Underlying Cognitive Processes or Private Social Practices?

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Abstract

This paper presents a critique of cognitive psychology's underlying cognitive process program, as well as suggestions for a more scientifically and pragmatically viable approach. The paper proceeds in the following sequence. First, the mainstream point of view of contemporary cognitive psychology is outlined. Second, its program of searching for nature's "underlying," "unconscious," and in principle unobservable cognitive micro-processes is criticized. Third and finally, cognitive science's neuropsychology program is discussed, not with respect to the considerable value of what it has and may discover in future, but with respect to the interpretation that would appropriately be placed on its findings. Throughout this discussion, an alternative position, namely, that cognitive processes are best viewed as private or mental versions of human social practices, is advanced.

Underlying Cognitive Processes or Private Social Practices? A Critique of Cognitive Psychology's Micro-Process Program

"Both the cognitive and behaviorist perspectives view organisms as machines that respond to environmental input with predictable output... behaviorists view the mind as a black box...the cognitivists have filled the box with software--mental programs that produce output."

--Drew Westen (1999, p. 20)

"Don't say what must be--look and see what is."

--Ludwig Wittgenstein, 1953

The origins of this paper lie in an experience I had some years back. A young cognitive psychologist, highly regarded and the recent graduate of a prestigious university, was applying for a job in the psychology department where I work. The young man, a memory researcher, presented his research on micro-memory processes. In his conclusion, proffered in the spirit of scientific discovery about "how the human mind and human memory work," he posited the existence of underlying, unconscious, unobservable "filing" and "backward search" cognitive micro-processes. On the basis, not of direct observation of such processes, but of reaction time data, he inferred that his subjects must have "filed" in short term memory the items they had memorized, and subsequently "searched" for them in reverse order from that in which they had learned them.

My immediate reaction to this presentation was not in accord with the researcher's own conclusions. At worst, it seemed to me that the young man, not on the basis of observation, but solely on the basis that a certain number of milliseconds had on average elapsed between the presentation of stimuli to subjects and their making of a response, had drawn a highly speculative conclusion about what must have occurred in that time interval. At best, it seemed to me that even if, despite this lack of compelling evidence, he were correct in his surmisals, that what he had done was to take a relatively simple memory task, one amenable to a certain obvious preferred solution, and given this to his subjects. What they had done, in turn, was to employ this obvious solution. He, being a well enculturated individual, had come to his experimental work with a knowledge of the very familiar forms of public human behavior known as "filing" and "searching," realized that his experimental task was amenable to strategies that lent themselves to being described (albeit metaphorically) in these terms, and had baptized them accordingly. However, even if this were an apt analogical description of his subjects' behavior, this did not strike me as being the discovery of anything universal about "how the human mind works," or of "nature's software," or anything of the sort. Rather, it seemed at best to show nothing more than that subjects had employed a sensible and obvious problem solving strategy. They had engaged in certain private, mental, analogical versions of familiar, learned, general

social practices--filing and searching--and had done so with considerable rapidity.

This paper, grounded in an intellectual framework known as Descriptive Psychology (Ossorio, 1966/95, 1978, 1981), will have the following structure. First, I will articulate more formally the mainstream point of view and program of contemporary cognitive psychology regarding underlying cognitive micro-processes. Second, I will critique this point of view. To anticipate, I will argue that the primary problem is with a critical part of what might be termed its "software program"--in particular, its attempt to discover nature's "underlying," "unconscious," and in principle unobservable cognitive micro-processes--as opposed to its "hardware" program that concerns itself with the biological structures, processes, and events involved in various kinds of human mental acts (cf. Ossorio, 1982; Jeffrey, 1998). Third and finally, I shall comment on the latter program, cognitive neuropsychology, not with respect to the considerable value of what it has and may discover in the future, but with respect to the interpretation that would appropriately be placed on its findings.

