads to delusional ideas in schizophrenia are characterised by a reasoning which appears mainly normal. By normal reasoning, one intends here a broadly logical and rational reasoning, but also including some errors of logic of a very common type. Such viewpoint corresponds to the one put forth by Maher (1988; 1999) who considers, as we did see it, that the delusional construction in schizophrenia is nothing else than normal reasoning worked out by the patient to try to explain the abnormal phenomena which he/she experiences.

However, one can notice that in the above-mentioned structure of reasoning, one part of the reasoning cannot a priori be truly considered as normal. It consists here of the different instances of primary delusional arguments. The latter are based, as we did see it, on errors of reasoning corresponding to post hoc fallacies. This type of error of reasoning arguably turns out to be extremely common. However, the instances of primary delusional arguments mentioned above present an unusual nature, in the sense that they put in relationship the patient's thoughts (or his/her emotions, feelings or actions) with external phenomena. Prima facie, such type of reasoning cannot be considered as normal. For why is the patient led to put his/her thoughts in relationship with external phenomena? One can formulate the question more generally as follows: why does the patient put in relationship the phenomena of his/her internal and personal life (his/her thoughts, emotions, feelings, etc.) with mere external phenomena? This distinguishes itself indeed significantly from the behaviour of a normal person, for whom it exists a very clear-cut intuitive separation between on one hand, his/her own internal world, and on the other hand, the external phenomena.

The answer to the previous question can be found here in the role of apophenia. Due to apophenia, the feeling indeed imposes itself to the patient that his/her internal world is closely linked up with the external world. So, his/her thoughts, emotions, feelings and acts appear to him/her to be closely linked up with the external phenomena that he/she perceives, such as ambient noise and dialogues, the words of the presenters of television or of radio, the dialogues of the characters of comic strips, the movements of the wings of a butterfly or of a bird, the natural phenomena such as the wind or the rain, etc. In the context which results from apophenia, the repeated instances that constitute primary delusional arguments can then take place naturally. For since the patient lives with a permanent feeling of interconnection between events that relate to him/her specifically and those which occur in the world which surrounds him, he/she is then led to observe many concordances between events related to him/her and external facts. In such context, primary delusional arguments can then take place naturally.

In the present context, the role of apophenia can be considered as fundamental. And this leads to suggest that considering its specificity and considering the leading role that it plays in the development of primary delusional arguments and therefore of all the characteristic delusional ideas of schizophrenia, apophenia could be counted among the criteria of the illness[2].

As we can see it, the process which gives rise to delusional arguments from the phenomenological experience constituted by apophenia proves finally to be in line with Maher's account. And one finds here a clear explanation of delusions as the patient's response to the abnormal phenomena which he/she experiences, among which one can then mention apophenia, as well as hallucinations.

Given what precedes, polythematic delusions can be defined as conclusions of arguments triggered by apophenia and that include some very common errors of reasoning such as post hoc fallacy and confirmation bias. Hence, apophenia *and* a normal reasoning including the type of aforementioned errors of reasoning turn out to be necessary and sufficient conditions for the development of polythematic delusions. This double condition notably explains why we are not all delusional. For if errors in reasoning based on post hoc fallacy and confirmation bias turn out

indeed to be very common, they only trigger primary delusional arguments when they are associated with the abnormal perception which consists in apophenia. It is worth pointing out, moreover, that such model leaves also room for more stronger conditions. For if apophenia constitutes one of the two sufficient conditions for the development of polythematic delusions, the latter can also take place in conditions where abnormal perception is constituted not only by apophenia, but also by other abnormal perceptions such as hallucinations. And also, whereas the second condition which is sufficient for delusions identifies itself with normal reasoning including post hoc fallacy and confirmation bias, it proves that the development of delusions can also be made by means of a reasoning which deviates more or less from normal reasoning. But the essential characteristic of the present model resides in the fact that apophenia and normal reasoning including the aforementioned very common errors, constitute necessary and sufficient conditions for the development of polythematic delusions.

5. The role of the hallucinations

At this stage, it is worth highlighting the role played by hallucinations, the other major symptom of schizophrenia, in the process which has just been described. I will set out to describe in more detail here the role played by auditory hallucinations - given that the corresponding analysis can be easily extended to hallucinations relating to other sensory modalities, i.e. visual, tactile, olfactory and gustatory.

