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On the Epistemology and Psychology of Speech Comprehension[1]

Abstract: How do we know what other speakers say? Perhaps the most natural view is that we hear a speaker's utterance and *infer* what was said, drawing on our competence in the syntax and semantics of the language. An alternative view that has emerged in the literature is that native speakers have a non-inferential capacity to *perceive* the content of speech. Call this the perceptual view. The disagreement here is best understood as an epistemological one about whether our knowledge of what speakers say is epistemically mediated by our linguistic competence. The present paper takes up the question of how we should go about settling this issue. Arguments for the perceptual view generally appeal to the phenomenology of speech comprehension. The present paper develops a line of argument for the perceptual view that draws on evidence from empirical psychology. The evidence suggests that a speaker's core syntactic and semantic competence is typically deployed sub-personally (e.g., by something like a module). The point is not just that the competence is tacit or unconscious, but that the person is not the locus of the competence. I argue that standing competence can enter into the grounds for knowledge only if it is subject to a certain sort of epistemic assessment, an assessment that is appropriate only if the person is the locus of that competence. If the person is not the locus of a speaker's core linguistic competence, as the psychological evidence suggests, then that competence does not enter into the grounds for our knowledge of what speakers say. If this line of argument is right, it has implications for the epistemology of perception and for our understanding of how empirical psychology bears on epistemology generally.

How do we know what other speakers say? That is, how do we come to know the content of another speaker's utterance? Here's one very natural answer. We hear the utterance and infer the content of the utterance from background knowledge (possibly tacit) of the syntax and semantics of the language and the context of utterance. We hear the utterance, but must *infer* its content. Call this the ***inferential view*** of speech comprehension. Another answer that has recently emerged in the literature is that, as native (or comparably fluent) speakers of a language, we have the capacity simply to *hear* what speakers say.[2] Our auditory experience of speech typically comes to us already interpreted, providing us with *non-inferential* access to the content of speech. Call this the ***perceptual view*** of speech comprehension.

This issue about our epistemic access to the content of speech echoes a familiar epistemological issue about perception itself, specifically about whether the access perception provides us to the world is in some sense direct. Sense-data theorists maintain that we have direct epistemic access only to our own sense data (entities internal to the mind). Our epistemic access to things outside the mind is indirect, epistemically mediated by acquaintance with sense data. By contrast, proponents of the direct-perception theory argue that perception provides us with direct epistemic access to the external world, access not epistemically mediated by sense data (or other such mind-internal entities). The issue about speech comprehension is analogous. On the inferential view, our epistemic access to the content of speech is indirect, the product of an inference from background knowledge of the syntax and semantics of the language. The perceptual view of speech comprehension has it that, as native speakers, speech comprehension provides us with the same direct access to the content of speech that, according to the direct-perception theorist, perception provides us to the external world. We can think of the perceptual view as extending the direct-perception theory to speech comprehension.

In denying that our access to the content of speech is inferential, the proponent of the perceptual view is not denying that our knowl-

edge of what speakers say derives from a complex psychological process that draws upon our competence in the syntax and semantics of the language. The point is that this psychological process should not be understood to be inferential. Similarly, a charitable understanding of the inferential view does not require us to suppose that speech comprehension involves explicit reasoning about the syntax and semantics of the language. Clearly speech comprehension typically does not involve making *overt* syntactic and semantic inferences. Charitably understood, both sides agree that our competence in the language plays *some* role in our ability to know what other speakers say, but typically not a conscious one. What then is at issue?

What I want to suggest is that an important point of disagreement concerns the epistemology, specifically the epistemic role linguistic competence plays in speech comprehension. We can understand the inferential view to hold that our standing competence *epistemically mediates* our access to the content of speech by entering into the grounds for the knowledge of what speakers say. On this view, our knowledge of what speakers say rests on certain assumptions about the syntax and semantics of the language. It is in this sense that speech comprehension is inferential. The perceptual view rejects this epistemological picture. The proponent of the perceptual view can concede that our standing competence plays an obvious psychological role in the comprehension of speech, but denies that it epistemically mediates our access to the content of speech. On this view, our linguistic competence does not enter into the grounds for our knowledge of what speakers say.

Whether we should think of our linguistic competence as epistemically mediating our access to the content of speech turns on the view we take about the epistemic status of that competence. There is a familiar issue in the literature about whether linguistic competence constitutes some kind of knowledge.[3] Knowledge enters into the acquisition of other knowledge by supplying *grounds* for belief. So if linguistic competence is that kind of knowledge, then the inferential view would be the right view of the epistemology. Yet the proponent of the inferential view is not committed to the idea that linguistic competence is knowledge. A proponent of the view might think that linguistic competence enters into the acquisition of knowledge in a knowledge-like way, and yet think that (for one reason or another) it does not

itself constitute knowledge. All the inferential view is committed to is the idea that linguistic competence has the same *epistemic status* as knowledge (whether it counts as knowledge or not). On the perceptual view, it does not have this status. Linguistic competence plays a merely psychological role in speech comprehension, but does not enter into the grounds for the resulting knowledge of what speakers say. So, for present purposes, we can set aside the question of whether linguistic competence *is* knowledge and concern ourselves with the narrower question whether it has the *same epistemic status as* knowledge, entering into the acquisition of knowledge by supplying grounds for belief.

Thus understood, the dispute between the inferential view and the perceptual view is an epistemological one concerning both the epistemic status of linguistic competence and the epistemic role it plays in speech comprehension. The present paper aims to confront a prior methodological question: what kind of evidence would settle the matter? Fricker (2003) has argued for a version of the perceptual view on phenomenological grounds, appealing to the phenomenal character of speech comprehension. The phenomenology is supposed to bear on the epistemology, because—according to Fricker—the epistemology is grounded in the phenomenology. Fricker argues that it is the phenomenology that supplies the grounds for our beliefs about what speakers say. The grounds for our beliefs about what speakers say derive from what they *seem* to say—how things phenomenally appear to us. Yet, while I think Fricker is right to suppose that speech comprehension is perceptual in character and that this provides some evidence for the perceptual view, I will argue that it does not bear directly on the epistemology in the way she suggests.

Instead, I will develop a very different sort of case for the perceptual view, one that draws on evidence from empirical psychology. There are striking empirical parallels between the psychology of speech comprehension and that of "high-level" perceptual capacities like face recognition. Specifically, there are striking parallels in the way these capacities can be impaired neurologically. This seems to provide evidence in favor of the perceptual view. The problem is that it is not obvious how such psychological evidence is of relevance to the epistemology. Indeed, it might seem that it couldn't be relevant, since epistemology is widely understood to be normative. Drawing epistemological conclu-

sions about speech comprehension from psychological premises would seem to commit a version of the naturalistic fallacy. The central philosophical aim of the present paper is to argue that indeed the right view of the epistemology of speech comprehension turns crucially on empirical issues about the psychology.

The discussion will begin by attempting to locate the inferential view—the epistemological version I have characterized above—within the philosophical literature. This will serve to make it clearer what my philosophical target is and what is at stake between the inferential and perceptual views. We will then consider Fricker's phenomenological argument for the perceptual view, then turn to my concerns about Fricker's attempt to ground the epistemology of speech comprehension in the phenomenology. We will then examine the neuropsychological parallels between speech comprehension and perception that seem to support the perceptual view. Finally, we will consider how such psychological evidence is supposed to bear on the epistemology. The account of this will be of broad philosophical import insofar as it suggests how empirical psychology is relevant to epistemology more generally.

1.

We began with the issue of how we know what other speakers say, an issue about the epistemology of speech comprehension. This issue, while interesting, does not stand out as particularly important in its own right. Our knowledge of what other speakers say is a relatively small part of what we know about the world. Yet the issue of how we know what other speakers say takes on much greater importance by virtue of being bound up with the issue of how we know that what other speakers say *is true*. In other words, the epistemology of speech comprehension is intimately bound up with the epistemology of testimony. The latter is of considerable importance, since a good deal of what we know about the world we know from the testimony of others.

The connection to the epistemology of testimony has to do with the question raised about the epistemic status of linguistic competence. Our linguistic competence plays a role both in our coming to know what speakers say and in our coming to know that what they say is true. The question is whether that competence enters into the grounds

for the knowledge thus acquired. The answer to this question bears on *both* the epistemology of speech comprehension and the epistemology of testimony. If our linguistic competence has the same epistemic status as knowledge, thereby entering into the grounds for our knowledge of what speakers say, then the same should go for the knowledge we acquire from testimony. Whatever role linguistic competence plays, it should play the same role in both cases. So learning something about the role linguistic competence plays in speech comprehension tells us something about its role in the epistemology of testimony. Focusing on speech comprehension has the advantage of keeping at bay a whole range of issues about the reliability of sources of testimony, allowing us to focus on the epistemic status of linguistic competence. The connection to the epistemology of testimony is mentioned here just to highlight the far reaching importance of this issue.[4]

The inferential view, as I have characterized it, treats a speaker's competence in the syntax and semantics of a language as having the same epistemic status as knowledge, entering into the acquisition of knowledge by supplying grounds for belief. Thus understood it would be natural to attribute the inferential view to those who hold that linguistic competence is some kind of knowledge. This view has been defended, in one form or another, by a diverse group that includes Dummett (1978), Evans (1981), Davies (1989), Matthews (2006) & 2003), Higginbotham (1992), and Chomsky (1984). There would appear to be no better candidate for someone who thinks linguistic competence has the same epistemic status as knowledge than those who think that it *is* knowledge.