The Mainstream Cognitive Psychology Point of View

In cognitive psychology's mainstream view, a person, if not literally a computer, is at least analogous to one. A person is an organic, information-processing machine that paradigmatically takes in sensory stimuli (input), performs operations on this input (processing), and behaves in various ways (output) on the basis of this processing. The processing may occur via a central, serial symbol crunching program, a more parallel processing, connectionist one, or some combination of these (Clark, 2001; Johnson-Laird, 1988, Barsalou,1992). (NB: When it is said that the new metaphor for cognitive psychology is the brain and not the computer, the only apparent difference seems to be that the preferred form of program is connectionist; for all that, it is still very much a program.) To relate this to concrete human affairs, consider the following hypothetical situations:

1.Teacher: "Johnny, take the square root of 16, add 6, and divide by 2." Johnny pauses reflectively for a moment, then says: "5."

2. Game show host: "The fourth planet from the sun; from its name, you might think it was made of candy." Contestant: "What is Mars?"

3. Politician, in a speech to his supporters: "It is said that if you have politics in your blood, the only thing that can ever replace it is formaldehyde."

Audience: laughs.

4. Baseball game; team at bat has a runner on first base with no outs.

Manager: signals the batter to bunt.

In the mainstream cognitive view, when one considers everyday phenomena such as these, it is abundantly clear that, if one were unable to understand the nature of what occurred in the cognitive processing of these four individuals, one simply could not understand how, given the stimulus inputs, their respective behavioral outputs could have come about. One could not understand, for example, how one could conceivably get from the stimulus situation of the baseball manager observing a runner on first with no outs, to his or her behavioral response of signalling the batter to bunt. One could no more understand it than one could the relation between the input and output of a computer if one regarded it only as a "black box," as the now largely discredited and abandoned radical behaviorist program attempted to do.

The first task of cognitive psychology, then, is in essence the old one of discovering "how the mind works," conceived here as discovering the underlying mental processes behind such phenomena as remembering, reasoning, recognizing, and so forth. It is the task of discovering the "software"--the underlying mental algorithms or "programs," be they serial or parallel in nature, that explain the relationship between input (e.g.,

"Was item X on that list you memorized?) and output ("Yes, it was."). Since much of this processing is extremely rapid, automatic, and unobservable to either the cognizing individual or to the scientist, the method for answering these questions cannot be via the old and largely discredited method of introspection, but must be *inferential* in nature. This method is *experimental* and consists essentially in designing experiments where subjects are given certain inputs, mentally process these inputs in some way, and yield outputs. From the data so obtained, which is frequently average response times, the underlying nature of the mental program that produced the observed outcomes from the observed inputs may be inferred. The situation confronted by the cognitive psychologist, then, is highly analogous to what one would confront if one had to explain the inner workings of a computer or a robot--the algorithms contained in its software--but could not look inside the computer at the software itself, and so was forced to infer what was in there from the observed relations between observed input and observed output.

A second, highly related critical task of the broad field of cognitive science is that of understanding the "hardware." The task here is the neuroscientific one of determining the neurophysiological structures and processes involved when a person implements a cognitive task such as reasoning, remembering, or calculating. Such cognitive activities are believed to *supervene* on the physiological events (Kim, 1993). That is to say, the cognitive activity in question could not occur if the relevant neural events could not occur, and could not be the same as they are if those underlying events were different ones. Thus, for example, I would be unable to remember my automobile accident if the brain states necessary to do so had been prevented or impaired by the blow to my head sustained in the accident.

A Critique of the Underlying Micro Process Program

Let us begin here with our own hypothetical, one that for the moment we shall let stand proxy for a vast range of human cognitive phenomena. The example involves empirical phenomena that human beings can indubitably and even trivially accomplish. A high school mathemat-

ics teacher says to her class: "I want you all to square the number 25 in your head." She pauses a moment, then says, "Okay, who got 625 as your result?" Most of the class raise their hands. The teacher then says, "Someone tell me how you did it." Johnny: "Well, I multiplied 25 times 10, then doubled that to get 500. Then I multiplied 25 times 5 to get 125, added this to the 500, and got 625." Teacher: "Very good, Johnny, did anyone do it a different way?" Suzie: "Yes teacher, I used a shortcut where you take the first number, 2, square it, and then add it to itself to get 6, then tack on 25 to the end--625!" Teacher: "Very good, Suzie, did anyone do it yet a different way?" Joey: "Yeah, well, I thought of it as 25 x 5 x 5, so I multiplied 25 times 5, got 125, then multiplied that by 5, and got 625."

