An Analytic View of Delusion

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Abstract: The present article proposes a logical account of delusions, which are regarded as conclusions resulting from fallacious arguments. This leads to distinguish between primary, secondary, ..., *n*-ary types of delusional arguments. Examples of delusional arguments leading to delusion of reference, delusion of influence, thought-broadcasting delusion and delusion of grandeur are described and then analysed. This suggests finally a way susceptible of improving the efficiency of cognitive therapy for delusions.

The purpose of this article is to present, as far as I know, a novel account of several types of delusions observed in psychoses. This account results from a logical analysis of delusions, where delusions classically found in psychoses are regarded as conclusions resulting from fallacious arguments. Although their conclusion appears obviously false, delusional arguments are described here as arguments for which the determination of the defective step can sometimes prove nontrivial. The description of delusions as fallacious arguments[1] leads finally to several suggestions, which could allow to reinforce the effectiveness of cognitive therapy[2].

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[1] This account is not exclusive of other accounts of delusional ideas. It consists simply here in a supplementary facet of delusion. In particular, the present logical analysis of delusion is compatible with Paul Chadwick's et al. (1996) adaptation of Albert Ellis' ABC-analysis to delusional thinking. The Cs of ABC-analysis which are the consequences of delusional arguments and the target of the therapy are not mentioned here, but can be easily inserted in the present

1. Delusion as Fallacious Argument

In psychiatry, delusions are classically defined as abnormal beliefs which satisfy the following criteria:[3] '(i) they are held with absolute conviction; (ii) they are experienced as self-evident truths, usually of great importance; (iii) they are not amenable to reason, or modifiable by experience; (iv) their content is often fantastic or at best inherently unlikely; (v) the beliefs are not shared by those of a common social or cultural background'. One traditionally distinguishes in psychoses between several types of delusions, among which: delusion of reference, delusion of influence, delusion of control, telepathy-like delusion, delusion of grandeur, delusion of persecution.

A significant part of analytical philosophy is devoted to the study of *paradoxes*. A paradox consists of an apparently valid argument[4] whose conclusion is however unacceptable because it engenders a contradiction.[5] In parallel, a significant field of investigation within analytical philosophy consists of the study of *arguments* whose conclusion is counterintuitive. There exists indeed philosophical problems which have the structure of an apparently valid reasoning and whose conclusion appears truly contrary to common sense. To the difference of paradoxes, such problems do not lead however to a contradiction. Nevertheless,

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account. The present framework also fits well with Hemsley & Garety's (1986) bayesian framework, and is also consistent with the continuum model of psychosis (Bentall 2003).

[2] In what follows, cognitive therapy is intended to be effective under the condition that the patient complies with the instructions of her psychiatrist, concerning in particular taking medication (and also developing social skills, etc.).

[3] Here I follow the definition of delusion given by Mullen (1979) and mentioned in Hemsley & Garety (1996).

[4] A valid argument is one whose conclusion is always true when its premises are true.

[5] There exists many paradoxes which are the subject of studies by contemporary analytical philosophers. Among those, one can mention: the Liar paradox, the sorites paradox, the surprise examination paradox, Newcomb's paradox, Goodman's paradox, etc.

the conclusion which results from them reveals strongly counterintuitive and contrary to common sense. Such arguments lead thus to an intuitively unacceptable conclusion.[6]

In this context, an argument can be defined as a series of propositions whose last constitutes the conclusion. The propositions constituting the argument are either given at the time of the statement of the problem (the premises), or added by deduction from the premises, by application of logical laws. In general, in the study of paradoxes or arguments whose conclusion is counterintuitive, the analysis consists in the search and the precise description of the step in the reasoning which is erroneous. For this purpose, logicians who study fallacious arguments usually break up first the corresponding reasoning into as many precise steps, and then determine among these latter on which specific step(s) is located the flaw.

I will present in what follows an account of delusions as fallacious arguments. In this context, a delusion or *delusional argument* can be regarded as a particular case of fallacious argument. Moreover, what I suggest in the following developments is that diagnosing the flaw in certain types of delusional arguments met in psychoses, despite their obviously false conclusion, is not necessarily trivial.

2. Types of Delusional Arguments

At this stage, it is appropriate to describe several instances of delusional arguments met in psychoses and corresponding to classical types of delusions: delusion of reference, delusion of influence, thought-broadcasting delusion and delusion of grandeur. I will thus present these latter under the form of delusional arguments i.e. under the form of reasoning leading to a fallacious conclusion. In what follows, I will use T_1 and T_2 to denote two given temporal positions, T_1 being slightly anterior to T_2 (to fix ideas, one can consider that the difference between T_1 and T_2 is only of a few seconds).

[6] Among such arguments, one can mention for example the Doomsday Argument. In particular, the Doomsday Argument leads to the conclusion that our birth rank within the human race leads to a vigorous Bayesian shift in favor of the probability of a nearest extinction of the human race. Such a conclusion appears quite counterintuitive. However, the problem of diagnosing the flaw in the Doomsday Argument appears as a task of great difficulty for which there does not exist at present time one consensual solution.