Yet, perhaps somewhat surprisingly, epistemological issues have not been a prominent concern in this literature. The central concern is with the foundations of linguistic theory. It is thought that, if we could credit competent speakers with knowing a grammar or meaning theory for their language—if linguistic theory can be construed as something competent speakers know—this would put substantive constraints on linguistic theory. For example, since the minds of speakers are finite, crediting competent speakers with knowing a meaning theory seems to require that such theories be finitely axiomatizable. Notice, however, that this does not seem to require that we take competent speakers to know the theory in any epistemically robust sense. Heck (2006) sug-

gests that it suffices to credit speakers with tacitly *believing* a meaning theory for their language. Chomsky makes a similar concession with respect to knowledge of grammar when he suggests that it suffices to credit speakers with *cognizing* the grammar of their language.[5] The important point for Chomsky is that the theory of grammar is to be understood as a *psychological* theory. The point of crediting speakers with *knowing* a grammar is to ascribe to them the psychology that the grammatical theory purports to characterize (at a high level of abstraction). The force of Chomsky's concession is that it would suffice for this that we credit speakers with merely cognizing the grammar.[6] This weaker thesis, stripped of any epistemological import, would suffice for the psychological reality of grammar. Dummett, by contrast, stands out as trying to get epistemological mileage out of the idea that competent speakers can be credited with knowledge of their language. Dummett argues that crediting competent speakers with knowing a meaning theory ties meaning to the epistemic capacities of speakers. On Dummett's view, whatever meaning is, it cannot outstrip the epistemic capacities of competent speakers, since we could otherwise not credit speakers with knowledge of it. Though his views are certainly relevant here, I do not want to make Dummett my central target. There is much more at stake in the epistemology of linguistic competence than Dummett's somewhat contentious view about meaning.

As we have seen, the view we take about the epistemic status of linguistic competence—whether it has the same epistemic status as knowledge—makes a crucial difference to the epistemology of speech comprehension and the epistemology of testimony. On the inferential view, our standing competence in the syntax and semantics of the language has the epistemic status of knowledge, entering into the grounds for our knowledge of what speakers say and the knowledge we acquire from testimony. On the perceptual view, our competence does not have this epistemic status and so does not enter into the grounds for such knowledge. So putting the focus on speech comprehension and the epistemology of testimony brings the epistemic status of linguistic competence to the fore. Specifically, it brings to the fore the question of whether linguistic competence has the epistemic status of knowledge. We can set aside the further question of whether linguistic competence *is* knowledge—that is, whether it meets the further conditions necessary to count as knowledge.

But what exactly would it be for linguistic competence to have the same epistemic status as knowledge? One of the distinctive features of knowledge, what distinguishes knowledge from non-epistemic states, is that it admits of (indeed stands in need of) epistemic warrant or justification. Knowledge is ***warrant apt***, as I will put it. Standardly, knowledge is understood to be justified belief that meets certain other conditions. If this is right, then knowledge is warrant apt, because belief is. Yet knowledge and belief are not the only warrant apt states. We can also evaluate fears, hopes, doubts and suspicions as warranted or unwarranted (e.g., in light of certain evidence); these states are also warrant apt. Yet what distinguishes knowledge from fears, hopes, doubts, suspicions and (mere) beliefs is that knowledge can also *confer* epistemic warrant (for belief and perhaps for other warrant apt states). Knowledge is ***warrant conferring***, as I will put it. This capacity to confer warrant is something knowledge shares with perceptual states, at least on some views of perception. What is distinctive about the epistemic role of knowledge is that it confers warrant by virtue of being warranted. Mere beliefs—those that don't count as knowledge for lack of warrant—do not confer epistemic warrant for (other) beliefs. So, knowledge is warrant *conferring* in virtue of its warrant *aptness*.

This appears to be an important difference between knowledge and (warrant conferring) perceptual states. Perceptual states supply warrant for belief, but do not themselves stand in need of warrant. I see that there is a desk before me, or at least it seems to me that there is. I thereby come to believe that there is a desk before me. There is a question about whether I am warranted or justified in believing this, but no similar question seems to arise about whether I am warranted in *seeing* things as I do or warranted in how things seem to me. Perceptual states are warrant conferring without being warrant apt. The question that confronts us is whether linguistic competence is, in this respect, like knowledge or like a perceptual state.

This serves to clarify the epistemological issue between the inferential and perceptual views of speech comprehension. The inferential view treats linguistic competence as an epistemic intermediary that confers warrant but which must itself be warranted in order to do so. It understands linguistic competence, on the model of knowledge, to

be warrant conferring in virtue of being warrant apt. On this view, we are warranted in our beliefs about what speakers say only if we are warranted in our understanding of the syntax and semantics of the language. On the perceptual view, by contrast, our linguistic competence does not epistemically mediate our access to the content of speech. On this view of things, our competence may be a source of epistemic warrant, insofar as we are presumably warranted in our beliefs about what speakers say by virtue of being competent in the language. The important point, however, is that being warranted in our beliefs about what speakers say does not require that the linguistic competence itself be warranted (e.g., vindicated by evidence of its correctness). On the perceptual view, being warranted in our beliefs about what speakers say does not require that we be warranted in our understanding of the syntax and semantics of the language. Our competence in the language is warrant conferring, but not warrant apt.

Thus understood, the inferential view of speech comprehension entails a particular epistemological view of language acquisition. On this view, acquiring competence in a language is not merely a matter of acquiring a correct understanding of the syntax and semantics of the language, since that competence also stands in need of epistemic warrant. In the course of acquiring competence in a language, a speaker must also acquire a body of evidence that serves to warrant that understanding. This idea that our understanding of a language stands in need of *evidence* is embodied in Davidson (1937) thought experiment of the radical interpreter. The radical interpreter is initially understood to be a theorist confronted with the task of interpreting a completely alien language. The theorist interprets the language on the basis of the evidence available to ordinary speakers (consisting of observations of the linguistic and non-linguistic behavior of other speakers and the circumstances under which that behavior occurs). The radical interpreter is limited to the evidence available to speakers, because Davidson takes speakers to be in the same epistemological predicament as the theorist—that of having to discover the language from the available evidence. Native speakers do not have any privileged access to the facts about meaning. Just as the theorist requires evidence of the correctness of their theory, speakers require evidence for their interpretation of the language.[7]

The problem is that the available evidence is not up to the task, which famously leads Davidson (following Quine) to a skeptical view about meaning. The initial observation is that the totality of evidence underdetermines the facts about meaning, since that evidence is compatible with rival meaning theories. Davidson argues (more strongly) that the facts about meaning are indeed *indeterminate*, not merely underdetermined by the evidence. The indeterminacy thesis is supposed to follow from the fact that *all* speakers are in the same epistemic predicament. The key premise is that there couldn't *be* determinate facts about meaning that outstrip the ability of all the speakers of a language to determine those facts. The thought seems to be that the facts about meaning are somehow determined by the practices of speakers, and so are determinate only to the extent that they can be determined by speakers.[8] Much of the focus in the literature has been on this move from underdetermination to indeterminacy.

What I want to focus on here is the picture of the epistemic predicament of speakers from which the argument proceeds—the idea that speakers must discover their language from the evidence available to them. Call this the ***evidential picture*** of language acquisition. This epistemological picture appears to be widely accepted. Indeed, it is perhaps so fundamental to our commonsense view of language acquisition that it might be difficult to see how it could be rejected. How else could speakers acquire competence in a language other than discovering the syntax and semantics of their language from the evidence available to them?

We can begin to see how there might be room to reject this picture, if we consider the possibility that certain aspects of linguistic competence might be innate. Chomsky famously argues that there is an innate universal grammar—a set of universal principles and parameters that underlie the grammar of every human language, understood to reflect the workings of an innate language faculty. Whereas the principles of universal grammar are invariant, differences between the grammars of human languages are attributed to the parameters of universal grammar, which admit of a fixed range of possible settings. Universal grammar delimits the range of possible grammars for a human language. On this view of things, external stimuli play a limited role in language acquisition, serving merely to set the parameters of universal grammar in

a particular way—picking out a particular grammar among those permitted by universal grammar. Such stimuli fall well short of providing *evidence* sufficient to determine the grammar of a language—evidence that would serve to determine the correct grammar from among the full range of *conceivable* alternative grammars. The innate contribution is postulated precisely to explain how language acquisition is possible, given the poverty of the available evidence. On this view, speakers achieve competence in the grammar of their language without having adequate evidence to vindicate that competence.

Yet the general point does not turn on the specific hypothesis of universal grammar. Any innate contribution will introduce a gap between the competence achieved and what the external stimuli provide evidence for. So if there is any innate contribution to language acquisition—and it is widely agreed that there must be *some* innate contribution, though not necessarily a specifically linguistic one—the external stimuli can suffice (with the innate contribution) to produce competence in the language without sufficing (absent the innate contribution) to vindicate that competence with evidence of its correctness.[9] Since the available evidence is not up to the task, it becomes crucially important to decide whether linguistic competence stands in need of such evidence—whether it is warrant apt.

The perceptual view of speech comprehension is less epistemologically demanding of language acquisition. On this view of speech comprehension, while linguistic competence may supply warrant for our beliefs about what speakers say, it does not itself stand in need of epistemic warrant in order to do so. This allows us to reject the evidential picture of language acquisition. In acquiring competence in a language, exposure to a community of speakers must suffice to *produce* a correct understanding of the language (perhaps with the aid of some innate contribution), but it need not suffice to *warrant* that understanding by supplying evidence of its correctness. Contra Davidson, speakers are not in the same epistemic predicament as the theorist. Whereas a theory stands in need of evidence of its correctness, the standing competence a (native) speaker possesses does not similarly stand in need of such evidence. On this view of things, the fact that the evidence available to speakers underdetermines the syntax and semantics of the language is of no particular import for either the speaker

or the theorist. Speakers do not require such evidence and there is no reason the theorist should be limited to the evidence available to speakers.