What these students describe can certainly be described as "cognitive processing." Each of them took the teacher's "input," performed operations on it, and on the basis of these operations generated "output." What can we say about the nature of these operations? What sort of account do the students give? Well, in effect, each is saying: "I engaged in a private version of a widely recognized shared social practice--doing mathematics--a social practice whose many logics and algorithms I learned in school. Everything that I did in solving this problem was a case of engaging in this practice--adding, multiplying, etc. So, at the end of the day, you could fairly say that *I was engaging in a private--'mental' if you will--version of a social practice*" (see Ossorio, 1978, for a thorough technical explication of the use or process descriptions for representing social practices in a scientifically useful way).

What else can we fairly say?

1. These explanations work very well. Each does quite a good job of describing how these students, given the teacher's "stimulus input," "processed" this input to bring about their respective correct "outputs."

2. The accounts are light years beyond the current state of the art micro-processes promulgated by cognitive psychology, all of which are putative underlying processes suitable for handling the likes of subjects who memorize 5 or 6 numbers and then have to identify "probe" items

as either present or absent from the memorized list--processes like "scanning," "searching" "filing", "retrieving," "storing," "encoding," "decoding," "spreading activation," and the like (cf. Jeffrey, 1998). None of these begins to approach a level of handling complexity that the simple explanations given above do.

3. The processes described here, far from being underlying, unconscious, unobservable, mysteries of nature, are already well understood (Jeffrey, 1998). We know a lot about them. Indeed, mathematics instructors in the students' school likely taught them the relevant algorithms. There is no presumptive reason to think that, when one discerns them, one has discovered something like "the architecture of the human mind" or "naturally occurring, underlying human cognitive algorithms" in the same way that, say, Darwin or Newton discovered something about the workings of the natural order.

4. In our hypothetical, we are able to *observe*. We do not need to infer the existence of something ineluctably hidden from view, much less speculate about what might have happened in the differential response times exhibited by Joey as opposed to Suzie.

5. The example illustrates a simple, easily observable fact. Many cognitive tasks are amenable to *multiple algorithms*. Clearly we see this all the time in everyday life. How can one get crosstown to store X? How can one capture the opponent's queen? How can the politiciancommunicate his or her desired message while skillfully evading the hostile implications of the reporter's question? Many different algorithms--many different "softwares"--will do the job.

6. Finally, building upon the previous point, it may be noted that, where uniformities of result are found (and here we shall give the benefit of the doubt to the proposition that data such as *average* response times can in fact yield such uniformities), these could easily be attributed to the creation of tasks that lend themselves readily to a single strategy. For example, a famous result indicates that, when subjects memorize a short list of very simple items such as 5 numbers, and are asked soon thereafter if a certain item was or was not on this list, they uniformly seem to

scan all of the items and not merely to scan until they reach the probe item (Sternberg, 1966). But, for example, suppose subjects were told to recite the prime numbers in order from small to large, or to determine the number of games in a single elimination athletic tournament involving 16 teams. It is likely that virtually all subjects would utilize the same relatively obvious strategies. But this would tell us nothing whatsoever about a uniformity in "nature's software."

Objection 1: This is Introspection and Folk Psychology, not Science

The objection. It may be objected that all of the considerations in the previous section amount to a collection of armchair arguments, folk psychological points, and introspective reports. Certainly, they do not document findings from carefully undertaken experimental studies. As such, they are not science, and indeed one might even contend that they are scientifically objectionable.

Reply. This objection amounts essentially to an argument from source, an argument of the form: "because it came from source X, it has no scientific legitimacy." But surely, source is irrelevant insofar as the *origin of scientific ideas* is considered. Kekule famously got his successful hypothesis for the structure of benzene from a dream. Einstein got many ideas from thought experiments about the implications of even highly fanciful events such as leaving earth riding a beam of light. Newton conjured up an ideal event, one that could never happen in the universe--an object moving indefinitely at constant velocity in a Euclidean straight line in a frictionless universe--and used this as an "ideal of natural order" (Toulmin, 1963), exceptions from which could be used to explain the motions of all actual physical objects.

