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Rethinking the Divide: Modules and Central Systems

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Abstract In this paper I argue that the cognitive system is best viewed as a continuum of cognitive processing from modules to central systems rather than having these as discrete and wholly different modes of cognitive processing. I rely on recent evidence on the development of theory of mind (ToM) abilities and the developmental disorder of autism. I then turn to the phenomenology of modular processes. I show that modular outputs have a stronger force than non-modular or central system outputs. I then evaluate social cognitions and show them to occupy a middle ground with respect to phenomenal strength between modular and non-modular outputs. The evidence presented then seems to indicate a continuum of cognitive processing rather than the traditional division between modules and central systems.

Keywords autism · modules · central systems social cognition · theory of mind

Introduction

Since the publication of *Modularity of the Mind* (Fodor, 1983) over 20 years ago, modularity has occupied a central role in the philosophy of psychology and cognitive science. Modularity has been relied upon as a theoretical basis for the explanation of language development (Pinker, 1997), an explanation of our ability to understand mental states (Botterill & Carruthers, 1999) as well as an explanation as to the root cause of autism (Baron-Cohen, 1995). Some views of modularity and their corresponding use of the concept in understanding psychological activity are restricted to lower level sensory processing, (Fodor, 1983) whereas others are "massively modular" and claim that many of our upper-level cognitive functions are subserved by modules (Barkow, Cosmides, & Tooby, 1992). While there are those that decry any modularity that proffers more modules than exist at the sensory periphery (Fodor, 2001), others find that the use of modularity in a

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looser sense is a laudable practice (Botterill & Carruthers, 1999). Some views critique the requirement of informational encapsulation (Appelbaum, 1998) while yet others maintain that informational encapsulation is unproblematic (Gerrans, 2002). Modularity is a many splintered thing.

The aim of this paper is to demonstrate that the cognitive system is best viewed as a continuum of cognitive processing rather than having modules and central systems as discrete and wholly different modes of cognitive processing. I will urge that theorists view our cognitive architecture as not restricted to or exhausted by modules and central systems. There is an intermediary level of processing, exemplified by certain forms of social cognition, that is in many respects modular in behavior but not completely informationally encapsulated. This view contrasts with the typical views in modularity debates wherein it is generally accepted that one is either a modularity theorist of the Fodorian type, or one is committed to a "massively modular" view of the mind. I will show this to be an inappropriate restriction of the choices available for research and theories of cognition.

To support my contentions, I recount the large body of literature, some well known and some less so, which implies that there is a domain of cognitive function regarding our understanding of others' minds (ToM knowledge). I then focus on the developmental disorder of autism as it highlights this domain. I bring to the fore recent research on autism that further supports the view that autism is a more highly domain specific disorder than is currently appreciated. However, there is a problem for any theorist arguing from a traditional modularity approach who wishes to claim that ToM processing is modular. Informational encapsulation is violated. Those who wish to claim ToM processing is modular are thus left with the untoward task of reconciling modularity with what is known about our knowledge of other minds. Theorists either remain committed to an austere version of modularity (Fodor, 2001) or espouse the sort of massive modularity that is oft criticized (see H. Rose & S. Rose, 2000 for an extended critique of evolutionary psychology). ToM processing and autism seem to present a prima facie strain on the traditional divide between modules and central systems.

Secondly, I rely on a comparison of the phenomenology of various cognitive activities from modular outputs and central system products to show a range of phenomenological strength. I will argue that there is an interesting relation between the type of cognitive process occurring and attendant phenomenological force of the outputs of the cognitive function in question. When we compare the phenomenology of certain exemplars of modular cognitive activity such as the perception of the Muller-Lyre illusion with other cases of cognitive processing such as traditional beliefs ($2 + 2 = 4$) and ToM cognitions (that person is eyeing me oddly) we find a range of attendant phenomenological strength which varies directly with the type of processing which gives forth the output.