Auditory hallucinations are susceptible, first, of playing a role at the level of primary delusional arguments. In this type of case, the primary delusional argument presents the same structure as the one described above, with the only difference that an auditory hallucination - in place of a real external event - constitutes then the second premise of the primary delusional argument. The following instance constitutes then an example of primary delusional argument of reference, but it is there an auditory hallucination, by which the patient hears the voice of the presenter of the show saying “Clumsy!” while he/she watches TV, that constitutes the support of the second premise of the argument:

(32) in T_1 I dropped my pen
(33) in T_2 I heard the voice of the presenter of the show saying “Clumsy!”
(34) $\therefore$ in T_2 the presenter of the show said “Clumsy!” because in T_1 I dropped my pen

In the same way, the following instance constitutes a case of primary delusional argument of telepathy. In that case, it is an auditory hallucination, by which the patient hears the voice of his neighbour saying “Calm down!”, that serves as a basis for the second premise of the argument:

(35) in T_1 I was very upset
(36) in T_2 I heard the voice of my neighbour saying “Calm down!”
(37) $\therefore$ in T_2 my neighbour said “Calm down!” because in T_1 I was very upset

It is worth mentioning, second, the role that can be played by auditory hallucinations at the level of secondary delusional arguments. In such case, the corresponding generalisations develop from instances of primary delusional arguments which also include auditory hallucinations. In the example below, the patient generalises from the conclusions of three instances of primary delusional arguments of reference. But while the two latter instances (39) and (40) are based on real external phenomena, the first instance (38) is founded on hallucinated content, by which the patient heard the TV presenter saying “Clumsy!”:

(38) in T_2 the TV presenter said “Clumsy!” because in T_1 I dropped my pen
(39) in T_4 the presenteress said “Calm down!” because in T_3 I was upset
(40) in T_6 the presenter of the show said “Thank you” because in T_5 I thought “I love this presenter”
(...) ...

(41) ∴ the TV presenters speak according to what I do or feel

As we see it, auditory hallucinations contribute in this way to increase the number of primary delusional arguments, by creating thus additional instances which add up themselves to the different types of standard instances previously defined. This gives then more weight to the inductive generalisations made by the patient from multiple instances of primary delusional arguments. Besides, it has also the effect of reinforcing the coherence of the patient's delusional system and of rendering it then more resistant to contrary argumentation.

It is worth mentioning, lastly, another type of role which can be played by auditory hallucinations. Such is notably the case when the content of the hallucinations proves to be consistent with the conclusions that result from secondary, tertiary or quaternary arguments. Auditory hallucinations have then the effect of reinforcing the latter conclusions. The instance below constitutes a case where an auditory hallucination comes to reinforce the conclusion of a *tertiary* delusional argument of telepathy. In that case, the hallucinated content resides in the fact that the patient hears the voice of his friend Joseph saying "I know the slightest of your thoughts":

(42) ∴ in T_{50} I thought that people know of my thoughts
(43) in T_{100} I heard Joseph saying: "I know the slightest of your thoughts"
(44) ∴ this confirms that people know of my thoughts

In a similar way, the following instance has the effect of reinforcing the conclusion which results from a *quaternary* delusional argument, where the hallucinated content consist of a voice heard by the patient that says: "You come from the planet Mars":

(19) ∴ in T_{50} I thought I was an extraterrestrial
(45) in T_{100} I heard a voice saying : "You come from the planet Mars"

In a general way, we see here how hallucinations constitute an element which has the effect of reinforcing considerably the conclusions resulting from delusional arguments. The hallucinations have then the effect of reinforcing the strength and the consistency of the beliefs' system of the patient, thus contributing to its maintenance, and rendering then his/her ideas more resistant to contrary argumentation.

6. Comparison with other cognitive models of delusions

The present model, as we can see it, mainly emphasises a cognitive approach of delusions encountered in schizophrenia. This model introduces a fundamental cognitive element, but also leaves room to a neurophysiological element (at the origin of apophenia), the role of which proves to be essential. One can notice finally that the model which has just been described turns out to be compatible with some other accounts of delusional ideas met in schizophrenia.