Now of course it might be objected against this that Kekule, Einstein, and Newton subsequently had their ideas subjected to empirical test via scientific methods, and that I have not done so here. This is true (though only in a certain peculiar sense in Newton's case--see Toulmin, 1963). However, it must be asked in the present case why we would

conduct such tests since there seems nothing to be proved here. Could we reasonably doubt (a) that many persons can perform these and countless other mathematical operations mentally, (b) that the students' explanations work, (c) that their respective algorithms yield correct answers in the present instance, (d) that these algorithms are learned ones and not naturally occurring processes like, for example, a digestive or a circulatory process, or (e) that there is in fact more than one algorithm that solves this, as well as countless other human problems? Could one seriously undertake an experiment to verify any of these propositions? To do so would seem to border on the fatuous.

Moving from our specific hypothetical situation to a more general and actual level, it is instructive to consider how most expert systems programs are currently constructed (Jeffrey, 1998). In their construction, the experts--the oncologists, stock pickers, engineers, and so forth--are first asked how they make their respective judgments. These persons essentially lay out the logic of their thinking, *not in terms of putative micro-processes* such as "serial scanning" or "spreading activation," but in terms of the actual molar discriminations made and conclusions drawn ("this is what I look for to determine if a cancerous process exists..."). The attempt is then made to capture this molar logic in the form of a program for use by others. In other words, the attempt is made *to replicate the social practices*--the teachable, learnable, doable, observable activities--of medical diagnosis, of stock selection, or bridge construction (etc.) as implemented by an expert in that field (see, e.g., Jeffrey & Putman, 1983). While one might argue that this is technology, not science, and so cannot serve to make a scientific point, it is suggestive to note the indubitable truth that no expert system could conceivably be constructed from the hypothetical, unobservable micro-processes of contemporary cognitive psychology that could compete in predictive power with those designed in the present, far more social practice oriented, manner.

By way of final reply to the objection that this is not science, it may be reiterated that, however one might care to classify them (e.g., as "folk psychology" or "everyday, garden variety mathematical problem solving"), the students' explanations of their behavioral output work very well.

They provide successful accounts of how, given the teacher's input, they performed operations on this input and achieved correct answers. Since our standard scientific assumption is that, if any theory or explanation A is to supplant an existing one, B, theory A must meet the simple requirement that it *offers a better account of the empirical phenomena at issue* (Kuhn, 1970; Searle, 1984; Toulmin, 1963). To date, there is nothing in the cognitive micro-process literature that even approaches the adequacy of the students' explanations (cf., Clark [2001] and Fodor [1987] on the very considerable and currently unsurpassed predictive power of "folk psychology").

Objection 2: Cognitive Processes are Often Unobservable

The objection. Even if it be granted, in the hypothetical case of the mathematics students, that introspective reports were given that proved valid, clearly in countless other cases this is not and cannot be the case. It seems the rule and not the exception that people do not and cannot report how they process input to produce output. They cannot explain why they said "she performed well" rather than "she performed good," how precisely they "got" the speaker's joke, or how they remembered that the Maid of Orleans was Joan of Arc. They can only say, in the face of such achievements, that "I just did it...just remembered it...just understood it; I don't know how ." We can only conclude from such facts that many cognitive processes are unconscious, therefore unobservable, and therefore discoverable only through inferential procedures, preferably those associated with the scientific method.

Reply. First of all, we might note that the widely acknowledged unobservability of these putative cognitive processes constitutes a distinct scientific *disadvantage* for the mainstream underlying cognitive process program. That said, it is true that there are many human accomplishments where the most that persons can say is, "I don't know *how* I do (or remember or understand) that--I just do it." Some of these are cognitive and some not (e.g., few persons could report how they stand up from a seated position). It is further true that, while introspection might have

provided valid explanations in our hypothetical case, it cannot work in the cases just cited and in countless others, since nothing is in fact observed in such cases that could be reported.

However, while our hypothetical involved three students giving introspective reports (and we have already commented on this as a potentially valid source of information), *our point here was never one about the introspective method*. We freely grant that it may sometimes, as in the case of our three students, prove a source of valid description and explanation, and at other times prove not a possible source at all.