We can of course set aside normative epistemology, and still raise the question of whether the external stimuli (perhaps together with some innate contribution) are *causally* sufficient to produce competence in a language.[10] This is a straightforwardly empirical issue, and—thus understood—the issue of underdetermination does not even arise. Either the external stimuli are causally sufficient to produce competence or they are not. The only sense we can make of the idea that external stimuli *causally* underdetermine competence in the language is to suppose that they are *not* sufficient to produce the competence. Yet this does not give us what we need for an argument for indeterminacy. There seems to be no sense to be made of the idea that the external stimuli are somehow *causally* indeterminate as between a range of states of syntactic and semantic competence.

It appears then that the perceptual view of speech comprehension, if correct, would undermine the epistemological picture of our predicament as speakers (what I am calling the evidential picture) from which the Davidsonian argument for indeterminacy proceeds. This would not put to rest all worries about indeterminacy, as there are arguments for indeterminacy that do not proceed from epistemological premises. But it would undermine the familiar epistemological line of argument for indeterminacy.[11] It would also have far-reaching consequences for how we understand our epistemic relationship to language, our access to the content of speech, and the grounds for the knowledge we acquire from the testimony of others. That, as I see it, is what is at stake between the perceptual and inferential views of speech comprehension.

Having some sense now of what is at stake between these views, we can turn to the question of which of them is right (if either). This raises a prior methodological question of what kind of evidence is relevant to deciding the matter. What I want to consider initially is a case Fricker makes for the perceptual view that draws on phenomenological evidence.

2.

The phenomenology of speech comprehension is the most immediately striking evidence in favor of the perceptual view. The experience of hearing speech in your native language contrasts starkly with that of hearing an unfamiliar foreign language. A foreign language can sound like an unintelligible stream of verbal noise in a way that your native language does not. In a completely unfamiliar language, it can be difficult even to perceive the boundaries between words, phrases and sentences. Even in a language in which you have some rudimentary competence, you might recognize individual words, but still have to *think* about what those words mean in order to know what speakers say. This seems to fit the inferential view, which is perhaps partly motivated by the thought that the same sort of thing must be going on in the case of one's native language. Yet the phenomenology in the native case is strikingly different. The experience of speech in your native language is imbued with meaning in a way that your experience of unfamiliar languages is not. While we must sometimes infer what a speaker has said, even in our native language, this does not seem to be typical. Our awareness of the content of speech is typically immediate and unreflective. Indeed, the content of speech in your native language can stubbornly intrude upon your mental life when you would rather it not, as for example when someone is publicly sharing personal details while talking on the phone. You can plug your ears or try to attend to something else, but you cannot simply block out the content of the speech. On the face of it, this phenomenal character of speech comprehension appears to support the view that we have immediate perceptual access to the content of speech.

However, I have argued that the disagreement between the inferential view and the perceptual view is best understood as being about the *epistemology* of speech comprehension—a disagreement about whether our linguistic competence mediates our epistemic access to the content of speech in a knowledge-like way. Yet it is not clear that anything about the epistemology of speech comprehension follows from the phenomenology. The proponent of the inferential view can happily concede that it *seems* we are just directly aware of the content of speech, but insist that this impression is illusory. Indeed, antecedently, there is good reason to suspect that the phenomenology is deeply misleading. We know that, underlying the apparent simplicity of speech comprehension, there is an exceedingly complicated process that goes into parsing the syntax of speech and interpreting its content. This process looks a lot like inference, introducing various commitments about the syntax and semantics of the language into the grounds for the resulting beliefs.

Fricker (2003) argues that the phenomenology is relevant to the epistemology because the epistemology is *grounded in* the phenomenology. According to Fricker, it is the phenomenology that supplies the grounds for belief. She claims that competent speaker-hearer's of a language enjoy quasi-perceptual experiences of the force and content of a speaker's utterance. The characterization of them as *quasi*-perceptual is meant to stop short of claiming that the having of such an experience is a genuine instance of perception. The important claim is about the epistemology. Fricker claims that such quasi-perceptual seemings are self-warranting and supply defeasible *prima facie* grounds for belief. Suppose you tell me (in English) that it rained in Berlin, and I thereby come to believe *that you said* that it rained in Berlin (set aside the question of whether I also believe that it rained in Berlin).[12] On Fricker's view, in hearing your utterance it will (quasi-perceptually) seem to me that you said (force) that it rained in Berlin today (content). My prima facie, defeasible ground for believing that you said that it rained in Berlin today is the (phenomenological) fact that things *seem* this way to me. What makes the grounds defeasible is that other evidence might come to light that would undermine the warrant for belief they would otherwise supply; the experience warrants the belief only in the absence of such defeaters. This is a familiar internalist picture of the epistemology of perception. The motivation for this picture is supposed to be that the seeming provides the subject with an internal rationale for belief, thereby grounding the belief. The internal rationale goes roughly like this: I believe that you said that it rained in Berlin today, because it seemed that you did.[13]

There are at least two worries about this epistemological picture. The first worry is that the internalist grounds Fricker invokes simply do not ring true as a justification. Suppose Smith says something to me and I take him to have said to me that Jones stole some money. In light of the seriousness of the accusation, we can imagine that I

might be pressed to justify my belief that this is what Smith said. Yet, if so pressed, invoking how things seemed to me appears to have no justificatory force whatever:

> A: "Smith said that Jones stole the money."
>
> B: "How do you know that Smith said that? What are your grounds for believing that he did?"
>
> A: "It seemed to me that he did."

Indeed, appealing to how things seemed is more naturally understood pragmatically as a way of backing away from or disavowing the belief, rather than a way of justifying it. ("Well, it *seemed* to me that he did.") A more natural way to *justify* such a belief would be something along the following lines:

> A: "Smith said that Jones stole the money."
>
> B: "How do you know that Smith said that? What are your grounds for believing that he did?"
>
> A: "I heard him say it."

That is, the more natural way to justify my belief would be to invoke the *source* of the belief, in this case citing the fact that my belief about what Smith said derives from first-hand experience, as opposed to merely hearsay. This justification also seems to be defeasible, but (unlike appealing to how things seemed) it does have justificatory force.

In light of the fact that Fricker's account is supposed to provide the believer with an *internal* rationale for belief, it is tempting to think that perhaps the way we justify beliefs to ourselves is different from the way we justify beliefs to others. Yet this doesn't seem right. Even in the first person case, if I were in any doubt about whether Smith said what I thought he said, to invoke the fact that it seemed that way would seem to provide little, if any, epistemic reassurance. But suppose that I am not in any doubt about what Smith said and I am merely trying to reconstruct for myself the rationale for my belief. Even in this case it seems that my internal rationale would not be any different from the one I would offer to others. I believe that Smith said Jones stole the money, because I distinctly *heard* him say it. To invoke the mere fact that it *seemed* that way to me would amount to a kind of epistemic hedge, rather than a justification.

We appeal to how things seem, not to justify belief, but to excuse error. It would be quite natural to appeal to how things seemed to me, in the event that I misheard or misunderstood what Smith said. To the extent that the way it seemed to me is the way it would have seemed to any similarly placed observer (as opposed to being due to inattentiveness or wishful thinking on my part), this gets me off the hook for the error. It mitigates my epistemic culpability for the error. Seemings are exculpatory rather than justificatory; they excuse error rather than justify belief.

The second worry about Fricker's epistemological picture is that *prima facie* defeasible grounds appear to provide a disincentive for further inquiry, which would make them an epistemically counterproductive source of justification. To illustrate, suppose Smith says something to me and it seems to me that he said he would give me a thousand dollars. On Fricker's view, this provides me with *prima facie* defeasible grounds for believing that Smith said he would give me a thousand dollars. Yet such *prima facie* grounds might provide only partial justification for the resulting belief. So suppose that I possess whatever other grounds are necessary to be justified outright (absent any defeaters) in believing that Smith said he will give me a thousand dollars. The problem is that there is now a disincentive for me to engage in any further inquiry that might threaten to bring possible defeaters to light. As things stand (by hypothesis), I am justified in believing something that I would really like to believe (that a person of integrity said he would give me a thousand dollars). It appears that I only stand to lose by seeking out evidence to the contrary. It is possible that I misheard him, and (let's suppose) I could readily find out. But why ruin a good thing? So I have an incentive not to seek out, perhaps even to shield myself from, possible defeaters. So my defeasible justification for belief appears to motivate willful ignorance.

Of course, there might be other incentives for further inquiry. Perhaps there is an incentive to pursue the truth, maybe even an obligation to do so. Yet this does not translate into an incentive for further inquiry, since further inquiry cannot secure the truth of my belief. Notice that

further inquiry cannot *make* my belief true. At best it can secure justification for *taking* my belief to be true. But on Fricker's view I already have this. However, while further inquiry cannot secure the truth of my belief, what it can do is bring error to light, should my belief turn out to be false. And there is some value in bringing such error to light; things might go badly for me in the future if I persist in a mistaken belief. So, even on Fricker's view, there may yet be an incentive for further inquiry. The worry is that, on Fricker's view, the grounds for belief end up being epistemically counter-productive-whatever other incentive there might be for further inquiry, the effect of my defeasible grounds is to *undermine* that incentive.

