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What is an Assumption?

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Abstract: The concept of an 'assumption' is discussed, and it is suggested that the psychological model implied by normal usage is misleading. A new model is proposed which distinguishes between 'assumptions', as constraints upon the thinking process, and 'postulates', as corresponding potential or actual propositional vocalizations. Some evidence for this model is provided, and its implications, particularly for the process of assumption identification, are discussed. It is suggested that assumption identification requires lateral thinking, and needs to be separated from problem-solving. The discussion is offered as an instance of an appropriate type of fusion of psychological and informal-logical approaches.

It is probably no exaggeration to say that everyone who has been involved in teaching or writing about clear or critical thinking, or in the analysis of everyday reasoning processes, has found it necessary to refer to 'assumptions'. If they have not used the word itself they will have used closely related terms, such as 'preconceptions', or 'implicit beliefs'. Ennis (1982, p.64) characterises his 'used assumptions' as 'unstated reasons'. Some, indeed (Scriven, 1976, p. 43), see the explication of unstated assumptions as necessary steps in the analysis of an argument. The words 'assumption' and 'assume' are also, of course, widely used in daily conversation, in a variety of senses. Writers frequently signal some concern about the universal comprehensibility of these terms by offering ostensive definitions (Moore, & Parker, 1986) but, when one considers their ubiquity, there has been surprisingly little explicit analysis of the concepts.

Ennis (1982) distinguishes two classes of 'assumption', those which he calls, as mentioned above, 'used assumptions', which are assumptions which the argument creator 'uses', or 'makes' in forming the argument, and those which he calls 'needed assumptions', which the argument analyst judges to be 'required', in some sense, if the argument is to be sound. The following discussion is an attempt to clarify the nature and role of the former of these classes of assumption. The concept of a 'needed assumption' is also in some need of clarification, especially since much of the work of informal logicians seems to be concerned with them, but that will not be attempted here, as the issues such an attempt would evoke are quite different, and warrant separate consideration. It may be assumed, then, that the word 'assumption', in our current discussion, means 'used assumption'.

There seem to be general beliefs that assumptions may act as 'implicit premises' for thought and action, that they may be unconscious, or at least unnoticed, and that people can consciously attend to them. One slightly pompous cliché, which nevertheless expresses the common attitude quite clearly, runs, 'Hold your assumptions up for examination in the light of day'. These beliefs about assumptions, together with the manifold natural language uses of the word 'assumption' and related terms, lead inevitably to certain lay psychological views about thinking, argument analysis and

problem–solving. There has not, however, been much formal analysis and research on these matters. We do not know, and have hardly asked, what kind of a 'thing' an assumption is, where it fits in the implicit hierarchy of psychological 'entities', or to what kinds of psychological processes it may contribute. We propose here to discuss some of these issues.

Let us start with some examples, to make it clear which of the uses of 'assumption' we are considering. Firstly, an everyday action situation. You are boiling an egg for your breakfast. You may be said to assume that the egg will not dissolve or explode, and that the stove will not fly away, and, more prosaically, that the egg will be ready within the time allotted to the meal, and that the stove will not catch fire. Secondly, a discussion situation. You urge your friend not to bet on a particular horse, because it does not have a particularly good record on this track, and because it has been assigned to an outside lane. You may be said to have assumed that your friend wants the bet to pay off. Thirdly, a problem-solving situation. You are asked to construct, with six matchsticks, a pattern that contains four equilateral triangles. You struggle with the problem for a while, and finally prove algebraically that there is no solution. You may be said to have assumed that the solution must be two-dimensional.

These examples should make it clear that we are not, at this point, concerned with situations in which someone says, 'I am assuming that ...' In fact, in each of the examples, described, it is most likely that there is no awareness of the assumptions that are made. Let us, indeed, assume for the moment that our discussion is only concerned with assumptions which are not present in consciousness. It is a natural extension of this thought, and the one which is usually made in discussing these kinds of situation, to suppose that people could *become* aware of the assumptions, or could, indeed, take steps to *make* themselves aware of them. People are urged, as we have seen, to 'examine' their assumptions.

This way of speaking, however, itself involves assumptions, in the very sense that we are discussing, about the nature of assumptions themselves. The most critical of these is the notion that an assumption is some kind of entity, somewhere in one's head, or at least in one's mind. This conceptualization is, in fact, so pervasive that phrases refering to assumptions which do not imply it are difficult to find. When we speak of 'finding' assumptions, 'identifying' them, or 'examining' them we are, in effect, treating them as if they were some kind of thing or entity.