Our central point, rather, is one mentioned previously: what are termed "cognitive processes" are far more profitably viewed simply as *engagement in versions of social practices*. By way of a further example of this, consider the case cited of someone saying, in the context of an ongoing stream of conversation, that another person "performed *well."* Likely, the speaker never had any conscious thought about selecting this word. So here, one might conclude, we are left with two choices as explainers of this utterance.

First, we might adopt the mainstream underlying cognitive process point of view. Its claim at this historical juncture would have to be an IOU to the effect that there are underlying, unconscious cognitive micro-processes at work here, which must, given the current state of our scientific knowledge, be the subject of future scientific inquiry. These processes, given their in principle unobservability, can only be inferred, and inferred on the basis of theorizing about what must have happened during extremely brief intervals of time.

Our second option, which is not an IOU, is to take the following position. There is a long-established core human activity, namely speaking a language, that is an inextricable part of a vast range of human social practices such as negotiating differences, writing letters, giving speeches, telling jokes, and indeed, doing science. This activity, verbal behavior, is governed by syntactical, grammatical, and usage rules. Competent, well-schooled, socialized users of a language, through long practice and use, are extraordinarily adept at following these rules with great automacity and

rapidity. In the English language, one of these rules is that one ought to modify a verb with an adverb and not with an adjective. The reason our speaker said "well" was that she, possessing knowledge of this rule and the ability to follow it, simply did so. Indeed, linguistically competent persons are clearly and obviously capable of uttering long strings of words, in some cases for hours on end, very rapidly and with great correctness. That is a satisfactory, successful, and wholly non-mysterious account of why she said "well" (Ossorio, 1982; Jeffrey, 1998).

What of the example of someone "getting" a joke? Above, an example was described wherein a politician told the joke that "It has been said that, if you have politics in your blood, the only thing that can ever replace it is formaldehyde." This example documents an actual incident, one in which the joke was told at a political rally and was met with immediate and widespread laughter from the audience. Again, we can issue an IOU to the effect that cognitive psychology will one day provide a correct analyis of what must be the underlying, unconscious, unobservable "mindware" (Clark, 2001) processes involved in getting this joke and subsequently laughing. Or we can say, per Littmann's (1983) analysis and empirical study of the social practice of telling jokes, that what is involved in humor is a juxtaposition of a serious frame for something and a nonserious one, the appreciation of which is what allows a person to understand or "get" a joke. Here, the serious frame, "here is the only way, if you are caught up in politics, to rid yourself of this obsession," is suddenly juxtaposed with the nonserious one--you have to die! A further competence in this case would be that of understanding a metaphorical use of language--that "in the blood" stands as metaphor for an intense preoccupation. Again, the burden of proof is on the cognitive scientist to come up with a better explanation than this.

Examples could be multiplied ad infinitum. Our basic point, however, is that persons involved in cognitive activity may most profitably and intelligibly be understood as engaging in private versions of what are paradigmatically learned, public social practices, and as employing the countless well known rules, algorithms, customs, and so forth embodied in the different versions of these social practices.

Objection 3: But You Still Haven't Shown <u>How</u> We Can Do This!

The objection. The author of this paper contends that people are competent to do such things as utilize mathematical and grammatical rules, employ and understand humor, reply tactfully to other persons' queries, and so on. In general, they are able to exhibit rather complex and molar behavioral phenomena rather skillfully, rapidly, and often automatically. And the claim is that they are able to do so because, through their socialization, they have acquired an understanding of, and an ability to participate in, these social practices. Well, granted that observationally people are able to do so, but what the author has not really addressed is the question of *how* they do so -- of how this is possible? Both we mainstream cognitive theorists and the author grant that biological events transpire in the case of all human actions. We are not at odds here. But, on his description, it is as if persons, because they have been socialized in a culture, have gone to school, have learned a language, and so forth, can somehow produce these amazingly complex feats without benefit of some more microscopic cognitive processes. It is as if the computer could square the 7 digit number without first engaging in the micro-level, Turing-computable operations specified in its software--converting Arabic numbers to 1s and 0s, implementing a step-by-step algorithm for the operation "multiply," and so forth. It is these sorts of micro processes that we as cognitive psychologists are trying to discover at the present, admittedly early, historical point in our science. What you suggest, however, would seem to border on the magical--"Voila! The 7 digit number has been squared. Joan of Arc has been identified as the 'Maid of Orleans.' The joke has been gotten. No further questions please."