The worry can be understood by way of analogy with a criticism that Reagan-era conservatives used to level against social welfare programs. The criticism was that such programs undermine the incentive to work. While many people *did* still work, and it was perhaps rational for them to do so, the point was that social welfare was economically counter-productive by *reducing* the incentive to work.[14] The worry about Fricker's epistemology is that, while it might nevertheless be rational to engage in inquiry for other reasons, the grounds for my belief are epistemically counter-productive; they reduce the incentive. Insofar as I am (prima facie) justified in my belief, absent any actual defeaters, there is a disincentive to bring possible defeaters to light, indeed an incentive to shield myself from possible defeaters. Why is this implausible? Perhaps this is just the way justification works. What is implausible is that, on Fricker's view, it seems justification, once secured, can be preserved by simply burying your head in the sand. Intuitively, justification doesn't work that way. To the extent that there is any real doubt about the truth of my belief and defeaters are a real possibility, I cannot retain even *prima facie* justification for my belief by simply shielding myself from contrary evidence—by simply burying my head in the sand.

What's the alternative? As I have already suggested, what justifies my belief about what someone says is that I *heard* them say it, not the fact that they *seemed* to say it. If I am justified in believing that Smith said he would give me a thousand dollars, what justifies my belief is that that is what I heard him say. If there is any doubt about whether Smith actually said this, this will also undermine my claim to have

heard him say it (since 'hear' is factive). If my claim to be justified in my belief turns on whether I heard him say it, such doubts will thereby threaten to undermine my justification. On this view of things, being justified in my belief requires that I eliminate such possibilities for error (though not necessarily *all* possible sources of error), thereby providing an incentive for further inquiry. If there is any real doubt about whether Smith said what I thought he did (e.g., if we were talking in a noisy bar), I can take no epistemic satisfaction in the mere fact that it *seemed* that he said it. Justification is preserved by putting such doubts to rest, not by shielding myself from them.

This is of course a quite general worry about the internalist picture of epistemic justification. So there is a big issue here that requires a good deal more discussion. Pursuing it here, however, would take us too far afield. My aim in the present discussion is to sketch my reasons for wanting to reject Fricker's attempt to ground the epistemology of speech comprehension in the phenomenology. While further discussion might be needed to make these objections stick, the problems that confront Fricker's account should suffice to motivate consideration of an alternative, to which we will now turn.

3.

While I have been emphasizing the points of disagreement with Fricker, we are in agreement that speech comprehension provides us with non-inferential access to the content of speech, understood on the model of perception. That is, we both endorse some version of the perceptual view of speech comprehension, as against the inferential view. We also agree that the phenomenology of speech comprehension provides *some* evidence for this view. The point on which I disagree with Fricker concerns relevance of the phenomenology to the epistemology.

Stanley (2005) argues that the value of the phenomenology as evidence for the perceptual view is undercut by the pervasive context sensitivity involved in the interpretation of speech:

> Those who hold that language understanding is akin to some kind of non-inferential perceptual grasping face the obvious objection that the pervasive context sensitivity and ambiguity of natural language sentences forces hearers to

> engage in inferential reasoning about meaning in order to grasp what is said by an utterance. When someone utters the sentence 'The policeman arrested the robber. He was wearing a mask', we generally interpret the pronoun 'he' as referring to the robber, rather than the policeman. We arrive at this interpretation by exploiting inferences about the plausibility of interpreting the pronoun in different ways, inferences guided by our knowledge of meaning together with background knowledge about the world. Virtually every sentence we hear contains context-dependent expressions. Therefore, virtually all of our experience as language interpreters involves making consciously accessible linguistically guided inferences about semantic content. (p. 131-2)

In light of this pervasive context sensitivity, the phenomenology of speech comprehension appears to be deeply misleading. While it seems that we simply *hear* what speakers say, providing us with direct access to the content of speech, determining the content of a speaker's utterance requires us to draw extensively on "knowledge of meaning together with background knowledge about the world." It is very natural to understand this as involving *inference* (though this does not follow straightforwardly). There may yet be some way to reconcile the perceptual view with the pervasiveness of context sensitivity, some theory about the way background knowledge enters into the interpretation of speech that is non-inferential. Stanley's point, however, is that the pervasiveness of context sensitivity undercuts the phenomenological evidence, such that it cannot be taken to be simply a phenomenological datum that our access to the content of speech is non-inferential.

Yet the phenomenology is not the only evidence that speech comprehension is perceptual in character, nor is it even the most illuminating evidence. Speech comprehension is susceptible to a kind of neurologic impairment that strikingly parallels neurologic impairments of high-level perceptual capacities. Let's talk about the visual impairments first. ***Visual agnosia*** is a selective neurologic impairment of the capacity to recognize objects (typically the result of stroke or other brain injury) that is not due to a global impairment of vision or visual acuity. Visual agnosia is not a conventional form of blindness.

In paradigmatic cases, a person who suffers from visual agnosia can see things clearly, but without recognition. This is thought to be due either to an impairment of the cognitive mechanisms responsible for recognition, or a disruption of the flow of visual information to those mechanisms. Different species of agnosia are distinguished according to the specific recognitional capacity that is impaired. ***Prosopagnosia*** (or face blindness) is an impairment specifically of the ability to recognize faces. Someone who suffers from prosopagnosia can see and recognize familiar objects but cannot recognize the faces of familiar people. This is taken to be evidence that there are perceptual mechanisms at work in face recognition that are distinct from those at work in the recognition of other kinds of objects, mechanisms that can be selectively impaired.

There is an analog of this phenomenon in auditory speech *perception* called ***(pure) word deafness*** (this is not yet the point about speech *comprehension*). Word deafness is a selective impairment of auditory word recognition, an impairment that spares the ability to recognize non-linguistic environmental sounds (e.g., the chiming of a bell or chirping of a bird). Subjects can hear and recognize environmental sounds, but can neither recognize nor repeat heard words. Word deafness is classified as a form of ***aphasia***—a selective neurologic impairment of linguistic abilities. However, we could also think of word deafness as a form of auditory agnosia, insofar as it is an impairment of a capacity to recognize a certain kind of thing (viz., uttered words). Word deafness is not a straightforward impairment of auditory acuity, since word deaf subjects typically score well on pure tone audiometric testing.[15] Nor is word deafness due to an impairment of the underlying linguistic competence, since word deafness does not affect the abilities to speak, read and write. The impairment is specific to language, but it is also specific to the auditory modality. It would is natural to characterize the phenomenology of word deafness by saying that subjects can hear speech, but do not hear it *as* speech. The etiology of word deafness corroborates this. Word deafness typically results from bilateral temporal lesions that are thought to interrupt neural pathways from the auditory cortices to the language centers of the brain. As a consequence, sensory input from the auditory cortices cannot reach the language centers of the brain and so cannot be processed *as* language.

Whereas word deafness is impairment specific to auditory speech *perception*, there is another neurologic impairment called ***(word) meaning deafness*** that is specific to speech *comprehension*. Meaning deafness is a neurologic impairment of auditory speech comprehension with spared linguistic competence and otherwise spared auditory perception.
[16]

In the classic cases of this phenomenon, subjects retain the abilities to speak, to read and to write. They can repeat words and in some cases have the ability to spell or write down the words they hear (typically with orthographic errors). Despite this, however, they are severely impaired in their ability to understand the speech that they hear. As the name suggests, subjects with meaning deafness can hear speech, but they appear to be deaf to its meaning or content. This phenomenon differs importantly from that of word deafness, since subjects with meaning deafness are able to hear the speech well enough to repeat it and even write to dictation—something word deaf subjects are unable to do. This suggests that meaning deaf subjects are able to hear the words, and perhaps process it as language in a way that word deaf subjects cannot. Yet they do so without understanding.

A striking consequence of this particular constellation of abilities is that, in some reported cases, meaning deaf subjects are able to write down words they hear (typically with some orthographic errors), initially without understanding, but then read and understand what they wrote. Kohn & Friedman (1986) describe this phenomenon as exhibited by patient HN:

> When asked to point to the *cup*, HN said "cup, cup, C-U-P, cup. What is it?" Finally, he wrote the word *cup*, read it aloud and said "Oh, cup," and immediately pointed to the cup. The words *sink* and *shelf* were likewise repeated several times, written, read, and then [the referent] correctly identified.

This phenomenon is, at least initially, very puzzling. That someone with meaning deafness retains the ability to repeat words and even write to dictation suggests that they are able to hear the words. Their ability to speak and read suggests that they still know what those words mean. Why then are they unable to understand what they hear?

The perceptual view of speech comprehension provides a very natural way to make sense of this. According to the perceptual view, normal auditory perception of speech normally comes to us interpreted for the content of the speech. We have the capacity to hear the content of speech—to hear it *as* having a particular content. The natural thought is that this capacity is impaired in people with meaning deafness. They hear the speech, perhaps even hear it as a certain sequence of words, but they do not hear it *as* having content.

The phenomenon of meaning deafness is less readily understood on the inferential view. On the inferential view, we perceive a speaker's utterance (perhaps perceive it as a sequence of words), but the comprehension of speech involves a *post*-perceptual inference from our syntactic and semantic competence. In the case of meaning deafness, it seems that neither the capacity to perceive speech, nor the linguistic competence is impaired. This seems to commit us to understanding meaning deafness as an impairment of the ability to draw the post-perceptual inference to the content of speech. Thus understood, meaning deafness constitutes a kind of rational impairment, an inability to engage in certain linguistic reasoning. Yet even this doesn't seem right, since meaning deafness is specific to the auditory modality. This is precisely what makes it natural to characterize the impairment as a kind of *deafness*. So the inferential view does not provide particularly apt characterization of the phenomenon of meaning deafness.