Some of us, if challenged on this issue, might deny that we really meant that an assumption was any sort of entity, even if we talked about it as if it were. Others are so explicit in attributing 'thinghood' to assumptions that the challenge is unnecessary. Thus Ennis (1982, p.64) says, "Although I have presented used assumptions to be things that people have, one might also want to allow them to be things that institutions have, if one would allow that institutions have reasons." On the same page he characterises the identification of a used assumption as the identification of a "mental-event-or-state".

Often, however, nothing specific is implied about what kind or level of entity an assumption is, just that it is something that can be sought, found, and examined. If we were to be asked what kind of entity, the most obvious answer would be that it is, in some sense, a stored proposition, and this is the kind of answer which, one suspects, many formal and informal logicians would give. Although such an answer would move us some way towards a psychological model of the situation it is not formulated at a level with which most psychologists would be comfortable. We can not, even vaguely, envisage the kind of neurological or physiological structure that would correspond to a stored proposition. But then, we know little about the way words or sentences are stored in memory, and subsequently accessed, although we know that

they are. So we should perhaps, for the moment, leave the psychologists' discomfort to the psychologists, and treat the stored-proposition idea as being, at least potentially, theoretically viable.

The notion has, however, both philosophical and practical difficulties to contend with. We are, after all, speaking of the storage of a proposition, not a sentence. It is one thing to point, in the context of logical analysis, to the denotation, irrespective of particular language or linguistic forms, of a statement or sentence, and call this a 'proposition'. It is quite another to go on to speak as if this construct can have an existence independent of the utterance from which it was extracted. Furthermore, we are here speaking of propositions of which the 'proposer', so to speak, is not necessarily aware, and it is not immediately obvious that this is a philosophically sustainable concept.

In practical terms, consideration of our examples suggests a certain implausibility in this notion. Presumably there is nothing special about our egg-boiling situation. Consideration of any action or proposed action would disclose a vast list of assumptions attendant on it. Is it seriously being suggested that whenever we do anything we first formulate, consciously or otherwise, a great list of assumptions? In any case, the lists of assumptions may in fact be, not merely large, but functionally infinite. We don't just assume that the egg will not melt or explode. We assume it will not turn into a wombat or a crow, and that the stove will not go on strike, or stop heating while it engages us in conversation. Furthermore, we could simultaneously be said to be assuming that the house will not fall down, that no-one will drop a hydrogen bomb, and so on. Clearly one could go on listing such assumptions as long as one's imagination, and the patience of one's auditor, held out.

It might be argued that the propositions we are discussing here are not, in some sense, 'real' assumptions. But it is not easy to see how they could clearly be distinguished from, for instance, the assumption in our matchstick example, that the solution is two-dimensional, which is as real as an assumption can be. The important question is, of course, just how real is that? Our usual way of speaking of assumptions treats them as some sort of entity that, at the least, corresponds to an engram in the brain. We speak as if they are the sort of thing that is, in some sense, there. We can be conscious of them or not, and if not, can seek, examine, and possibly modify them. But perhaps our normal way of speaking of them is misleading. Perhaps we do not have to envisage potentially infinite arrays of engrams in the brain, which would presumably take correspondingly infinite periods of time to set up.

Our list of examples in fact contains a clue, which is strengthened when we discuss with problem-solvers what is going on in their minds. Many if not most assumptions appear to correspond more to an absence of some conception than to its presence. The stove-user does not usually think 'The stove will not turn into a wombat'. He or she merely fails to consider the possibility that it might. Similarly the unsuccessful matchstick manipulator does not think, 'The solution has to be two-dimensional', but fails to consider that it might be three-dimensional. In fact, if that issue ever does consciously arise, the problem is probably solved. Even where we naturally describe an assumption in positive terms, as when our investment advisor assumes that his or her friend wants to win the bet, it is usually easy to express it the other way. Thus we could say that they failed to consider the possibility that winning was unimportant to the friend (supporting the underdog might have been more important).