2.1 Primary Delusional Arguments

Let us begin with *primary delusional arguments*. Consider first primary delusional arguments leading to *delusion of reference*. Let us call *primary delusional argument of reference* the corresponding line of reasoning. Consider, to begin with, an instance according to which the patient concludes that at a given time, television spoke in function of her thoughts (the symbol ∴ denotes the conclusion):

(1) in T_1 I thought of leaving the hospital but the gate was closed

(2) in T_2 the organiser said 'Be free!'

(C3) ∴ it is because in T_1 I thought of leaving the hospital that in T_2 the organiser said 'Be free!'

Consider, second, *primary delusional arguments* leading to *thought-broadcasting delusion*. Let us call *primary delusional argument of thought-broadcasting* such a reasoning. In the following instance, the patient concludes in a delusional way that her thoughts were responsible for the fact that someone shouted at a given time:

(4) in T_1 I thought of *x* 'What an idiot!'

(5) in T_2 I heard *x* shout

(C6) ∴ in T_2 *x* shouted because in T_1 I thought of *x* 'What an idiot!'

Consider, third, *primary delusional arguments* leading to *delusion of influence*. Let us call such a reasoning *primary delusional argument of influence*. In the following instance, the patient concludes that her thoughts were responsible for some sizzles heard during a telephone call:

(7) in T_1 I thought of *x* 'He is an idiot!'

(8) in T_2 the telephone call of *x* has been disturbed by some sizzles

(C9) ∴ in T_2 the telephone call of *x* has been disturbed by some sizzles because in T_1 I thought of *x* 'He is an idiot!'

Consider also the following instance, approximately of comparable nature, where the patient is led in a slightly different way to the conclusion that the mere fact that she focused on a given person caused this last person to have a nervous twitch:

(10) in T_1 I focused myself on *x*

(11) in T_2 *x* had a nervous twitch

(C12) ∴ in T_2 *x* had a nervous twitch because in T_1 I focused myself on *x*

2.2 Secondary Delusional Arguments

Let us turn now to *secondary delusional arguments*. Such a line of reasoning can be defined as an argument whose premises are conclusions of primary delusional arguments. At this step, it is worth drawing a distinction between secondary delusional arguments emerging at the stage of the formation of delusion, and secondary delusional arguments occurring at the stage of the maintenance of delusional beliefs.

Let us begin with secondary delusional arguments that appear at the stage of the formation of delusion. Consider, first, *secondary delusional arguments of reference*. As an example, the following delusional argument which takes into account several instances of *primary delusional arguments of reference*, leads the patient to generalise to the conclusion that the presenters speak in function of her thoughts:

(13) in T_1 I thought of the presenter 'Idiot!'

(14) in T_2 I heard the presenter say, 'That is not good!'

(C15) ∴ in T_2 the presenter said 'That is not good!' because in T_1 I thought of the presenter 'Idiot!'

(16) in T_3 I felt fine and lucid

(17) in T_4 the host of the show said 'We are in great form!'

(C18) ∴ in T_4 the host of the show said 'We are in great form!' because in T_3 I felt fine and lucid

(19) in T_5 I was distressed

(20) in T_6 the host said 'Stop stressing!'

(C21) ∴ in T_6 the host said 'Stop stressing!' because in T_5 I was distressed

(C22) ∴ television speaks in function of my thoughts

One can term *inductive delusional argument of reference* this last type of reasoning. The preceding example thus comprises three instances of primary delusional arguments of reference. The patient generalises then from these three instances, by an inductive reasoning. The structure of the argument is thus as follows:

(A23) delusional argument of reference$_1$ whose conclusion is: in T_2 television spoke in function of my thoughts

(A24) delusional argument of reference$_2$ whose conclusion is: in T_4 television spoke in function of my thoughts

(A25) delusional argument of reference$_3$ whose conclusion is: in T_6 television spoke in function of my thoughts

...

(A26) delusional argument of reference$_n$ whose conclusion is: in T_{2n} television spoke in function of my thoughts

(C27) ∴ television speaks in function of my thoughts

Consider, second, *secondary delusional arguments of thought-broadcasting*. One has also the following generalisation from several instances of primary delusional arguments of thought-broadcasting. Here, the patient concludes more generally that other people react to her thoughts (x_1, x_2, ..., x_n denote n different people):

(28) in T_1 I thought of x_1 'What an idiot!'

(29) in T_2 I hear that x_1 was annoyed

(C30) ∴ in T_2 x_1 was annoyed because in T_1 I thought of x_1 'What an idiot!'

(31) in T_3 I thought of x_2 'He is stupid!'

(32) in T_4 I heard x_2 shout

(C33) ∴ in T_4 x_2 shouted because in T_3 I thought of x_2 'He is stupid!'

(34) in T_5 I thought of x_3 'Bastard!'

(35) in T_6 I heard x_3 to make noise

(C36) ∴ in T_6 x_3 made noise because in T_5 I thought of x_3 'Bastard!'