The present analysis, to begin with, is susceptible of inserting itself as part of the adaptation of Albert Ellis' ABC-analysis described by Chadwick et al. (1996). In this context, the internal and external events with regard to the patient, that are the premises of primary delusional arguments, constitute the As. The primary, secondary, tertiary and quaternary delusional arguments, can also be assimilated to the Bs. Lastly, the negative emotions (anger, anxiety, frustration, etc.) felt by the patient, that result there from the conclusions of delusional tertiary and quaternary arguments, constitute the Cs. As we can see it, the present analysis leads, in comparison with the standard ABC-analysis, to distinguish several steps at the level of the Bs. This distinction is important, since it allows to distinguish several steps whose function is different, within the reasoning that leads to delusional ideas. Thus, the B_1s (primary delusional arguments) are instances that lead to the attribution of a causality relationship between internal and external (to the patient) phenomena; the B_2s (secondary delusional arguments) result from a generalisation of inductive nature; the B_3s

(tertiary delusional arguments) correspond to an interpretative step at a monothematic level; finally, the B_4s (quaternary delusional arguments) are characteristic of a step of interpretation at a polythematic level, the conclusion of which truly constitutes a global explicative theory of the abnormal phenomena undergone by the patient. On the other hand, we are led there to distinguish between those parts of the patient's reasoning which are globally valid (the B_2s, B_3s and B_4s) and the part which is invalid (the B_1s, based on post hoc fallacy). Such nuanced point of view should be likely to preserve - what constitutes one of the key points of cognitive and behaviour therapy - the therapeutic alliance, i.e., the relation of collaboration between the patient and the therapist aiming at shared objectives in the struggle against the illness. As we can see it, the present analysis leads to especially emphasise post hoc fallacy, which constitutes the weakness in the patient's reasoning, but the repeated instances of which, triggered by apophenia, truly constitute the building block of the delusional construction.

The present model also has number of affinity with the approaches which are at the root of cognitive therapy of schizophrenia (Kingdon & Turkington 1994; Kingdon & Turkington 2005; Chadwick & al. 1996; Beck & Rector 2000). In this type of approach, the therapist sets out to reduce progressively the patient's degree of belief in his/her delusional polythematic ideas. To this end, the therapist suggests the patient, in a spirit of dialogue of Socratic inspiration, to elaborate alternative hypotheses; he also teaches the patient the approach which consists in searching elements likely to confirm or to disconfirm his/her own hypotheses, as well as to build out alternative hypotheses. The contribution of the present analysis with regard to cognitive therapy of schizophrenia is likely to manifest itself in several ways. It proves to be useful to specify then, for the clinician, what could be such contribution, and to also provide a specific framework in which the present model will possibly be tested. The distinction of different steps in the development of delusions allows first to distinguish between different hypotheses corresponding to the conclusions of primary, secondary, ternary and quaternary arguments. The degree of belief associated with each of these levels of hypotheses is also susceptible of being evaluated separately, by notably allowing to determinate then at which level resides the strongest degree of conviction. In the same way, each of the conclusions of the primary, secondary, tertiary or quaternary arguments, will possibly be tested (confirmed/infirmed) and give room for the elaboration of alternative hypotheses (David Kingdon, personal communication). For example, at the level of primary delusional arguments, it will be possible to consider the belief according to which the presenter said in T_2: “You should not drink!” *because* the patient was drinking an aperitif in T_1; this hypothesis will possibly give rise to a search for evidence, and then confronted with an alternative hypothesis such as: the presenter said in T_2: “You should not drink!” because it was scheduled in the script of the television program. At the level of tertiary delusional arguments, the hypothesis according to which television speaks about the patient will also possibly be the object of a search for evidence, etc.

The interest for the clinician of the present approach resides, second, in the fact that it provides the patient with an alternative global explanation of the abnormal phenomena that he/she undergoes. The delusional construction of the patient constitutes, as we did see it, a theory which allows him/her to explain all the abnormal phenomena that he/she experiences. On can assume in this respect, that the fact for the patient to get a satisfactory theory explaining all abnormal phenomena which he/she experiences, is also likely to play an important role in the *maintenance* of his/her delusional system. In this context, the present analysis allows to propose to the patient an alternative explicative theory, grounded on apophenia and the different steps of reasoning which result from it. Such theory distinguishes itself from the explicative theory with which the patient is usually confronted (according to the common elliptical point of view, the latter is “mad”) and proves to be less stigmatising, since the reasoning which leads to delusions is notably considered here as normal. For this reason, one can assume that the patient could be more willing to adhere to the present alternative theory, as a global explanation of the abnormal phenomena which he/she experiences.