Yet we can do better in adjudicating between these views than simply evaluating whether our ordinary perceptual concepts provide a more apt characterization of meaning deafness than does the concept of inference. Science often confronts us with phenomena that put pressure on our ordinary concepts, requiring us to extend, revise or even abandon them in favor of more technical concepts. Fodor's (1983) notion of modularity falls in the latter category and offers an attractive way to make sense of meaning deafness and other such neurologic impairments. Indeed, such neurologic impairments are a key bit of evidence for modularity. In the next section, we will explore how we might make sense of the phenomenon of meaning deafness in terms of the notion of modularity, and consider how this bears on the epistemology.

4.

Fodor conceives of a ***module*** as a dedicated cognitive processor specialized for a particular cognitive task. Modules are mandatory in their operation and restricted in the range of information they can bring to bear on their assigned task (i.e., informationally encapsulated), which allows them to perform their task quickly by freeing them from the burden of deciding which information might be relevant. Postulating modules dedicated to particular cognitive tasks allows us to explain how specific cognitive abilities can be selectively impaired. We can explain word deafness, for example, by postulating a "word-recognition" module. On the assumption that general-purpose perceptual mechanisms are responsible for identifying both linguistic and non-linguistic sounds, it is puzzling how word recognition could be selectively impaired. This is not at all puzzling, however, if we suppose that there are distinct (largely autonomous) modules dedicated to specific auditory recognition tasks. We can explain the phenomenon of meaning deafness by supposing either that the neurologic injury impairs the module itself or that it interrupts the auditory signal that the module operates on.

The phenomenon of meaning deafness suggests that modularity might extend beyond speech *perception* and into speech *comprehension*. What is initially puzzling about meaning deafness is that the person who suffers from it appears to have all the information necessary to determine the content of speech. Roughly, they can hear the words that a speaker utters (as exhibited by their ability to write them down), they know what those words mean (as exhibited by their ability to speak and read with understanding). They also possess the relevant background knowledge about the context. Yet they are unable thereby to understand what was said. While they seem to possess the relevant information, somehow it cannot be deployed in auditory speech comprehension. The notion of modularity provides a natural way to make sense of this. Just as we postulated a word recognition module that identifies words, we might postulate a "semantic module" that assigns meanings to them. Because meaning deafness is specific to the auditory modality, meaning deafness is generally understood in the neuropsychology literature to be the result of a disruption of the signal between the auditory system and the regions of the brain responsible for semantic interpretation—something like the postulated semantic module. If the semantic module itself were impaired, we would expect comprehension to be impaired across sensory modalities.[17] That the deficit is modality specific suggests that the semantic module is still functional but no longer accessible to the auditory modality.

The phenomenology of speech comprehension provides some corroborating evidence for this modular view of speech comprehension. The striking thing about the phenomenology was that we seem to be directly aware of the content of a speaker's utterance. Yet this is very puzzling in light of the fact that our ability to know the content of a speaker's utterance must obviously draw upon complex facts about the syntax and semantics of the language. We can reconcile this with the phenomenology if we suppose that the intervening stages of syntactic and semantic processing are modular. Modular aspects of our cognitive lives are supposed to be cognitively opaque to us. We have no awareness of, nor introspective access to what goes on inside our modules. To the extent that speech comprehension is modular, we would be aware only of the output of the module. If the output of the module is the content of a speaker's utterance[18], the content of speech would seem to be direct, precisely because the intervening stages of syntactic and semantic processing are cognitively opaque to the speaker-hearer.

Postulating modularity in speech comprehension seems to cut both ways with respect to the dispute between the perceptual and inferential views. On the one hand, it seems to support the perceptual view by making explicit the way in which speech comprehension is supposed to be perception-like. Perceptual capacities are paradigmatically modular. To the extent that speech comprehension turns out to be modular, we can take this to vindicate the hunch behind the perceptual view that speech comprehension is perception-like. On the other hand, the idea that speech comprehension is modular can also be taken to vindicate the inferential view, since what modules do looks a lot like inference. We can think of the modules that subserve speech comprehension as making a series of inferences to determine the content of an utterance from background syntactic and semantic information about the language. So while evidence that speech comprehension is modular does support the view that its psychology resembles that of perception, it also seems to support the view that it is inferential.

Yet it was previously argued that the disagreement between the perceptual view and the inferential view should be understood to be about the epistemology rather than the psychology. Proponents of both views can agree that the psychology of speech comprehension involves a complex (perhaps modular) process that draws upon our syntactic and semantic competence. The point of disagreement was about whether that competence enters into the *grounds* for the knowledge of what speakers say. This turns on whether linguistic competence has the epistemic status associated with knowledge—warrant apt (requires epistemic warrant) and warrant conferring (confers warrant for belief), and must *be* warranted to confer warrant. On the inferential view, linguistic competence has this epistemic status. On the perceptual view, it does not.

The question of whether speech comprehension is modular bears on this epistemological issue in an interesting way, since it seems that the notion of epistemic warrant does not properly apply to modules. Suppose there is a parsing module at work in speech comprehension that serves to parse the syntactic structure of utterances. This parsing module embodies certain commitments about the syntax of the language (perhaps it even employs internal syntactic representations). Yet there does not seem to be any question about whether the parser is *warranted* in these syntactic commitments. The notion of epistemic warrant is a normative one that applies to persons in virtue of their capacity for rational revision of belief. If you believe that Barack Obama is in Chicago, there is a question of whether you are warranted in that belief, whether you have adequate evidence or reasons for holding it. If not, then perhaps you ought to revise or suspend it. Because persons have the capacity to believe things *for reasons* (more generally to *do* things for reasons), we can evaluate the adequacy of those reasons. However, modules lack this capacity and so do not seem to be up for this kind of epistemic assessment. We cannot ask whether a parsing module is warranted in parsing utterances as it does, or whether it is has adequate evidence for the syntactic commitments it thereby manifests. Modules do various things but are incapable of doing those things *for reasons*. Consequently there is no question of whether they have adequate reasons or evidence for what they do.

This is not to suggest that input modules are not subject to any sort

of epistemic assessment. We can assess whether a module is working correctly or whether it is a reliable source of information. This is epistemologically significant, insofar as it bears on whether the module can be a source of knowledge; a module presumably cannot be a source of knowledge if it is not sufficiently reliable. The point is that a module is not properly assessed as *warranted* or *unwarranted* in what it does or how it does it. We can evaluate whether the parsing module reliably parses utterances correctly, but not whether it is warranted in parsing utterances as it does. There is no question of whether it has adequate reason or evidence for parsing utterances that way rather than some other. Either it parses in accord with the syntax of the language or it doesn't; there is no further question of whether it is warranted in how it parses.

While it might be out of place to ask whether your parsing module is warranted in parsing an utterance as it does, there is a question about whether *you* are warranted in relying on your parsing module. Yet epistemic warrant for relying on your cognitive faculties does not seem to require detailed evidence of their inner workings. Being warranted in relying on your visual system does not require that you have detailed evidence of how the visual system extracts information about the properties of distal objects from the light that strikes the surface of the retina. What warrants you in relying on your visual system is evidence of a more general sort that indicates that your visual system is working properly, or perhaps merely the *absence* of evidence suggesting that it isn't. Similarly, being warranted in relying on your parsing module does not require detailed evidence about the syntax of your language, but instead turns on more general evidence about whether your faculties are working properly.

This bears on the question of whether our standing competence in a language is warrant apt, because the warrant aptness of standing states is parasitic on the epistemic assessment of persons. Beliefs can be evaluated as warranted or unwarranted, because we can evaluate whether believers (persons) are warranted in *holding* them. Beliefs are properly subject to such evaluation by virtue of the believer's capacity to rationally revise their beliefs. Standing linguistic competence manifested by modules is not properly subject to such assessment, because the modules lack this capacity for rational revision. The competence is

not properly evaluated as warranted or unwarranted, because the module is not properly evaluated as warranted or unwarranted in *deploying* that competence.

We can begin to see now how the epistemology of speech comprehension turns on empirical issues about the psychology. If linguistic competence is deployed in speech comprehension by modular subsystems, then the competence thus deployed is not warrant apt. If it is not warrant apt, then it does not have the epistemic status of knowledge—confers warrant only by virtue of being warranted—and so does not epistemically mediate our access to the content of speech. So far, however, the empirical evidence that speech comprehension is modular seems thin. The phenomenon of meaning deafness falls well short of establishing that speech comprehension is modular. Fodor has a rich conception of modularity, and while selective impairment of cognitive abilities is characteristic of modularity, it does not by itself suffice to establish modularity. While modularity explains how selective impairment of a cognitive capacity is possible, selective impairment of a cognitive capacity does not suffice to establish that there was a specialized processor with a proprietary database dedicated to that particular cognitive task.[19]

Not only is the evidence of modularity thin, the pervasive context sensitivity of speech provides rather more compelling evidence that speech comprehension is *not* modular. Consider again Stanley's example:

> (1) The policeman arrested the robber. He was wearing a mask.