Development, Autism and Modularity

In this section I argue that ToM knowledge is a type of processing which seems to be the result of modular processes. Further, autism, with its specific core of deficits, indicates that there is an area of higher level cognition (ToM) which seems to act in many ways as if it is modular. Indeed, other researchers (Currie & Sterelny, 2000) agree that human social interaction is enough of a domain which admits of a type of modular processing. Still other researchers have argued (Barkow et al., 1992; Baron-Cohen, 1995) that human social interaction is the result of fully modular processes (though not exactly modular processing of a Fodorian type) and this processing is highlighted by autism. In addition, there is recent research on social cognition which further supports the prevalent notion that ToM is a domain subtended by dedicated cognitive processes.

Theory of Mind Development and Modularity

Fodor argues that modules possess nine properties. What I call Fodor's 9 are as follows:

(1) Domain specificity
(2) Mandatory operation
(3) Limited central access
(4) Fast processing
(5) Informational encapsulation
(6) Shallow outputs
(7) Fixed neural architecture
(8) Patterned or fixed deficits
(9) Characteristic ontogeny

To a greater or lesser extent these are the characteristics of a cognitive module. Some modules may possess a fewer number of these qualities than others. But Fodor believes that where there are a few of these characteristics, there will likely be the others as well. ToM knowledge and autism seem to demonstrate a number of these traits.

Recent research by Puce and Perrett (2003) has demonstrated that there are dedicated neural systems for the processing biological motion.[1] The movements of hands, faces and eyes are particularly salient stimuli in arousing specific groupings of neurons. As is well known, infants are able to follow the gaze of others as well as track the pointing gesture of others around the age of 8–12 months (Baron-Cohen, 1995). Furthermore, research by Woodward, Sommerville, & Guajardo (2003) has shown that young children have a complex and detailed understanding of intentional action. They have shown that children will attempt to complete actions adults fail to accomplish. So, in cases where an adult is reaching for a cup and fails to achieve this result the child will attempt to complete this action. Such behavior develops between the ages of 14–18 months.

There is also a host of data on imitation in infants and children.[2] Meltzoff and Brooks (2003) claims that imitation allows the child to make a 'like me' judgment. For example, when the child imitates smiling, the concomitant pleasant affective shift which occurs allows the child to know that smiling indicates a pleasant internal state of another. According to Woodward et al. (2003, pp. 151–155), children are more likely to imitate intentional action than accidental acts. They thus conclude that the recognition of intention is helpful in defining the types of behaviors that are of interest to mimic.

The refrain often heard in articles on infant cognitive development is that there is much more in the child's head than Piaget ever expected. Particularly surprising is the wide range of ability that infants and toddlers show in appreciating mental states. The above findings related to mental awareness have led researchers to conclude that there is a domain of cognitive processing specifically for social/ToM stimuli. Finding a "domain" is the first of

[1] Biological motion is the mimicking of human or animal movement by point light displays. This research was first begun by Johansson (1973).

[2] Exactly what the implication of imitation evidence means to ToM issues is unclear. Sterelny (2003) argues that imitation coupled with general cognitive processes allowed for much of hominid cultural development. Whereas others, Gopnik and Meltzoff (1996) have argued that this basic ability supports theoretical learning in general. It seems the evidence is equivocal.

Fodor's (1983) requirements for modularity: domain specificity. While it is an important first step in modular research to identify a domain, this is merely heuristic. In order to establish that there are modules processing the input from this domain, more needs to be done. While it isn't clear the vast world of the "social" could be accounted for by modular processing (see Fodor, 1998 for an argument concerning the difficulties in modeling along computational lines the social world), there are ongoing research programs which attempt to show that ToM processing does have special modules or circuits.