(C37) ∴ people react to my thoughts

This is an *inductive delusional argument of thought-broadcasting*. This example is composed of three instances of primary delusional argument of thought-broadcasting, from which the patient proceeds, in an inductive way, to a generalisation. Its structure is clearly identical to that of the *inductive delusional argument of reference*:

(A38) delusional argument of thought-broadcasting $_1$ whose conclusion is: in T_2 x_1 reacted to my thoughts

(A39) delusional argument of thought-broadcasting $_2$ whose conclusion is: in T_4 x_2 reacted to my thoughts

(A40) delusional argument of thought-broadcasting $_3$ whose conclusion is: in T_6 x_3 reacted to my thoughts

...

(A41) delusional argument of thought-broadcasting $_n$ whose conclusion is: in T_{2n} x_n reacted to my thoughts

(C42) ∴ people react to my thoughts

Consider, third, *secondary delusional arguments of influence*. Just as previously, one has also the *inductive delusional argument of influence* where the patient concludes more generally than she influences other people, and whose structure is:

(A43) delusional argument of influence$_1$ whose conclusion is: in T_2 x_1 was perturbed by my thoughts

(A44) delusional argument of influence$_2$ whose conclusion is: in T_4 x_2 was perturbed by my thoughts

(A45) delusional argument of influence$_3$ whose conclusion is: in T_6 x_3 was perturbed by my thoughts

...

(A46) delusional argument of influence$_n$ whose conclusion is: in T_{2n} x_n was perturbed by my thoughts

(C47) ∴ people are perturbed by my thoughts

The foregoing secondary delusional arguments are inductive secondary delusional arguments, i.e. secondary delusional arguments occurring at the stage of the formation of delusion. Let us consider now secondary delusional arguments emerging at the stage of the maintenance of delusion. Under these circumstances, the conclusion resulting from inductive secondary delusional arguments is already established, and the corresponding line of reasoning takes into account a novel instance of primary delusional argument. An example of this pattern of reasoning is thus as follows:

(48) television speaks in function of my thoughts

(49) in T_{100} television spoke in function of my thoughts

(C50) ∴ this confirms that television speaks in function of my thoughts

In this context, the secondary delusional argument of reference has the form of a *confirmatory* secondary delusional argument.

2.3 Tertiary Delusional Arguments

Let us proceed now to examine *tertiary delusional arguments*. The corresponding line of reasoning can be defined as an argument whose premises are conclusions of secondary delusional arguments. Consider, first, *tertiary delusional arguments of reference*. An instance of this last type of reasoning is as follows, where the patient presents the delusional argument according to which television speaks about her:

(51) the presenters speak in function of my thoughts

(C52) ∴ television speaks about me

Consider, second, *tertiary delusional arguments* of *thought-broadcasting*. In this case, the patient concludes in a delusional way that other people can hear (or read) her thoughts. An instance of this pattern of reasoning is as follows:

(53) people act in function of my thoughts

(C54) ∴ people hear my thoughts (people read my thoughts)

Consider, third, *tertiary delusional arguments* leading to *delusion of influence*. The following instance is an instance of *tertiary delusional argument of influence*. The patient concludes then that she disturbs people:

(55) people are perturbed by my thoughts

(C56) ∴ I disturb people (I influence people)

2.4 Quaternary Delusional Arguments

Let us turn now to *quaternary delusional arguments*. Such a type of reasoning can be defined as an argument whose premises are conclusions of tertiary delusional arguments[7]. Consider for example an argument leading to delusion of grandeur. The following instance thus constitutes a *delusional argument of grandeur*:

(57) I have the capacity to influence people

(58) television and the media speak about me

(59) people hear my thoughts

(C60) ∴ I am an exceptional person

[7] More generally, we have the following definition: *n*-ary delusional arguments are arguments whose premises are conclusions of (*n*-1)-ary delusional arguments.

(C61) ∴ I am extraterrestrial

Here, it appears that such an argument has the following structure:

(A62) ternary delusional argument of influence$_1$ whose conclusion is: I have the capacity to influence people

(A63) ternary delusional argument of reference$_1$ whose conclusion is: television and the media speak about me

(A64) ternary delusional argument of thought-broadcasting$_1$ whose conclusion is: people hear my thoughts

(C65) ∴ I am an exceptional person

(C66) ∴ I am extraterrestrial

3. Analysis of delusional arguments

3.1 Analysis of Primary Delusional Arguments

It is worth attempting now to analyse the delusional arguments which have been just described, and to diagnose for each of them the particular step leading to the fallacious conclusion. Consider first an instance of *primary delusional argument of thought-broadcasting*:

(67) in T_1 I thought of *x* 'Bitch!'

(68) in T_2 I heard *x* shout

(C69) ∴ in T_2 *x* shouted because in T_1 I thought of *x* 'Bitch!'

One needs here to determine which of the steps (67)-(C69) proves to be faulty. It appears first that the premise (67) constitutes a fact and the corresponding proposition is thus true. In the same way, the premise (68) also constitutes an established fact and the corresponding proposition is also true. Thus the premises

(67) and (68) appear true. Since the remaining step (C69) is false, it is therefore the inference from (67)-(68) to (C69) which is erroneous.