Reply. While this may have seemed the present position, it is not in fact so. Again, let us return to our example of the students squaring 25. Each of these students, in outlining his or her solution strategy, specified a series of simple steps. For example, Suzie stated that she first separated out the 2, then squared it, then added it to itself, then tacked 25 onto the result. Her final answer, though the whole episode may have taken but a few seconds, was the result of a series of "micro" steps, and could not

have taken the form that it did had any of these been different. It is true, however, that these simple achievements were not analyzed into more molecular cognitive processes. Per Wittgenstein (1953), explanation (or description) must come to an end somewhere, and in the present analysis it comes to an end with these simple *achievements*, and not with any *processes* that might be decomposed further into subprocesses (cf. Ossorio,1982b; Jeffrey, 1998). When Suzie or I "just know" that 2 x 2 = 4, that 4 + 2 = 6, and so forth, no process is observed, but only what could be called an "event" that is also in this case an "achievement" (e.g., I recognize that the answer is 4). Similarly, in our case of the person getting the political joke, clearly the observed result, that of understanding the joke and laughing, could not have occurred in any given instance if, along the way in the telling of the joke, a listener did not recognize that "in the blood" is a metaphor for obsession, that formaldehyde is what undertakers use to preserve cadavers, and so forth.

Thus, there is no denial in the present position of more simple achievements, and certainly no claim that a human being could do anything comparable to squaring a 7 digit number without benefit of mental achievements and acts of a simpler nature. The complex includes, requires, and may be decomposed into the simple, although when one stops to observe what actually happens, the speed with which the complex is achieved by humans can seem stunning indeed. This is true both for normal persons composing sentences or getting a joke, or for geniuses and idiot savants capable of solving complex mathematical problems in mere seconds.

At this point, then, what divides the present, Descriptive Psychologically based, social practice position from the mainstream underlying process approach? Both camps acknowledge that biological states of affairs must obtain for any person to do these things (Ossorio, 1982a), and both agree that complex human mental acts may be decomposed into simpler mental accomplishments (Jeffrey, 1998). The issue becomes one, then, of where one is to draw the line; i.e., of what are to be the ultimate "simples" or "logical atoms" here. On the present view, it is those cases in which the person might be said to "simply know or remember or understand"--

where the person knows "right off" what his name is, that 2 + 2 = 4, that he should say "well" rather than "good," or that the word printed on the page is "butter." Where cognitive psychology would go further and ask, "what underlying processes must be involved in his remembering or knowing or recognizing such things?", we are inclined to stop here at this level of simple achievement (Ossorio,1982b; Jeffrey, 1998). The whole project of trying, on the basis often of no more than what might have happened in the milliseconds between input and output, to claim that an inherently unobservable, unconscious encoding or scanning or spreading activation process must have occurred, and that that process must be a unique, universal one illuminating "how the human mind works," seems to yield little of value. It seems only to be taking what are demonstrably *achievements* (the subject remembered X or recognized Y or calculated Z) and trying to make them into *processes* (Jeffrey, 1998). It seems only to be saying, "We suspect, but cannot observe or demonstrate, that even finer grain mental processes are really happening deep down behind these basic achievements." It seems only an exercise consisting in positing things we already know people do in appropriate circumstances--search and scan and file--to exist in analogical micro-versions occurring at an unobservable level. Is anything gained from such speculation? Anything universal? Anything about "how nature works" or "how the mind works?" Anything that can be used in expert systems or in educational, therapeutic, or other applications (Jeffrey, 1998)? If we accept cognitive psychology's ultimate "atoms," the underlying micro-processes, must we then decompose these into "quarks," and if so, where ought we to stop if we are to avoid infinite regress?