If we think of an assumption as being, not a positive proposition, but some sort of limitation or circumscription of the thinking process, or the field that the thinking process concerns itself with, many of the

problems we have raised are greatly alleviated. In particular, we no longer have a problem with apparently infinite memory and time requirements. More importantly, an assumption, on this model, need not involve the storage of any propositions whatsoever. To say that a person made such-and-such an assumption would be to say that their thinking was limited by boundaries of some particular description, but that description itself would not need to be encoded anywhere in that person's brain. Alternatively, one could say simply that the assumption consists in the person acting (where thinking is counted as an action) as if such-and-such were the case. Clearly, for this to happen, 'such-and-such' does not need to coded and stored anywhere. Incidentally, this formulation is not as different from the other as it seems, as one can see people as *limiting their thinking* to a universe in which such-and-such is the case.

Another, and major, implication of the acceptance of this model would be that our usual way of speaking of assumptions would be actively misleading. An assumption would not be any kind of entity. Nowhere in the system would there be a file of assumptions which could be taken out and looked at. Indeed, one might reasonably expect that people asked to examine their assumptions would find this a puzzling and difficult instruction. The primary, if not the only, technique for finding one's assumptions would be to examine one's thinking to try to observe in what ways it was being limited. Clearly, this process would be difficult to combine with the thinking itself. In other words, one would probably have to stop thinking about the problem before one could start to search for one's assumptions. Unfortunately, too, the same factors which caused a thinker to make a particular assumption in the first place would be likely to operate during the assumption-seeking phase. There is no reason to think that stopping trying to solve the problem would automatically nullify whatever originally caused the person to take on the assumption, be it personality factors, past experiences, or specific interpretations of the description of the problem itself. Assumption-seeking would, then, be very much a lateral thinking process (de Bono, 1977), and would involve creativity at least as much as logic.

There is, in fact, some empirical support for this kind of model. People who are attempting to solve a problem, and are making a mistaken assumption, do indeed seem unable to comply with the request to examine their assumptions. Furthermore, the information that they are making a false assumption does not appear to assist them in their endeavors. In a fairly informal experiment in 1967, the first author of this paper set students a problem which almost invariably elicits initially a false assumption which prevents its solution. The problem, using three rows of three dots each, in the form of a square, was worded as follows:

'Draw 4 straight lines, without taking your pen off the paper, in such a way as to interconnect all 9 dots.'

The false assumption that most people initially make is that the lines must be drawn within the confines of the dots, and indeed, that they must start and end on dots. Two groups of 15 subjects were allowed to spend as long as they wished on the problem, and all except two in each group eventually solved it. The difference between the groups was that one group was told, after one minute, "You are making a false assumption which is preventing you from solving the problem". The average solution times of the two groups were almost identical.

In a much more recent experiment, conducted by the second author of this paper, subjects attempted a series of 7 problems which differed in type and in subject matter, but which were selected for their tendency to elicit inappropriate assumptions. The experimental group was warned in advance of this tendency, and reminded at

the start of each problem to watch out for such assumptions. Again there was no evidence that this instruction was in any way helpful. Where there were marginal differences, they tended to favour the control group.

With respect to the other suggested implication of the model, that it may be necessary to stop trying to solve a problem before some of one's assumptions can be found, there is much indirect evidence which suggests, at the least, that some kind of hiatus in the thinking process may be helpful. Many successful thinkers have, in describing their own creative performance, drawn attention to the way in which solutions to problems have a way of 'popping up' during periods when a problem was not actively being pursued. The discovery through a dream of the ring structure of the benzene molecule, by the 19th century chemist Kekule, is a famous example, but there are many others. The French mathematician Poincairé (1924) attempted to base a theory of unconscious thought on his frequent experiences of this kind. In fact, many of these instances of sudden and unexpected problem-solution could be accounted for in terms of the recognition of a solution-blocking assumption.

Interestingly, our normal usage of terms such as 'assumption' is also, in some ways, consistent with the idea that an assumption is an aspect of the structure of a particular thinking episode, rather than some sort of entity which exists in the mind independently. If we set out to solve a problem, are interrupted, and do not continue, we do not think of ourselves as going about thereafter bearing a freight of unactivated assumptions, as if they were propositions which had been stored away. We only speak of 'assumptions' in the context of a particular argument or piece of thinking. We 'make' assumptions, in a particular context. We do not 'have' them, in a long-term sense, in the way in which we have traits, or beliefs.

So far, we have been discussing assumptions of which the thinker is not conscious, but we often, of course, appear to make assumptions deliberately. We say things like, 'Let us assume for the sake of discussion that ...', and, 'We are, of course, assuming that ...'. It might seem, on first consideration, that the model we are considering could not apply to these kinds of assumption. Surely they, at least, can be directly examined, and must exist, somewhere in the brain, as stored propositions?