Let us analyse thus in detail the step (C69). The corresponding proposition concludes that there is a *relation of causality* between two facts: φ_1 (in T_1 I thought of *x* 'Bitch!') and φ_2 (in T_2 *x* shouted). But it appears that there is only a relation of *anteriority* between φ_1 and φ_2. The fact that φ_1 is anterior to φ_2 is a logical consequence of (67) and (68). Indeed, the implicit step according to which:

(70) I thought of *x* 'Bitch!' just before I heard *x* shout

results from (67) and (68). However, such a relation of *anteriority* between φ_1 and φ_2 does not entail the existence of a relation of *causality* between φ_1 and φ_2. Thus, the conclusion appears too strong. As one can see, the reasoning corresponding to the primary delusional argument of thought-broadcasting shows finally the following structure:

(71) φ_1 is slightly anterior to φ_2

(C72) $\therefore$ φ_1 is the cause of φ_2

This reasoning appears thus fallacious because the conclusion proves too strong. The premise is true, but the conclusion is false. Informally, the fallacy is as follows: given the fact that an event φ_1 slightly precedes an event φ_2, I cannot conclude that φ_1 is the cause of φ_2. The flaw in the corresponding argument is thus the step which assigns a relation of causality between the two facts φ_1 and φ_2. Therefore the inference from (71) to (C72) is faulty because it unduly transforms a relation of *anteriority* between two facts φ_1 and φ_2 into a relation of *causality*. It appears thus that the essence of the fallacious reasoning in the *delusional argument of thought-broadcasting* is the following: *anteriority does not imply causality*. In fact, such a reasoning is classically described as a fallacious argument termed *post hoc fallacy*, which finds its origin in the Latin sentence 'Post hoc, ergo propter hoc'. The corresponding error of reasoning appears when it is concluded that

an event φ_1 is the cause of an event φ_2 simply because φ_1 occurred before φ_2. Nevertheless, the error lies in the fact that one does not have sufficient evidence to allow such a conclusion.[8]

Let us now investigate a bit further the mechanism that triggers primary delusional arguments. It seems here that the inference from the anteriority step to the causality step results from the fact that the quasi-simultaneous occurrence of φ_1 and φ_2 does not appear random to the patient. From the fact that she considers that this double occurrence is non-random, the patient infers a causal relationship between the two events. An the point is that, given their intrinsic nature, these two events are plausibly compatible. In other words, the patient makes here a *misinterpretation of random events*. The corresponding fallacious reasoning can thus be rendered as follows:

(73) φ_1 is slightly anterior to φ_2

(C74) $\therefore$ the fact that φ_1 is slightly anterior to φ_2 is non-random

(C75) $\therefore$ φ_1 is the cause of φ_2

At this step, it is worth delving more deeply in this particular case of misinterpretation of random events. It appears that such a line of reasoning is related to *misinterpretation of random data*[9]. Classically, the fallacies related to misinterpretation of random data come in two forms (cf. notably Gilovich 1993). On the one hand, the following argument is an instance of a fallacious reasoning known as the *clustering illusion*:

(76) the sequence '...0**1111**010...' has 4 repetitive digits

(C77) $\therefore$ this sequence is non-random

[8] A *post hoc fallacy* can also be regarded as a particular case of cognitive distortion usually referred to as *arbitrary inference* (or *jumping to conclusions*).

[9] The passage from misinterpretation of random *data* to misinterpretation of random *events* in the case of the *clustering illusion* is explicitly mentioned in Bressan (2002, p. 18): 'People who underestimate the probability that two identical digits occur one after another by chance may, in everyday life, underestimate the probability that two similar events occur one after another by chance.'.

From the fact that a repetition of identical alternatives (following a terminology from Bressan 2002) occurs in a sequence[10], one is led erroneously to the conclusion that the sequence is non-random. However, such repetitive patterns occur frequently in random sequences. The fallacy comes here from the fact that one intuitively underestimates the occurrence of such repetitive patterns in random sequences.

On the other hand, it is worth considering another fallacious reasoning relating to the probability of coincident random numbers. As an example, it appears that one has a tendency to strongly underestimate the probability of coincident birthdates[11], in a sample of say, 23 persons. For in a random sample of 23 persons the chance that at least two of them will have the same birthdate equals 0,5073. Hence, the corresponding fallacious argument can be rendered as follows:

(78) the sequence '223_1-5_2-**276_3**-121_4-56_5-159_6-**276_7**-310_8-357_9-...-89_{22}-246_{23}' has 2 identical numbers

(C79) ∴ this sequence is non-random

Let us analyse now in more detail how these last two fallacious arguments are involved in primary delusional arguments. For consider the following combination of the *clustering illusion* which has been just mentioned, and the case of underestimation of the probability of *coincident numbers* in a series. Consider then a sequence of 23 numbers, drawn in the range 1-365 and the following argument:

(80) the sequence '223_1-5_2-206_3-121_4-56_5-159_6-**310_7**-**310_8**-357_9-...-89_{22}-246_{23}' has 2 repetitive numbers

(C81) ∴ this sequence is non-random

It should be apparent here that this last argument is a combination of the clustering illusion and of the underestimation of the probability of coincident numbers described above.