Objection 4: Only Micro-processes Can Link Biology and Cognition

Pursuing the previous objection further. In the objection stated in the previous section, the example of Turing-computable processes was mentioned. In the functioning of a computer, one of the things such processes accomplish is the linking of software and hardware operations. One might say (albeit arguably) that the "mind-body" connection--the

"missing link" between mind and body in the case of computers--is established here in intelligible form. The Arabic number problem "4 + 11 = ?" is entered into the computer, the software then directs physical operations wherein these Arabic numbers are converted to 1's and 0's (or "ons" and "offs"), an algorithm for the operation "add" is implemented, the result is converted back to an Arabic number, and this number is displayed as output. The dream of many cognitive scientists (see, for example, Clark, 2001) is to someday possess a comparable understanding of human brain-behavior relations: What precisely and in detail happened in Suzie's brain when she was given that mathematical input--what biological and algorithmic software operations--to permit her to come up with her output? This dream seems to beg for further, very fine grain descriptions of cognitive micro-processes, analogous to those in Turing computable programs, than the author of this paper allows.

Reply. While this objection might be considered from a number of vantage points (see, eg., Ossorio, 1982a), I shall consider it here within the traditional scientific outlook in which it is conceived. Looked at from this vantage point, and going back again to the previous objection, it can indeed seem magical to say that, "Well, of course, biological events transpired in Suzie when she added 2 plus 2 to get 4, and she 'just knew' that that was the answer, but there is nothing of value to say about what occurred at a more molecular cognitive level *to link* the biological and psychological levels." Here is where "brain meets mind," where we go from propositions like "brain processes X, Y, and Z occurred in Suzie" to ones like "Suzie mentally calculated the correct answer." And, despite centuries of difficulty, we are inclined to say that surely modern science can and will tell us more about this mind-body connection business.

However, at the present historical juncture, science has *not* answered this question; it remains a mystery (Chalmers, 1996; Clark, 2001; McGinn, 1999, 2003). Virtually everyone agrees that, in the totality of any given cognitive event, events of a "brain sort" occur--synaptic transmissions, action potentials, and the like. And virtually everyone agrees that events of a "mental sort" occur--Suzie calculates the answer "in her head" and the like. And, we know more and more about what physiological processes

empirically co-occur with cognitive activities, with raw feels, and with consciousness itself (Clark, 2001). However, to date, no one has jumped what Levine (1983) has termed the "explanatory gap" here--no one has solved the perennial problem of the mind-body relationship (Chalmers, 1996; Clark, 2001; McGinn, 1999, 2003). No one has successfully described a sequence analogous to the Turing computation one above wherein all of the hardware and software operations from input to output are seamlessly specified and linked.

That said, perhaps the first thing to note is that the cognitive psychologist who utters propositions like, "the subject, faced with the probe, reviewed all the memorized items," is surely no closer to linking the biological with the cognitive than one who says "Suzie just knew that 2+2 equals 4." Involved in the first utterance, by inference, are implications like "the subject *just knew* that the second item on the memorized list was 23." The gap remains.

The term we have for such gaps is "strong emergence" That is to say, we have a situation in which, when matter or energy become configured in certain ways, new properties emerge that are not explicable in terms of the individual elements comprising the totality (Broad, 1925; Kim, 1999; Teller, 1992). Emergent phenomena, far from being rare, are encountered all over nature and all over science. Quarks and atoms do not possess properties such as life, self-replication, consciousness, emotionality, motivation, understanding, belief, or memory. But, when when trillions of them become configured in certain ways--as amoebas or frogs or homo sapiens--such properties are exhibited by the individuals so configured (McGinn, 1999). And while from time to time reductive explanations prove fruitful (Searle, 1984), the overwhelmingly common state of affairs is that we are left in such circumstances to say, "that's just how things are; when matter becomes configured this way, you get these properties; *why or how* you get them we do not know (Chalmers, 1996; Clark, 2001).

It is no different in the present instance. And, since we have an explanatory impasse for both the believers in cognitive micro-processes

and for those who would work at the level of social practices, the choice would seem to come down to what on *other scientific grounds* proves superior. And that, for reasons I believe I have already demonstrated, is the social practice point of view. That is to say, observable, intelligible, rule-governed, well-understood human behavioral patterns such as those involved in solving mathematical or logic problems, playing chess, or uttering grammatically and semantically correct sentences are to be preferred scientifically to inherently unobservable, unconscious, inferred, and often metaphorically labelled micro-processes. Finally, while space does not permit discussion of the matter here, Jeffrey (1998) has argued convincingly that, on *pragmatic grounds,* the social practice approach to human cognitive possesses distinct advantages over the mainstream view in applied enterprises such as expert systems design, education, and the remediation of cognitive deficits suffered by individuals.