We understand 'he' to refer to the robber rather than the policeman, because we bring to bear relevant background information about the habits of policemen and robbers. This is precisely the kind of cognitive capacity—making a decision about what the relevant information is—that serves as a point of contrast to modularity. Modules are supposed to be informationally encapsulated. The range of information they bring to bear on a cognitive task is restricted. Yet the range of information that might be relevant to the interpretation of speech appears to be open-ended. There is no limit to the range of knowledge about the world that might be relevant to resolving context sensitivity.

This suggests that there are at least some aspects of speech comprehension that cannot be modular, though there may be other aspects that nevertheless are modular.

Yet, while the idea that linguistic competence is deployed by input modules has served as a useful heuristic, the general line of argument that linguistic competence is not warrant apt does not require that speech comprehension be modular. It can proceed from a much weaker psychological premise. The central idea was that the linguistic competence deployed in speech comprehension is not warrant apt, because the modules that deploy it are not properly evaluated as warranted or unwarranted in what they do—only persons are properly subject to such evaluation. So the crucial psychological assumption was just that the linguistic competence is deployed by some component of the locus of cognitive activity that is distinct from the person (and does not itself count as a person). This does not require that the locus of cognitive activity be modular—specialized, dedicated, informationally encapsulated, and so on. The important point then is that the competence is deployed *sub-personally*, and to that extent is not warrant apt.

The strongest case for sub-personal deployment can be made for syntactic competence by virtue of its sheer complexity. To do justice to that complexity, it will be useful to discuss the point in connection with a concrete syntactic example. Consider the following two variants of Stanley's example:

> (2) When he donned a mask, the policeman arrested the robber.
>
> (3) He donned a mask, when the policeman arrested the robber.

In the case of (2), as in Stanley's original example, the pronoun 'he' can be understood to refer to either the policeman or the robber (or someone else). Bringing to bear our background knowledge about policemen and robbers, we are perhaps more apt to understand it to refer to the robber. In the case of (3), by contrast, 'he' cannot be understood to refer to either the policeman or the robber and must instead be understood to refer to some other (contextually determined) person. According to current linguistic theory, this is due to a syntactic constraint (Principle C) to the effect that a pronoun cannot be co-indexed with

a noun phrase (NP) that it c-commands. The relation of c-command supervenes on the (hierarchical) syntactic structure of the sentence, not the linear order of the expressions that make it up. Roughly, a constituent c-commands constituents that are lower in the structure. Notice that 'he' occurs to the left of the NPs in both sentences, but only in (3) does it c-command them. It seems implausible to credit a speaker-hearer with determining that 'he' cannot refer to either the policeman or the robber from Principle C and the facts about the c-command relation. Even if we might be tempted to credit an ordinary speaker-hearer with working out the referent of the pronoun, ordinary speaker-hearers are simply not cognizant of the relevant syntactic facts to work out the constraint imposed by Principle C. Such syntactic details are more plausibly worked out sub-personally and constrain the interpretations that are even entertained at the person-level.

There is a natural temptation to take the fact that a speaker-hearer's understanding of the sentence conforms to Principle C as evidence that they *must* be cognizant of the relevant syntactic facts—that they must at least tacitly know such facts. This invites conflation of the person-level and the sub-personal. The idea that a speaker tacitly knows the syntax of their language is unobjectionable insofar as this is understood to mean merely that the syntax of the language is somehow or other reflected in their psychology (perhaps sub-personally). However, emphasizing that it is the speaker-hearer who knows the syntax of the language is apt to suggest that the person is the locus of the syntactic competence, making the competence subject to person-level epistemic evaluation. I suspect that this understanding is quite widespread. The point I have been emphasizing, however, is that the person is not necessarily the locus of the competence. Many of our cognitive accomplishments are properly credited to sub-personal components of the mind (which may or may not be modular). You cannot take credit for what goes on within the subsystems of your mind any more than you can take credit for what goes on within your digestive system. The mere fact that it goes on within your mind rather than your stomach does not make it something that you are properly credited with doing.

What is particularly instructive about the example is that it suggests that there is a division of labor between the person-level and the sub-personal. This would make some aspects of linguistic competence

warrant apt and others not. It is not up to the speaker-hearer to determine the range of interpretations of a pronoun that are permitted by Principle C and background facts about c-command. This is something that is determined by a sub-personal parser, which only makes available those interpretations that are syntactically possible. The parser is not properly evaluated as warranted or unwarranted, and consequently neither is the syntactic competence it deploys. However, if the parser leaves open a range of syntactically possible interpretations, it may be left up to the speaker-hearer to decide on the appropriate one, drawing on relevant background knowledge. This contribution by the person to the interpretation of speech is properly subject to evaluation as warranted or unwarranted, but the prior sub-personal contribution is not. So the epistemic status of any particular bit of syntactic competence turns on an empirical question about whether that competence is deployed by the person or deployed sub-personally.

The important empirical question about the psychology that bears on the epistemology is not whether speech comprehension is modular, but rather whether the linguistic competence brought to bear is deployed by the person or deployed sub-personally. This puts all of the weight on the distinction between the person-level and the sub-personal. Let us turn now to the question of how this distinction is to be drawn.

5.

It is perhaps natural to associate the sub-personal with the unconscious and involuntary—cognitive processes we have no conscious insight into or control over. So it would be natural to demarcate the person-level from the sub-personal along these lines. Yet, while sub-personal psychology is *typically* unconscious and involuntary, I do not think this is the appropriate basis for the distinction. We can readily make sense of the idea that persons do things unconsciously—that they can be credited with doing things they are not conscious of doing. I might tap my foot under the desk, or shift gears while driving my car, but without being particularly aware of doing so. Nevertheless it is me (the person) who taps my foot or shifts the gears. If this is right, then the sub-personal is not distinguished from the person-level by virtue

of being unconscious. It also seems that a cognitive capacity does not have to be voluntary in order to be credited to the person. Beliefs are paradigmatically person-level states, and yet James (1897) makes a convincing case that, contrary to the ideal of rational deliberation, very little of what we believe is the result of a choice or voluntary act of will by the believer. Many of our beliefs are foisted upon us by the world around us, rather than being chosen upon consideration of the evidence. Yet, even if James is right that belief is foisted upon us involuntarily, this does not make it sub-personal. Importantly, it does not exempt those beliefs from evaluation as warranted or unwarranted. So neither being unconscious nor being involuntary is what is distinctive of the sub-personal.

While the notion of modularity is too strong for my purposes, thinking about how we might weaken it is instructive as to how to draw the distinction between the person-level and the sub-personal. Fodor conceives of a module as a dedicated processor—a locus of cognitive activity—that is specialized for a particular task and restricted in the range of information it can bring to bear. As we saw in the previous section, the argument that syntactic competence is not warrant apt turned only on the idea that the competence is deployed by a locus of cognition that is distinct from the person (and not itself a person). It is this that is supposed to exempt the competence from evaluation as warranted or unwarranted, since it is only persons (and information states deployed by persons) that are properly subject to such evaluation. That the person is not the only locus of cognition in the human mind was an empirical discovery of fundamental importance to cognitive science. Lesion data—visual agnosia, aphasia, and other selective cognitive impairments—are a key bit of evidence for this. Such impairments suggest that there are distinct (to some degree autonomous) loci of cognition that underlie these capacities. Yet the lesion data leaves it largely open to what degree these cognitive loci are modular—the degree to which they are dedicated, specialized, informationally encapsulated and so on. For present purposes we can leave this an open question. The important point is not that the locus of cognition *is* modular, but rather that the locus of cognition is *not* the person.

The point is usefully understood by way of contrast with belief. There are at least two ways in which the person is the locus of belief, in

a way that the person is not similarly the locus of syntactic competence. First, while James is probably right that belief is not subject to the will to the degree that we perhaps like to imagine, we do have the capacity for rational revision of belief. This makes the person a locus of *control* over what is believed, even if the revision of belief such revision of belief is more a matter of being receptive to relevant reasons or evidence, rather than an act of "will to believe." The second way in which the person is the locus of belief is nicely captured by Evans' (1981) suggestion that "It is the essence of a belief state that it be at the service of many distinct projects, and that its influence on any project be mediated by other beliefs." A person can manifest a belief in an indefinite variety of ways, subject to the influence of their desires and other beliefs. The person can *act* on the beliefs in various ways or *draw inferences* from it (forming new beliefs). The person thus has the ability to deploy the belief in an open-ended variety of ways. In this respect, the person is not just a locus of control over what is believed, but also a locus for the *deployment* of the belief.

A native speaker's syntactic competence seems to differ from belief in both of these respects: the person is neither a locus of control over syntactic competence, nor the locus of its deployment. Native speakers lack the capacity for rational revision of the syntactic competence that they have for their beliefs. The initial obstacle for such revision is that most native speakers would be unable even to recognize the linguistic evidence that would be relevant to rationally revising their syntactic competence. Most native speakers would simply not be equipped to evaluate the evidence that bears on the truth or falsity of Principle C.[20] Yet even theorists who understand the linguistics do not have rational control over their native syntactic competence. As a theorist, I might come to be convinced (on theoretical grounds) that 'he' in (3) can indeed refer to the policeman or the robber (contrary to Principle C). Yet my native understanding of that sentence still prohibits this interpretation. This is very much like the way an illusion can persist (e.g., the Müller-Lyer illusion), even when you know that it is an illusion. While I might revise my belief *qua* theorist about what 'he' refers to, I do not thereby revise my intuitive understanding *qua* native speaker about what (3) can mean. This suggests that the person is not the locus of *control* over the underlying competence.