Now this last erroneous line of reasoning can be applied straightforwardly to the interpretation of random events. For consider now a series of events, considered from the viewpoint of a patient. Let us draw a

[10] Of any length.

[11] To simplify matters, birthdates are considered here as numbers that are drawn in the range 1-365.

distinction between internal (thoughts[12]) and external (facts) events. Let us then denote an internal event relating to a given person[13] x and the associated - positive or negative[14] - mood by $[x^{p}]$. Let us also denote an external event whose agent is a given person y and the corresponding - positive or negative[15] - mood by $]y^{q}[$. For example, $[x^{+}]$ denotes a positive thought directed to x, while $]y^{-}[$ denotes that y expresses a negative emotion such as anger. The conclusion that φ_1 is the cause of φ_2 is grounded on the fact that the quasi-simultaneous occurrence of φ_1 and φ_2 is construed as a causally meaningful coincidence. With the relevant machinery in place, we are now in a position to describe the *structure* of the above instance of primary delusional argument:

(82) the sequence $\varphi_1[223^{+}]\text{-}\varphi_2]5^{-}[\text{-}\varphi_3[206^{-}]\text{-}\varphi_4]121[\text{-}\varphi_5[56^{+}]\text{-}\varphi_6]159^{+}[\text{-...-}\varphi_{19}[\mathbf{310}^{-}]\text{-}\varphi_{20}]\mathbf{310}^{-}[\text{-}\varphi_{21}[89^{-}]\text{-}\varphi_{22}]246^{+}[\text{-}\varphi_{23}[112^{-}]$ of events has occurred

(83) $\varphi_{19}[\mathbf{310}^{-}]$ is slightly anterior to $\varphi_{20}]\mathbf{310}^{-}[$

(C84) $\therefore$ the repetitive occurrence of $\varphi_{19}[\mathbf{310}^{-}]$ and $\varphi_{20}]\mathbf{310}^{-}[$ is non-random

(85) $\varphi_{19}[\mathbf{310}^{-}]$ is virtually compatible with $\varphi_{20}]\mathbf{310}^{-}[$

(C86) $\therefore$ $\varphi_{19}[\mathbf{310}^{-}]$ is the cause of $\varphi_{20}]\mathbf{310}^{-}[$

where $\varphi_{19}[\mathbf{310}^{-}]$ and $\varphi_{20}]\mathbf{310}^{-}[$ respectively correspond to 'in T_1 I thought of x_{310} 'Bitch!'' and ' in T_2 x_{310} shouted'. To conclude now. The above analysis reveals that the mechanism that triggers primary delusional arguments can be analysed as a special case of *misinterpretation of random data* applied to plausibly compatible events that facilitates the ensuing *post hoc fallacy*[16].

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[12] I oversimplify here.

[13] In a wider framework, one could consider here a given *being* (including persons, animals, etc.).

[14] Where the internal event is denoted by $[x^{+}]$ if the mood is positive (joy, warmth, friendliness, etc.) or by $[x^{-}]$ if the mood is negative (anger, frustration, fear, etc.).

[15] Where the external event is denoted by $]y^{+}[$ if the mood is positive or by $]y^{-}[$ if the mood is negative.

[16] The role of the *clustering illusion* in the formation of delusions has notably been mentioned by Tom Carroll (2002). Cf. in particular, the article on the *clustering illusion* (retrieved June 1, 2002): 'Combining the clustering illusion with confirmation bias is a formula for self-deception and delusion.'.

Moreover, it appears that the cause of the error of reasoning inherent to the primary delusional argument of thought-broadcasting can be generalised to delusional arguments of reference or of influence. Indeed, the structure of these latter arguments appears from this viewpoint, quite identical to that of the primary delusional argument of thought-broadcasting. Consequently, it is the same type of error of reasoning which engenders the conclusion resulting from these primary delusional arguments.

3.2 Analysis of Secondary Delusional Arguments

At this stage, it is also worth providing an analysis of the various types of *inductive* secondary delusional arguments described above, occurring at the stage of formation of delusion. Consider first the *secondary delusional argument of thought-broadcasting*, whose structure is as follows:

(A87) delusional argument of thought-broadcasting $_1$ whose conclusion is: in T_2 x_1 reacted to my thoughts

(A88) delusional argument of thought-broadcasting $_2$ whose conclusion is: in T_4 x_2 reacted to my thoughts

(A89) delusional argument of thought-broadcasting $_3$ whose conclusion is: in T_6 x_3 reacted to my thoughts

...

(A90) delusional argument of thought-broadcasting $_n$ whose conclusion is: in T_{2n} x_n reacted to my thoughts

(C91) $\therefore$ people react to my thoughts

In such an argument, the parts (A87), (A88), (A89) et (A90) can be analysed like as many instances of the *primary delusional argument of thought-broadcasting* described above. In this case we have three different instances of this last type of reasoning. By contrast, the conclusion which results from (C91) has a different logical base and constitutes the conclusion of an inductive reasoning, whose structure is as follows:

(92) in T_2 x_1 reacted to my thoughts

(93) in T_4 x_2 reacted to my thoughts

(94) in T_6 x_3 reacted to my thoughts

...