As we did see it, the present model conforms mainly with the one developed by Brendan Maher (1974; 1988; 1999), based on the fact that delusions result from a broadly normal interpretation of the abnormal phenomena undergone by the patient. The present analysis also

specifies with regard to Maher's model that apophenia (eventually associated with hallucinations) constitutes an abnormal perception which is enough for giving rise to delusional polythematic ideas met in schizophrenia. It has then been objected, as we did see it, to Maher's model, that it did not allow to account for the fact that delusions can also take place in seemingly normal conditions, especially in a patient not suffering from hallucinations. But the present model points out that such conditions are not normal, since apophenia is present in such a patient. Since apophenia leads to abnormal perceptions, the essential factor described by Maher at the origin of delusional ideas, is therefore present as well. On the second hand, the present model also provides some elements of response with regard to the second objection, formulated against Maher's model, by Davies and Coltheart (2000), according to which it does not allow to describe how delusional beliefs are adopted and maintained in spite of their implausible nature. The present model, however, sets out first to describe step-by-step the type of reasoning which leads to the adoption of polythematic delusions. By its structure, this type of reasoning appears mainly normal. It proceeds by enumeration of some instances, and then by generalisation and lastly, by interpretation. The present model also provides, as far as I can see, an answer to the criticism raised by Davies and Coltheart with regard to Maher's model, who blame the latter for not describing how delusional beliefs are maintained in the patient's belief system, in spite of their implausible nature. In the present model, as we did see it, it is the fact that new instances are generated every day which explains that beliefs are maintained. For when delusional beliefs are established in the patient's belief system at the end of the stage of their formation, they are then maintained because apophenia continues to trigger every day[3] new instances of primary delusional argument. The latter come, in the patient's mind, to *confirm* the conclusions of delusional arguments at a secondary, tertiary and quaternary level, already established at the stage of the formation of delusional ideas. From this point of view, there is no essential difference in the present model in the way that the formation and the maintenance delusional ideas take place. For as we did see it, the building block of the delusional construction is constituted there by the instances of primary delusional arguments, triggered by apophenia. And these instances which concur to the formation of delusional ideas, also ensure their maintenance every day, by confirming the conclusions of secondary, tertiary and quaternary arguments, which are already established at the stage of the formation of delusional ideas[4].

Finally, the model which has just been described provides, as far as I can see, in comparison with Maher's model, an element which proves to be necessary in the context of an explicative model of polythematic delusions. This element consists of an answer to the question of *why* the content of delusional ideas in schizophrenia identifies itself most often with delusions of reference, of telepathy, of thought insertion, of influence and of control. As it was exposed above, the answer provided by the present model is that a mechanism of the same nature, grounded on post hoc fallacy, leads to the development of these different delusional topics. In primary delusional arguments of reference, of telepathy or of influence, an event which is internal to the patient precedes an external event. And in the case of a primary delusional argument of control, this structure is simply reversed: it is an external event which precedes an event of the patient's internal life.

We see it finally, the preceding analysis allows to justify and to reinforce Maher's initial model. In this context, one can notice that one of the consequences of the present model is that the sole apophenia, associated with normal reasoning, turns out to be sufficient to give rise to the emergence and the maintenance of a delusional system[5].

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[1] Monothematic delusions are not included into the scope of the present study.

[2] One can notice that a neurophysiological explanation on the origin of apophenia is provided by Manfred Spitzer (1995, p. 100). He describes then how the latter is linked to the level of activity of dopamine and of norepinephrine, which have an influence on the value of the signal/noise ratio that is at the root of the activation of neural circuits: “if the signal to noise ratio is too high, (...) small environmental signals (i.e. perceptions to which we would normally pay little or no attention at all) may become amplified to a degree that is much higher than usual. This could result in experiences of “significant events” when merely ordinary events were in fact happening”. Spitzer shows then how apophenia can be the consequence of an imbalance at the dopamine level. By placing normally insignificant events (among which the patient's thoughts) in the foreground, the modification of the signal/noise ratio allows then the particular feeling of interconnection that constitutes apophenia to occur. Under these conditions, one can notably conceive of how the patient's thoughts can appear to him/her as prominent so as to be put on the same plan, then put in relationship with external facts such as the words pronounced by a TV presenter.

[3] As an anonymous referee for *Philosophiques* suggests, it would be necessary to quantify precisely the frequency of these instances. This could be made in a separate study.

[4] These elements of response with regard to the way the maintenance of polythematic delusions takes place need to be supplemented, especially as regards the way the conclusions of quaternary delusional arguments are put in coherence with the rest of the patient's beliefs, takes place. Such analysis, which requires subsequent work, is however beyond the scope of the present study.

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