The person does not seem to be the locus of *deployment* of that competence either. Whereas beliefs are "at the service of many distinct projects," a speaker-hearer's competence in the syntax of a language is deployed *only* in language cognition. A speaker-hearer's competence with respect to Principle C is manifested solely in their comprehension and production of sentences containing anaphoric pronouns. Moreover, this inability to manifest this competence in any other domain is not merely because Principle C is not relevant to any other domain. We can imagine circumstances that would make this competence relevant to the speaker-hearer's projects (e.g., taking a course in syntactic theory), but this information is simply not available for the person to deploy arbitrarily in any novel domains it might be relevant to. Of course, native competence in a language provides an extremely rich source of evidence about the syntax of the language, thereby providing a basis for forming syntactic beliefs. But the point is that the competence itself—that which supplies the basis for forming those beliefs—is not available to the person to act on or draw inferences from in arbitrary ways. It is not "at the service of many distinct projects." The point can be brought out by analogy with the visual system. Being sighted provides one with a rich source of evidence about the workings of the human visual system—a basis for forming beliefs about vision. Yet, whereas those beliefs can be deployed by the person in an open-ended number of ways, the mechanisms of the visual system themselves have no other outlet than vision. Similarly, whatever syntactic beliefs one might form by reflecting on one's own competence, the syntactic competence itself has no other outlet than language cognition.

The sheer complexity and abstruseness of syntax makes for a very strong case that the person is not the locus of syntactic competence. There is a certain core psychology that is constitutive of the person, including certain general-purpose cognitive abilities—importantly a general ability to understand things and reason about them. This constitutes a central locus of cognitive activity. Part of the reason for postulating other loci of cognition is that the sophistication of some cognitive accomplishments far outstrips the general cognitive abilities of the person. One reason for not crediting a sighted person with sophisticated aspects of visual processing is that the core cognitive abilities of the person are simply not up to the task—most of us aren't smart enough

to figure out how to see. This is corroborated by the lesion data. The fact that visual capacities can be selectively impaired, while the core psychology of the person is spared, provides further evidence that the ability is subserved by a distinct locus of cognition. The complexity of natural language syntax similarly provides evidence that the person is not the locus of syntactic competence—most competent speakers (*qua* persons) simply aren't smart enough to figure out the syntax of their language, or even recognize the relevant evidence. Again this is corroborated by lesion data. In cases of Broca's aphasia, a person's syntactic competence can be severely impaired, while the core psychology of the person is largely spared. Again, this suggests that there is a locus of cognition distinct from the person that underlies the syntactic competence.

The phenomenon of meaning deafness provides a key bit of evidence that the same is true for *semantics*. As we saw, what is initially puzzling about the phenomenon of meaning deafness is how auditory speech comprehension can be impaired, even when the speaker-hearer seems to possess all the relevant information: how could the person hear the words, know what they mean and yet somehow be unable to put this information together? Yet this is puzzling only if we suppose that there is a single locus of cognition (viz. the person). What the phenomenon of meaning deafness suggests is that the person is not the only locus of cognitive activity in speech comprehension. Specifically it suggests that speech comprehension is subserved by cognitive loci distinct from the person and that bring to bear information about the semantics of the language to interpret speech. It seems plausible that the same mechanisms of semantic interpretation that are at work in speech comprehension are also at work in speaking, reading and writing; we don't have to acquire our semantic competence completely anew for each capacity. So the most plausible explanation of how one of these capacities can be impaired would postulate a disruption of the access to those semantic mechanisms, rather than an impairment of the semantic mechanisms themselves. That is, the most plausible explanation of meaning deafness would be to suppose that what is impaired is the *route* by which the mechanisms of semantic interpretation are brought to bear on auditory perception.

The idea that the person is not the locus of deployment of seman-

tic competence is corroborated by the phenomenon of semantic priming.[21] The experimental paradigm for priming studies involves presenting subjects (e.g., on a screen) with orthographic strings that are either words or non-words. The subjects are given the experimental task of indicating for each whether it is a word or a non-word. Call this the *target*. Immediately before each target is displayed, a word is flashed on the screen (this one is always a word). This is called the *prime*. It turns out that when a target word is semantically related to the prime, subjects are significantly faster at identifying it as a word. For example, subjects will identify the word 'doctor' as a word significantly faster when it is preceded by 'nurse' than when it is preceded by 'banana'. Surprisingly, this effect has been demonstrated in 'masked' priming studies in which the prime is displayed for only a fraction of a second, such that the subject cannot identify the prime. That is, the word 'nurse' primes 'doctor' (though 'banana' does not), even when subjects are unable to tell what word appeared before 'doctor'. Since the effect appears to be by virtue of the semantic relationship between the words, this suggests that semantic information is deployed without conscious access on the part of the person, which suggests that the person is not the locus of deployment for that semantic information.

Despite such evidence, the idea that semantic competence is deployed sub-personally is counter-intuitive, more so than in the case of syntax, perhaps because we think of ourselves as having more insight into the meanings of words than we have into the syntactic structure of sentences. It seems more plausible to credit a competent speaker (*qua* person) with believing that 'dog' refers to dogs than to credit them with beliefs about c-command or the principles of Government and Binding Theory.

However, while we can clearly credit speakers with beliefs about the meanings of words, it is not obvious to what extent such beliefs are constitutive of the underlying semantic competence. Consider what current linguistic theory tells us about the semantics of the verb 'seem'. The verbs 'want' and 'seem' are thought to differ in the argument structure they project, such that the superficially similar (4) and (5) differ in their underlying syntax and semantics.

(4) John wants to like Jane.

(5) John seems to like Jane.

Whereas 'want' takes its subject term 'John' as an argument in (4), corresponding to the experiencer of the desire, 'seem' does not similarly take 'John' as an argument in (5). Instead, it is thought that 'John' occurs as the subject of (5) as the result of a syntactic displacement from the complement clause. Semantically, the referent of 'John' is construed as an argument of the verb 'like'—the experiencer of the liking—not the verb 'seem'. So whereas 'want' takes two arguments, the referent of 'John' (specifying the experiencer of the desire) and the semantic value of 'to like Jane' (specifying the content of the desire), 'seem' takes as argument a single argument, something like the proposition that John like Jane (specifying the content of the seeming). This is a lexical-semantic difference in the argument positions projected by 'want' and 'seem'. If this is right, then crediting speakers with knowing that 'seem' denotes the relation of seeming and 'want' denotes the relation of wanting doesn't begin to capture the underlying lexical-semantic competence.

Yet even for expressions with rather less exotic lexical semantics, insofar as the semantics of natural language is compositional, lexical-semantic competence has to be deployed in speech comprehension via the syntax of the language. So even if we can credit a speaker (the person) with believing that 'dog' refers to dogs and this is (more or less) constitutive of the lexical competence, deploying this competence involves parsing the phrases it occurs within (definite descriptions, generic plurals, quantified noun phrases, etc.) and interpreting them accordingly. As we have seen, there is a strong case to be made that the person is not the locus of such competence. So even if we can properly evaluate a person's beliefs about the meanings of their words as warranted or unwarranted, the contribution they make to the comprehension of speech may be immune to such evaluation. That is, we might be able to evaluate whether the person is warranted or unwarranted in believing that 'dog' refers to dogs, but we cannot evaluate whether the person's parser and semantic interpreter are warranted or unwarranted in the interpretations they assign to complex phrases in which 'dog' occurs. The parser and interpreter, precisely because they are not persons, are not subject to epistemic norms of rationality; no question arises about whether they are warranted in how they interpret utterances. We can ask whether they interpret utterances correctly or

whether they do so reliably, but there is no question of whether they have adequate reason or evidence to interpret utterances as they do. So, insofar as the person is not the locus of linguistic competence, it is a mistake to think of that competence as standing in need of evidence.

6.

There is an obvious general objection to the idea that linguistic competence is deployed sub-personally, one that needs to be addressed. It might seem that our capacity to *speak* a language seems to require that the person be the locus of linguistic competence. While speech *comprehension*, because it is largely passive, can plausibly be understood as something that occurs sub-personally within the speaker, things look very different when we turn our attention to speech *production*. Speaking is not something that simply happens within a person. It is something the person *does*. Moreover, it is something the person does that is somehow informed by their competence in the syntax and semantics of the language. This would seem to commit us to supposing that the person is the locus of deployment of that competence. This, in turn, would entail that (contrary to what I have argued) linguistic competence is warrant apt. In speaking a language, it is *the person* that takes on certain syntactic and semantic commitments by virtue of how they speak the language, and there is a real question about whether the person is warranted in those commitments (e.g., by the available evidence).

Yet, in light of the preceding discussion, there is something suspicious, even in the case of speech production, about the idea that the person is the locus of linguistic competence. We have no more insight into the syntax and semantics of our language in speech production than we have in speech comprehension. We have no more ability to rationally revise or arbitrarily deploy that competence. It seems no more plausible to credit the speaker-hearer (the person) conforming to Principle C is in speech *production* than it was in the case of speech *comprehension*. The person is in no better position, *qua* speaker, to determine whether the relation of c-command holds.

While we clearly should credit the person with agency over speaking, it is not clear that this commits us to crediting them with agency

over the syntactic and semantic details of doings so. Motor control of bodily movements provides a good model for this. When I take a sip of my coffee, I (the person) can be credited with picking up my coffee cup. In the course of doing this, specific muscles contract in very specific ways in order to move my hand and arm in just the right way. While I can be credited with picking up my coffee cup, it seems implausible to credit me with agency over the details of execution, which are almost entirely opaque to me. There seems to be a kind of division of labor between me and my motor system. The person is the locus of the act, but the motor system is the locus of execution of the neuromuscular details. This is not to suggest that the person merely initiates the act. The person maintains a level of monitoring and control during the execution of the act, but not at the level of neuro-muscular activity. This has something to do with the representation of the act through which the person exercises control over it. It is represented as a particular movement of the arm, not as a constellation of neuromuscular activity.