(95) in T_{2n} x_n reacted to my thoughts

(C96) $\therefore$ people react to my thoughts [from (92), (93), (94), ..., (95), induction]

Insofar as the premises (92)-(95) are regarded as true, this type of inductive reasoning appears quite correct. It is a strong *inductive generalization*, given that the premises (92)-(95) are considered as true.[17]

However, it should be pointed out that the inductive reasoning is correct in the restricted domain of reference considered by the patient. This last domain of reference only includes events of the following type:

(97) in T_1 I thought of x_1 'Bitch!'

(98) in T_2 I heard x shout

In contrast, this last inductive reasoning is incorrect in the extended domain of reference that includes instances of the form:

(99) in T_{96} I thought of x_1 'What an idiot!'

(100) in T_{97} I did not hear that x_1 was annoyed

or else:

(101) in T_{98} I did not thought of x_1 'What an idiot!'

(102) in T_{99} I hear that x_1 was annoyed

[17] A paradigm case of inductive generalization is as follows. An urn contains 100 balls. I draw 99 balls from the urn and these last are red. By induction, I conclude that the 100th ball will also be red. Such an inductive generalization yields a conclusion which is not certain but appears nevertheless strongly probable. For the conclusion resulting from an inductive generalization is based on the existence of a supposed law which explains, in this example, that all the balls are red.

that are not taken into account by the patient.

At this stage, it also appears that the analysis relating to the inductive delusional argument of thought-broadcasting can be applied to the *inductive delusional argument of reference* as well as to the *inductive delusional argument of influence*. Indeed, it proves that the structure of these latter delusional arguments appears quite identical to that of the inductive delusional argument of thought-broadcasting.

Let us turn now to *confirmatory* secondary delusional arguments, emerging at the stage of maintenance of delusion. Consider then the following instance:

(103) television speaks in function of my thoughts

(104) in T_{100} television spoke in function of my thoughts

(C105) ∴ (104) confirms that television speaks in function of my thoughts

The corresponding argument is a valid one. Nevertheless, it should be pointed out that the argument is valid in the restricted domain of reference mentioned above and consisting of confirmatory instances of the generalisation (103). In contrast, the argument is invalid in the extended domain of reference consisting of both *confirmatory* and *disconfirmatory* instances of the generalisation (103). And the point is that this last class includes all *relevant* facts with regard to (103). For in this extended reference class, the corresponding line of reasoning, taking into account the disconfirmatory instances, is as follows:

(106) television speaks in function of my thoughts

(107) in T_{100} television spoke in function of my thoughts

(C108) ∴ (107) confirms that television speaks in function of my thoughts

(109) in T_{101} television did not spoke in function of my thoughts

(C110) ∴ (109) disconfirms that television speaks in function of my thoughts

Thus, since the patient considers a restricted domain of reference in inductive secondary delusional arguments instead of the more relevant extended one, the whole pattern of argument can be analysed as a

confirmatory bias, a tendency to privilege confirmatory instances of a given generalisation, instead of considering both confirmatory and disconfirmatory instances.

3.3 Analysis of Tertiary Delusional Arguments

Let us now turn to tertiary delusional arguments. Consider the following instances, corresponding respectively to *tertiary delusional argument of reference*, *of thought-broadcasting* and *of influence*:

(111) the presenters speak in function of my thoughts

(C112) ∴ television speaks about me

(113) people act in function of my thoughts

(C114) ∴ people hear my thoughts (people read my thoughts)

(115) people are perturbed by my thoughts

(C116) ∴ I disturb people (I influence people)

In all these cases, given the content of the premise, it appears that the corresponding line of reasoning is not an unreasonable conclusion inasmuch as the premise is considered as true. Such a line of reasoning can be construed as a patient's attempt to explain and make sense of the perplexing situation corresponding to the premise.

3.4 Analysis of Quaternary Delusional Arguments

Let us turn now to *quaternary delusional arguments*. Consider an argument leading to delusion of grandeur. Let us recall indeed that the structure of this type of argument described above is as follows:

(A117) inductive delusional argument of influence$_1$ whose conclusion is: I disturb people

(A118) inductive delusional argument of reference$_1$ inductive delusional: television speaks about me

(C119) ∴ I am an exceptional person [from (A117), (A118), deduction]

(C120) ∴ I am extraterrestrial [from (C119), deduction]

Here, it proves that the conclusion (C120) is too strong, given the premise (C119). Thus (C120) appears false. However, the conclusion (C119) appears true since the premises consisting of the conclusions of (A117) and (A118) are regarded as true.

4. Cognitive Techniques for Delusional Arguments

The foregoing developments suggest that cognitive therapy applied to delusions could be the subject of an adaptation, susceptible of improving its effectiveness. The general idea is that cognitive therapy should focus on the fallacious arguments revealed by the analysis of the delusional arguments presented by the patient. For this purpose, the questions posed to the patient by the therapist could be adapted so as to make the patient become aware of the errors of reasoning at the origin of her delusional arguments.