We wish to suggest, in fact, that these explicit locutions, vocalized or otherwise, which we shall refer to during the remainder of this discussion as 'postulates', should not be regarded as corresponding directly to used assumptions, even though this is certainly a way in which the word 'assumption' is regularly applied. Rather, they should be regarded as being, in effect, expressions of the intent to 'install' the corresponding assumption. What we mean by 'installing' an assumption is setting up the thinking environment in such a way that the relevant constraint obtains, a process which, we are suggesting, may or may not be carried through successfully. Thus, a person may truthfully express the intention to make a particular assumption, but examination of their subsequent behavior may show that it is not consistent with that assumption.

The model, then, may be characterized as follows. Whenever we think, reason or argue certain boundaries obtain, limiting the scope of the thinking, or the solution-set we will consider, or the universe of things we will regard as relevant. These boundaries or limits cannot be directly observed. They are not in any sense 'things', but are aspects, more or less complex, of the framework within which our thinking is confined. For the remainder of the discussion we will be labeling these limits by the term 'assumption'. Sometimes the thinker will consciously decide that it would be appropriate for the thinking, or the solution-set, to be, in the sense under discussion, confined, and will frame propositions to this end, which we have called

'postulates'. It is normally the case that assumptions corresponding to these postulates are successfully installed, and it is this that probably accounts for the general failure to distinguish between the two constructs that we have labelled 'assumption' and 'postulate'. These labels are idiosyncratic. Better ones could probably be devised. Some might prefer, for instance, 'assumptional boundary' and 'assumptional proposition'. We prefer, however, to use a term for the second type of construct that does not tie it to the notion of an assumption since, according to our model, it does not necessarily give rise to one, or even play any role in the relevant thinking episode.

It is the suggested contingent nature of the association between postulates and assumptions that is at once the heart of this model and, so to speak, its Achilles heel. If this association is indeed contingent, there are important implications for Psychology, and for all disciplines concerned with thinking. Psychologists would, for instance, have to consider such issues as that of the nature of the 'installation' process. People concerned with informal logic and clear thinking would have to reconsider what is involved in identifying mistaken assumptions, or at least recognise that it is more than a matter of looking and seeing. If, however, the framing of a postulate is inevitably associated with the installation of an assumption, much of the point of drawing attention to the distinction disappears.

So is it possible to formulate a postulate and to fail to install the corresponding assumption? We think that it is. Suppose that a person says, in the context of the appointment of an engineer, 'I am assuming that the appointee is just as likely to be a woman as a man'. This might reasonably be taken to be the expression of a postulate, in our sense. Now suppose that in all subsequent discussion of the topic, no apparent allowance is made for the possibility of a female appointee, male personal pronouns are used exclusively, no mention is made of the fact that the company has no female toilet facilities, or of the fact that much of the equipment the appointee will use requires male strength. We might reasonably conclude that the proposed assumption was not in fact made, at least during the part of the discussion that we witnessed. It would, however, be inappropriate to conclude that the speaker had been lying in his initial statement. He may genuinely have intended to make, or, in our terms, to install, the described assumption, but have been unable to do so, because of the long-standing habit of assuming that engineers would be males, or for some other psychosocial reason.

Again, suppose that someone was trying to solve the nine-dots problem mentioned earlier. They might consciously note that the solution might involve lines that extended outside the array of dots. If we subsequently observed that in all of their attempts at solution the lines remained confined by the array, how would we describe this situation? One way might be to say that they proceeded on the assumption that the lines could not extend outside the array. The person might in fact object to such a description, because they remembered thinking that the lines did not necessarily have to remain within the array, and, of course, because they were not aware that a distinction could be made between an assumption and a postulate, the word 'assumption' often being used in everyday parlance for both. A compromise might be made by describing them as having proceeded *as if* on the assumption that .... This is, indeed, the compromise we often make in real life situations. What it means when we use it in relation to another person's behavior is something like, 'Well, they may have *thought* of a contrary assumption but, if so, it didn't show up in their subsequent behavior'. Our translation of this would be, 'Well, they may have formulated a contrary postulate, but they don't seem to have succeeded in installing the corresponding assumption'.