One example of modular ToM modular processing comes from Baron-Cohen (1995). According to Baron-Cohen's theory, specific computations subtended by modules dedicated to a specific set of inputs do take place relevant to human social interaction. Baron-Cohen's theory of mindreading depends on our ability to recognize certain specific characteristics of minded creatures. We have a module for detecting intentional action (IDD), for detecting eyes and eye-gaze (EDD) and a module for realizing that others are attending to objects (SAM). These three modules feed forward into a theory of mind mechanism (ToMM) which gives us our ability to recognize false beliefs as well as a myriad of other ToM tasks. Breaking the problem of mindreading down into component parts, such as intention and attention detection makes the computational demands more tractable. An example of further making such difficult computations more tractable comes from additional research currently underway.

In a study by Rittscher, Blake, Hoogs, and Stein (2003) researchers are working through a number of possible computational architectures to model the perception of intentional action. They further study the plausibility that such programs could be implemented in the brain. There are further research efforts under way which demonstrate that the social realm is eccentric enough of a domain to allow for modules to react to tokens of social interaction. Specifically, Currie and Sterelny (2000) hypothesize that there is a secondary module, dedicated to ToM type of input, which tags perceptual content as "social" in order to help identify for the central system relevant perceptual inputs for later belief formation.

Thus, it seems there is ample evidence to admit that the social domain is a domain, and that there is the strong possibility of computationally modeling such a domain in a modular fashion. While current attempts may have their difficulties the ongoing research cannot simply be dismissed with the skeptical claim that the social domain is simply too heterogeneous to develop a module which might effectively process its input (Fodor, 2001).

There are yet other ways in which ToM knowledge seems to fit Fodor's requirements for modularity. The pace and growth of children's social knowledge (characteristic ontogenetic development) is reminiscent of how many researchers, including Fodor himself, treat language (a prime example of modularity). The relative stability of language learning across children and cultures, coupled with the specific type of knowledge language seems to represent, often lead researchers to posit some sort of innate knowledge structure that has to account for the rapidity and ease at which children learn language. Also, when children are deprived of sufficient linguistic input they are severely hindered at becoming competent language users. This fact is often cited in support of the contention that the language module is only active for a critical period, thus adding to the notion that there is a specified, native section of the mind/brain specific to language.

The similarities that social knowledge development and language learning share seem to reinforce the idea that ToM learning is a predisposed, structured (highly canalized) developmental ability. The type of development we see in children as they become more facile at using ToM explanations seems to be more structured than a central system, with its widely holistic processes, could hope to generate based on experience alone. ToM learning is not as straightforwardly holistic as other information processing that occurs in the central system. Rather, it is constrained to the broad domain of social knowledge in fairly recognizable ways: young children learn first about intentions, then desires and finally beliefs (Wellman, 1991).

Another property of modular processes is mandatory operation: number of 2 of Fodor's 9. In certain situations, very young children seem to automatically infer that certain objects or perform acts in intentional ways: i.e., objects as agents. As research is beginning to bear out, infants are predisposed to see the world as inhabited by intentional agents and artifacts (Johnson, 2003). According to this research, infants as young as 12 months rely on morphological and behavioral cues to recognize intentional movement. Young children readily interpret actions by others in mentalistic terms and these interpretations require very little prompting. For instance, when presented with animation depicting a circle, square, and triangle moving up an incline, the children tend to interpret those acts as being performed by intentional creatures rather than as simple acts of objects.[3] Persons with autism, when presented with the same stimuli, will not interpret them in the same way (for more information see Malle, Moses & Baldwin, 2003). Further, we typically have no conscious control over attributing or interpreting certain actions as intentional, regardless of prior knowledge.

Other research on the perception of intentional action also indicates that there are specific neural mechanisms for the accomplishment of such goals (Batki, Baron–Cohen, Wheelwright, Connellan, & Ahluwalia, 2000; Puce & Perrett, 2003). A dedicated neural mechanism(s) is requirement 7 in Fodor's requirements of modularity. Research by Puce and Perrett (2003) implicates the superior temporal sulcus (STS) is involved with perception of biological motion and of faces. In addition, persons with autism show that they process face perception information outside the fusiform gyrus (Pierce, Muller, Ambrose, Allen, & Courchesne, 2001). This last finding not only supports the idea that there is a dedicated neural mechanism for certain forms of socio-cognitive tasks, but that there can be selective damage to it that effects those sorts of processes. This sort of characteristic breakdown is also an important part of modularity: characteristic 8.