Taking into account what precedes, let us consider then how cognitive therapy could be adapted. To begin with, consider the first stage, which is that of the precise description of the various delusional arguments presented by the patient. Each type of delusional argument presented by the patient should then be successively analysed and described step-by-step. It would be worth here considering conclusions such as 'I am extraterrestrial', 'people hear my thoughts' or 'in T_2 I disturbed *x*'. At this stage, questions of the type 'and what makes you think that?' could usefully be posed, in order to determine with precision the various steps of the argument leading the patient to such conclusions.

Once the delusional arguments of the patient accurately defined, the therapist could then determine with precision the fallacious arguments in the delusional arguments presented by the patient. This would then make it possible to the cognitive therapist to adapt her questions and her assertions so as to firstly allow the patient to identify the flaw in her reasoning. Preferably, the questions posed by the cognitive therapist should then focus on the erroneous steps in the various instances of delusional arguments. The cognitive therapy would thus concentrate in priority on these defective parts, which constitute the weak point of the patient's reasoning.

The foregoing analysis also shows that multiple instances of a special case of *post hoc fallacy* could play a dominating role in the development of delusional beliefs met in psychoses. This also suggests that it could also be useful to make the patient understand first how this general line of reasoning appears fallacious. For this purpose, it would also be useful to make the patient aware of the faulty reasoning resulting from *misinterpretation of random events* and *confirmatory bias*.

In a general way, the refutation of an instance of the primary delusional argument of reference, of influence or of thought-broadcasting could be performed as follows. Such an argument has the following structure, which is that of the *post hoc fallacy*:

(121) φ_1 is slightly anterior to φ_2

(122) $\therefore$ φ_1 is the cause of φ_2

As the conclusion of the argument is relevant to causation, it is useful here to make use of the conditional theory of causation[18], a simple kind of theory of causation. According to this theory, φ_1 cause φ_2 just when φ_1 is sufficient (φ_1 is always followed of φ_2) and necessary (non-φ_1 is always followed of non-φ_2) for φ_2. In a general way, one could suggest here to the patient that (i) φ_1 can occur without φ_2 not succeeding to it, i.e. φ_1 is not a sufficient condition of φ_2; and in addition (ii) that φ_2 can occur without φ_1 not preceding it, i.e. φ_1 is not a necessary condition of φ_2. The questions intended to lead the patient to become aware of the erroneous step of her reasoning could thus be of various types: (i) and if φ_2 had been caused by another cause that φ_1, for example φ_3?[19] (ii) and if the fact that φ_1 is followed of φ_2 were a mere coincidence? Moreover, in all cases, it should be stressed on the need to have evidence that φ_1 is both a sufficient and a necessary condition of φ_2, to allow concluding that φ_1 is the cause of φ_2.

For this purpose, it could be very helpful to make the patient aware of the techniques of reality-testing applied to possibly causally related events. Such a technique of *causality testing* could be presented along

[18] Such a simple theory has some defects but it proves adequate for present purposes.

[19] Such an approach which consists in suggesting alternative causes ('discuss alternatives') is explicitly mentioned by Kingdon & Turkington (1994, p. 156).

the following lines. Consider for example the hypothesis that events of type φ_1 are the cause of events of type φ_2. In order to eliminate random factors and possible coincidences, one must establish that φ_1 is both a sufficient and a necessary condition of φ_2. In this context, the consecutive events that are relevant are not just confirmatory instances of the sufficient condition, as the restricted domain of reference considered by the patient only contains. Rather, the relevant consecutive events are confirmatory and disconfirmatory instances of both the sufficient condition and the necessary condition. One should then test several times if φ_1 is followed of φ_2 (confirmation of the sufficient condition) or of non-φ_2 (disconfirmation of the sufficient condition), and if non-φ_1 is followed of non-φ_2 (confirmation of the necessary condition) or of φ_2 (disconfirmation of the necessary condition). It should be noted that for the sake of simplicity, confirmatory instances of the necessary condition ('I did not thought of *x* 'Bitch!' just before I did not heard *x* shout') should be preferably ignored.[20] The result of the test would have the following structure (to fix ideas, the elements of the primary delusional argument mentioned above are used here):

I thought of *x* 'Bitch!' just before I heard *x* shout	5	confirmatory instances of the sufficient condition
I thought of *x* 'Bitch!' just before I did not I heard *x* shout	18	disconfirmatory instances of the sufficient condition
I did not thought of *x* 'Bitch!' just before I heard *x* shout	43	disconfirmatory instances of the necessary condition

Table 1. Causality testing

At this point, one might legitimately wonder how the preceding analysis could be made understandable to a patient suffering from a severe illness. But what precedes could be restated in more simple terms and reorganised in gradual steps, I think, in order to make it accessible to the patient. Let us examine how this goal could be achieved. It should be pointed out that the main target of the therapy would be the repetitive occurrence of pairs of matching consecutive internal/external events that seems so disturbing to the patient

[20] And also to the motive that cognoscenti will recognise here an unexpected variant of Hempel's problem.