For the assumptions that people make ought surely to be able to be, at least tentatively, inferrable from their behavioral con-

sequences. It would seem likely, indeed, that this is how we usually identify them. Where the assumption is not consciously made this is in fact how we often appear to identify our own assumptions. When one shows the solution of the nine-dots problem to someone who has failed to solve it they are likely to say something like, 'Oh, I see. I was assuming that the lines had to start and end on dots'. Even more revealingly, they may say, 'Oh, I see. I must have been assuming that ...'. The ones who use the first form are not usually reporting that they *thought* that the lines had to start and end on dots. On further questioning they often report that the question of whether or not the lines had to start and end on dots was not one that had occurred to them. This, of course, is highly consistent with our proposal that an assumption is a constraint within which thinking operates, rather than some kind of mental or psychological entity.

Questions about what kinds of things should be treated as psychological entities, and as what kinds of entities, are vital, both for people who operate formally as psychological theorists and for those, such as specialists in the area of clear thinking, who do so informally. Appropriate decisions on these issues determine what kinds of theories make sense, and what things it makes sense to have theories about. Too often psychologists, philosophers, and other specialists allow the vagaries of normal linguistic usage to determine their thinking and theorizing.

Thus many psychologist-years have been spent constructing and testing theories of 'aggression', in the apparent belief that, just because there is a noun, there is something sufficiently in common between its applications for it to be appropriate to theorize about it. This has occurred in spite of the fact that a particular act, for instance, shooting a person, may or may not be called 'aggression', depending on our attitude to it. It has occurred in spite of the fact that it is evident that the word 'aggression' may appropriately be applied to the same act, carried out by two different people, although the psychological genesis of the act may be totally different. Thus it seems obvious that if two men each knock down a little old lady, and take her pocket-book, one because he delights in hurting and humiliating little old ladies, and the other because he wants the contents of the pocket-book, and doesn't care who gets hurt in the process of his obtaining it, no single and simple theory is going to accommodate both incidents. The fact that we call both incidents 'aggression' carries no guarantee that it is appropriate to have a theory of aggression.

Similarly, the fact that we apply the words 'assume', and 'assumption', to a variety of circumstances, all of which relate in some way to ongoing thinking processes, carries no guarantee that it is appropriate to divide up our theoretical world in accordance with those usages. To some, what we are saying here may seem so obvious as to be insulting to their intelligence. But what we observe in the behavior of informal logicians is somewhat parallel to what was going on in our example with the engineers. Even if most informal logicians would, in our terms, 'postulate' the first sentence of this paragraph, most of what they normally say about assumptions – consider, for instance, the quotation from Ennis (1982, p. 64) used earlier in this paper, which begins, "Although I have presented used assumptions as things that people have," – appears to 'assume' the contrary. It is, in fact, hard to find instances of reference to assumptions which do not fulfil this description.

We have suggested that descriptions of used assumptions are best conceptualised, not as referring to some kind of stored engram, but as drawing attention to some limitation or constraint on the way in which the a problem or topic is being considered. We have proposed distinguishing the installation of such a constraint from the enunciation of a proposition essentially descriptive of it (which

we called a 'postulate'), and pointed out that the connection between these is by no means a necessary one.

It may, of course, turn out that this particular model of used assumptions cannot, on broader consideration, be maintained. Further psychological investigation, such as is currently being pursued, particularly by the second author of this paper, may fail to support it. It may be that other concepts strongly associated with assumptions, concepts such as that of belief, and attitude, will prove difficult to integrate into the model. Nevertheless, we strongly suspect that the mode of theorizing that the model represents, fusing, as it does, critical conceptual analysis with the empirical and theoretical techniques of psychology, provides a valuable path for the development of the study of everyday thinking.

Some sort of fusion of psychology with informal logic is, in any case, rendered necessary by the approach to argument analysis taken by many informal logicians and clear thinking specialists. To the extent that Ennis (1982) is correct in asserting that the claim to have identified a used assumption is an empirical "mental-state-or-event claim" he is wrong to go on to offer (p. 67) a series of rule-of-thumb criteria for their identification, based on common sense, intuititive notions about the consistency with which people operate and, (though he specifies it is to be used "only as a last resort") relative simplicity. There may be relatively few propositions that psychologists can justly claim to have established, but one of them is that these kinds of judgement are extraordinarily fallible. Evaluation of the truth or falsity of propositions about what is going on "in peoples' heads" is likely to require the use of a range of psychological research techniques, backed by appropriate and well-informed psychological theory.

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