A Note on the Cognitive Neuroscience Project

On the present view, as well as on the mainstream cognitive science view, there is a basic assumption that the mental supervenes on the physical. That is to say, for any given cognitive activity such as squaring numbers in one's head, having a daydream, or obsessing about being contaminated by germs, the activity in question could not occur if the relevant neurophysiological events could not occur, and could not have been precisely the same had those events been different (Kim, 1993). At present, a large body of scientific evidence supports the contentions (a) that damage or alterations to certain brain sites results in impairments in certain types of cognitive functions such as memorial and computational ones (Bickle & Mandik, 2002), and (b) that different mental activities are accompanied by activities in different parts of the brain (Bechtel & Mundale, 1999; Bickle & Mandik, 2002). Thus, both for reasons pertaining to the pure scientific understanding of that part of nature which is the brain, and for those pertaining to the finding of cures for diseases such as Alzheimers, Parkinsons, and many more, the cognitive neuroscience project is of the utmost value.

That said, on the current view, it is critical that the findings of cogni-

tive neuroscience be *understood in a certain way*...namely, that biological events are related to cognitive ones, not as "the correct scientific account of what is *really* happening when persons cognize," but as *part to whole*. While comprehensive argumentation to this effect is beyond the scope of this chapter (but see Ossorio, 1978, 1982a; Bergner, 2005), a few brief reminders are in order.

It was stated above that the mental supervenes on the physical. What is equally true is that the physical supervenes on the mental. That is to say, going back to our young students squaring 25, if it were not the case that Suzie squared 25--had she instead looked out the window and daydreamed when her teacher gave the problem--it would not be the case that the same processes occurred in her brain (Bechtel & Mundale, 1999; Bickle & Mandik, 2002). Further, looking more extensively into what is involved Suzie's behavior, had there not been an existing human social practice known as mathematics, and within it such elements as whole numbers and such operations as adding and multiplying, and if Suzie had not possessed the requisite knowledge and competency in these matters, it also could not have been the case that said brain processes would have occurred. Now, realities such as mathematics and Suzie's knowledge and competence are not themselves physical realities. Unlike stones and chairs and billiard balls, they do not meet the criteria or "assertability conditions" (Kripke, 1982) for physical realities such as the possession of properties like mass, spatial location, length, width, height, velocity, charge, and so forth (Bergner, 2005). Notwithstanding, we would be loathe to say of any ot them that they are fictional, illusory, imaginary, or in any other sense *unreal*. Finally, operations such as squaring 25 are multiply realizable on countless physical systems and via many algorithms and so cannot be identified with any single physical pattern of happenings. Any behavior--here, Suzie's squaring of 25--is a complex state of affairs encompassing many constitutive states of affairs, only some of which are physical states of affairs: persons making discriminations, attempting to bring about some outcome, utilizing certain competencies, bringing various physical states of affairs into play (from molar ones such as arm motions to molecular ones such as synaptic events), and more (Ossorio,

1981; 1982a; 1995). Understood top down, we observe this totality, we observe the various elements comprising it, and we understand that all sorts of relations such as supervenience may obtain between these elements. And, given such facts as multiple realizability and the nonphysical character of most of them, we realize that we cannot reduce the mental aspects to the physical ones, but must conclude that the physiological is but one aspect of behavior. It is related to behavior, not as "what's actually happening," but as part to whole (for extensive argumentation to this effect, see Ossorio, 1978; and Bergner, 2005).

Conclusion

In this paper, a point of view has been presented which maintains that cognitive processes are best viewed as private or mental versions of human social practices. When Suzie calculates a product, or Johnny utters a grammatically correct sentence, or Mary decides her next chess move, or Peter concludes that his child should be sent to his room, all are engaging in some version of some stage in the enactment of some social practice. The advantages, both scientifically and pragmatically, in understanding cognitive processes in this way are that such practices are observable, are well understood, and tap into a vast background of knowledge concerning intelligible human behavioral patterns. As such, they are to be preferred to inferred, inherently unobservable, unconscious, and often metaphorical micro-processes whose very existence rests on weak evidential grounds.

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