that she interprets them misleadingly.[21] As these latter pairs seem non-random to the patient, they are at the origin of the patient's erroneous causal interpretation and of further delusional elaboration. The scope of the therapy, at this step, will be to offer an alternative explanation of these perplexing pairs of matching internal/external events. I suggest that such a goal could be achieved by the following steps:

(i) explain to the patient, from a general viewpoint, the difference between facts and their interpretation;

(ii) make the patient aware that conclusions of primary delusional arguments are *interpretations* of facts, not genuine facts;

(iii) agree with the patient that pairs of matching internal/external events are genuine facts;

(iv) acknowledge that these pairs of matching consecutive internal/external events ('concordances') are puzzling and perplexing, and that they stand in need of explanation;

(v) acknowledge the conclusions of primary, secondary, ternary and quaternary delusional arguments as a patient's attempt to make sense of this disturbing repetition of concordant pairs of events;

(vi) propose an alternative explanation of concordances as random events. To this end, it could be suggested to the patient that she only counts the concordances, without directing her attention toward the discordances (in our terminology, disconfirmatory instances of both the sufficient and the necessary condition): 'You seem to be very aware of the concordances, but I wonder if you had ever noticed how many discordances had occurred?'. If the patient would direct her attention toward these discordances, could it be said, maybe she would be led to the alternative conclusion that the concordances and discordances occur at random;

(vii) agree with the patient on what counts as discordances;

(viii) invite the patient to test the random hypothesis by counting and then comparing the concordances and discordances.

At this step, it would normally be possible to the patient to agree with the therapist that her primary delusional arguments were fallacious. Furthermore, it seems that at this stage, the *behavioural* part of cognitive-behavioural therapy could normally take place, namely, a gradual exposition of the patient to the

[21] The present view is close to the ideas emitted in Maher (1988, 1999) concerning the predominance of normal (i.e. broadly rational) reasoning in delusional thinking.

situations that engender primary delusional arguments[22]. The patient could then be learned accordingly to replace the erroneous pattern of reasoning:

(123) φ_1 has occurred prior to φ_2

(124) $\therefore$ φ_1 is the cause of φ_2

by the correct one:

(125) φ_1 has occurred prior to φ_2

(126) I have no evidence that if φ_1 had not occurred then φ_2 would not have occurred

(127) $\therefore$ I cannot conclude that φ_1 is the cause of φ_2

What precedes also sheds light, I think, on the reason why questions usually posed during the classical cognitive therapy are currently only partly effective against the delusional arguments described above. For such questions do not reach the core of the fallacious reasoning. Let us thus consider a patient who concludes 'people hear my thoughts'. If one poses the question to the patient: 'Do you think that people can read your thoughts?', it is quite possible that the patient internally reconstitutes the inductive delusional argument of thought-broadcasting which has led her to the conclusion that people read her thoughts, in the following way:

(128) in T_2 x_1 reacted to my thoughts

(129) in T_4 x_2 reacted to my thoughts

(130) in T_6 x_3 reacted to my thoughts

...

(131) in T_{2n} x_n reacted to my thoughts

[22] This behavioural part seems inadequate for secondary, ternary, ... , *n*-ary ($n > 1$) delusional arguments.

(C132) ∴ people react to my thoughts [from (128), (129), (130), ..., (131), induction]

(C133) ∴ people hear my thoughts [from (C132)]

By proceeding thus and since she considers that the premises (128), (129), (130), ..., (131) are true, the patient concludes correctly by a strong inductive reasoning, that people react to her thoughts, and then by a further step concludes that people hear her thoughts. For as noted above, this *part* of the inductive delusional argument of thought-broadcasting which is based on an inductive reasoning reveals strong. And such a part of the inductive delusional argument of thought-broadcasting is strong because it does not include those erroneous steps which have been identified as at the origin of the conclusions of primary delusional arguments.

Finally, the main point that results from the preceding analysis is that cognitive therapy should address firstly primary delusional arguments. The above developments finally suggest a priority, leading to focus on the treatment of primary delusional arguments.

Conclusion

The above developments lead to the suggestion that the effectiveness of the cognitive therapy of psychoses could be reinforced by several aspects resulting from an account of delusions as delusional arguments. First, the therapist could analyse the patient's delusions as delusional arguments and sub-arguments, and then identify the faulty steps in each corresponding delusional argument. At this stage, the cognitive therapist could adapt the corresponding therapy according to the defective steps thus determined. Finally, the contribution to cognitive therapy which result from the current analysis could consist in the definition of a priority concerning primary instances of delusional arguments in the treatment of delusions in cognitive therapy. Once this task accomplished, the classical cognitive therapy could then take place.

Lastly, an interesting feature that also ensues from the present account is that it seems that, once the therapist and the patient have agreed that the conclusion of primary delusional arguments results from a fallacious reasoning, the behavioural part of cognitive-behavioural therapy could normally follow.

The above considerations finally suggest that such an approach could usefully be the subject of a *controlled study*. Such a study should be preferably targeted to those patients who do not suffer from auditory hallucinations, since the present account has been only concerned with delusions. If the results of such experimentation were to appear positive, it could constitute a way of reinforcing the impact of cognitive therapy applied to psychoses.

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