Something similar is true of speech production. We exercise agency over speech production (roughly) at the level of the *content* of speech. The compositional-semantic details of execution—what goes into determining the content—are handled sub-personally. The decisions we make as speakers in the course of speaking are about *what* to say. The syntactic and semantic details of how to say it are largely worked out sub-personally. This is not to suggest that we are not capable of choosing our words carefully. The idea is that the choice of words is guided by a grasp of the difference the choice of words makes to the *content* of speech. This does not give us any particular insight into the syntactic principles or compositional semantics that enter into determining that content. For example, a competent English speaker grasps what (3) can be used to say, subject to the constraint imposed by Principle C, but this does not give them any particular insight into what the underlying constraint is—that the pronoun cannot be co-indexed with a noun phrase it c-commands. Whether the c-command relation obtains and which interpretations are possible subject to the Principle C is determined sub-personally. Only syntactically possible interpretations are made available to person-level psychology to inform speech production.

This constitutes a mere sketch of what the psychology of speech production might look like. But it serves to illustrate how there might be a division of labor between person-level and sub-personal psychology, such that crediting persons with agency over speech production does not commit us to supposing that the person is the locus of deployment of syntactic and semantic competence. The person is the locus of control over the force and content of speech, but not necessarily the locus of execution of the syntactic and compositional semantic means of expressing it.

7.

To return to the central epistemological theme, I have argued that to the extent that the person is not the locus of linguistic competence, linguistic competence is not warrant apt—not properly subject to being evaluated as warranted or unwarranted. There is no question of whether the sub-personal mechanisms of language cognition are warranted or unwarranted in the competence they deploy (e.g., by the available evidence). If this is right, then we should reject the idea, widely implicit in much philosophical theorizing about language, that linguistic competence stands in need of evidence.

This evidential picture of our epistemic relationship to language is made explicit in Davidson's thought experiment of the radical interpreter. The radical interpreter is confronted with the task of discovering the syntax and semantics of a language from the available external evidence. Davidson takes speakers to be in the same epistemic predicament; we are all radical interpreters. We can concede that we are all in the predicament of having to somehow or other *acquire* our language from exposure to a community of speakers. That exposure, together with whatever innate contribution might be made by the mind itself (universal grammar, innate learning biases, or whatever), must be *causally* sufficient to produce the competence. What is not obvious is that such exposure must also epistemically warrant that competence by providing evidence of its correctness. What I have argued is that such evidence is called for only insofar as the person is the locus of the competence.

It is an empirical matter which aspects of linguistic competence

are deployed sub-personally. As I have suggested, a speaker's global competence is almost certainly a mixture of the personal-level and the sub-personal. The evidence canvassed here suggests that a speaker's core syntactic and (compositional) semantic competence is deployed sub-personally. If this is right, then such competence is not warrant apt. As I have argued, this has far reaching consequences for the epistemology of speech comprehension and the epistemology of testimony. It also undermines the evidential picture of our epistemic predicament as speakers, from which Davidson's argument for indeterminacy proceeds. While I take the psychological phenomena discussed here to be compelling evidence that a speaker's core competence is deployed sub-personally, there are no knock down arguments in empirical matters. The important point, however, is that it is an empirical matter. The philosophical aim has been to show how the right account of the epistemology does turn on empirical questions about the psychology.

Notes

[1] I have benefited greatly from many discussions about material with various people over the years, including Dorit Bar-On , Michael Glanzberg, Guy Longworth, Bill Lycan, Ram Neta, Gurpreet Rattan and Barry Smith. Special thanks to Dorit for helpful and detailed comments on this paper. Special thanks also to Bill Lycan for comments on an earlier version.

[2] Very different versions of this idea have been developed by Fricker (2003), Millikan (2004), and Smith (2009). (Also see Smith's contribution to this volume.) I elaborated a version of this view in Pettit (2001). Consequences of the view for the liar paradox are explored by Patterson in his contribution to this volume.

[3] For discussion of this issue see Longworth (2008b) and his contribution to this volume. My own view on this issue is elaborated in Pettit (2002).

[4] I am sympathetic to Burge's (1993) account of the epistemology of testimony. See Longworth (2008a) for discussion and criticism. Burge's focus is slightly different from mine. He focuses on the epistemology of testimony and the role perception plays in the transmission of knowledge from one speaker to another. My focus is on the epistemology of speech comprehension (how we know what speakers say) and the role linguistic competence plays.

[5] See Heck (2006), footnote 17 on p. 42

[6] Chomsky is widely taken to have backed off on the claim that speakers know the grammar of their language, in favor of the weaker claim that they cognize the grammar. He hasn't. Chomsky still maintains that grammatical competence is knowledge, indeed a paradigmatic instance of knowledge. It is not even an open question for epistemology to decide. The interesting (empirical) issues, for Chomsky, concern what speakers know, how the knowledge is acquired and how it is put to use.

[7] This is roughly what Bar-On (2004) calls the 'Theory'-Theory of linguistic under-

standing.

[8]For Davidson, the facts about meaning are constituted by the practice of radical interpretation by speakers. It is this practice of trying to interpret one another that fixes the facts about meaning, insofar as there is any determinate fact of the matter.

[9]Cowie (1999), a stern critic of nativism, argues that there has to be some innate contribution to language acquisition, if only innate learning procedures. The substantive question is whether the innate contribution is specifically linguistic in nature (e.g., universal grammar).

[10]This is not the way the issue is framed in the linguistics literature. The assumption is that speakers do achieve competence in their language *in some form or other*. The initial empirical issue is what the substance of that competence is. This is the central project of current linguistic theory. The second empirical issue concerns how that competence is achieved (and the role external stimuli play in achieving it). Innate mechanisms of acquisition are postulated to bridge the gap between the competence that is achieved and the contribution external stimuli make toward achieving it. Here again, the question of whether the competence is underdetermined by its evidential basis does not arise. On this view of things, the relationship between the external stimuli and the competence is not an evidential one.

[11]See McGee (1998), for example.

[12]Millikan (2004) develops a very different version of the perceptual view. On her view, when you tell me that it is raining in Berlin, what I hear is *the raining in Berlin*. On the version of the perceptual view that I develop in Pettit (2001), what I hear is that it is raining in Berlin (rather than hearing that you said it is raining in Berlin). On this version, the content of my auditory experience of your utterance has the same content as your utterance itself. I won't attempt to defend this idea here.

[13]On Fricker's view, a speaker-hearer's competence in the syntax and semantics of a language can enter into the grounds for our beliefs about the content of speech, only insofar as the syntax and semantics is reflected in the phenomenology. Fricker does suggest that complex phrases or sentence will seem to have a particular syntactic structure, and that a meaningful constituent will seem to have a particular meaning. Yet an uttered sentence will also seem to have a particular force and content. It is this seeming that supplies the grounds for the hearer's belief about the content of the sentence, not an inference from background syntactic and semantic knowledge.

[14]For the record, I am not convinced by this criticism of welfare. What robs people of the incentive to work is a lack of opportunities for meaningful work that offers a living wage. Welfare merely undermines the incentive poverty would otherwise provide to settle for meaningless low-wage employment.

[15]There is a debate about this in the neurologic literature. The evidence that auditory acuity is normal in cases of word deafness owes to tests that show they can hear a normal range of pure tones. Yet there is evidence that some subjects have an impaired ability to discriminate sequences of short tones that occur in quick succession. One hypothesis is that their ability to recognize words is impaired because word recognition is especially demanding of this ability, much more so than the recognition of environmental sounds. Auditory word recognition depends on our ability to identify the individual speech sounds that make them up. This alternative hypothesis has it that there are no language-specific mechanisms at work in auditory perception, but rather general purpose mechanisms of sound recognition. Word recognition can be selectively impaired merely because it is especially demanding of these mechanisms.

[16]Recent cases of meaning deafness are described by Kohn & Friedman (1986), Franklin, et. al. (1996), and Hall & Riddoch (1997). The phenomenon was originally described by Bramwell (1897). Bramwell's article is reproduced in Ellis (1984).

[17]Indeed, this is precisely what seems to be going on in cases of what is called ***semantic dementia***. Semantic dementia involves a cross-modal impairment of comprehension, but with preserved fluency of speech production.

[18]This cannot be exactly right, in light of Stanley's point about context sensitivity, which we will come back to.

[19]This issue plays out in the debate within the neuropsychological literature about whether word deafness is attributable to perceptual mechanisms dedicated to language, or a general impairment of the ability to discriminate sounds over time that happens to affect speech perception disproportionately.

[20]Ordinary speakers are not equipped to evaluate the evidence that would bear on Principle C, because they lack any understanding of the c-command relation in terms of which Principle C is formulated. The c-command relation, as mentioned above, supervenes on the hierarchical structure of the sentence, not the linear order of the words that make it up. This hierarchical structure is a product of the asymmetric relationship between a head and complement that underlies the syntactic derivation of all phrases. This hierarchical structure of phrases underlies all substantive grammatical principles. Most fundamentally, ordinary speakers are not equipped to rationally revise their syntactic competence, because they have no particular insight into the fact that language has this hierarchical structure.

[21]The original experimental paradigm goes back to Meyer & Schvaneveldt (1971). For a useful summary of recent work in the area see McNamara (2005).

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