Overall, it seems that there is ample evidence to support the contention that ToM knowledge is modular. The domain of ToM, though heterogeneous, is eccentric enough to be a domain. There is physiological and cognitive evidence that there are specific areas and computational resources devoted to ToM processing. ToM processing is, in many ways, uncontrolled and impervious to other relevant knowledge we might have. And finally, when we next turn to the disorder of autism, there seems to be a characteristic breakdown pattern affecting ToM processing associated with autism. As we will see, the characteristic breakdown pattern associated with autism highlights another property of ToM knowledge: characteristic ontogenetic development. Overall, it seems ToM knowledge fits many of the criteria required of modules.

[3] I am here thinking of the presentation of various shapes that interact in ways that can be described as intentional. When presented with a movie of a square getting in the way of a triangle moving toward a basket, children generally interpreted the action as intentional. "The square impeded the triangle from going where it wanted." Presentations of this nature have been widely used in understanding young children's knowledge of intention.

Autism and Modularity

Now that we have dealt with the domain of the social and the possibility of computational solutions to the processing thereof and the other reasons one might plausibly view ToM processing as modular, we must look more closely at clinical disorder of autism. Autism, with its specific cluster of deficits seems to highlight the other ways in which ToM processing might be modular.

As we have seen above, another property of modules is feature 8: characteristic breakdown pattern. The specificity of autistic deficits point to a domain of knowledge that the person with autism is unable to process (Russell & Shamara, 2001) If a module subserves a specific function and that module is damaged, then we ought to see infelicities of function. Autism seems to show exactly the type of specific breakdown pattern one would expect from a damaged module(s) dedicated to ToM processing. Persons with autism are often unable to learn or explain that other people act in ways that are often concordant with the beliefs and desires a person is taken to hold. They are unable to appreciate that others might have beliefs other than their own or that these beliefs might be at odds with the way the world is (see the wide variety of false-belief tasks, Baron-Cohen, 1995). Furthermore, persons with autism do not appreciate humor, which has an ineliminable social component (Reddy, Williams, & Vaughan, 2002). It should also be stressed that the autistic pattern of breakdown does not have reliable effects outside the realm of human social interaction. That is, there are no reliable findings concerning autistic behavior that seem to imply that there are other areas of central system activity, certain features of Executive Control such as planning, that are impaired by the autistic disorder (Ozonoff & Strayer, 2001).

As recent research is beginning to bear out, persons with autism have a variety of preserved cognitive abilities, thereby making the disorder more specific than traditionally envisioned. Persons with autism hold many different types of beliefs about the world and can formulate plans of action, mental or otherwise. They are also able to function quite well in areas in which social knowledge is not at a premium. Music, mathematics and art are all areas in which some autists excel. Many autists' abilities show them to be capable of having beliefs about any number of areas, with little to no problems evidenced within that area, which seems to exclude a general cognitive problem as the root cause of autism.

Temple Grandin (a high-functioning autist) certainly has beliefs about the effectiveness of her designs, and Jessy Parks (a well-known artist with autism) has beliefs about the arrangement of paints on her palette and the amount of money in her checking account. These cases show that persons with autism do not have a general problem with forming beliefs; they just have difficulty with forming beliefs about others' beliefs. The specific problem that they have in forming social knowledge exemplifies the characteristic breakdown pattern that modules are supposed to show when they are damaged. Furthermore, when high-functioning autists do generate an understanding of social interaction it seems to be accomplished in a different way than normals.[4] This shows that shows are solving social problems in an atypical fashion. Often these solutions require amazing amounts of mental control.

Persons with autisms' seeming lack of the development of social understanding when compared to the relative ease at which young children begin to understand about other's mental states seems to imply that social cognition is a skill or type of knowledge that undergoes

[4] See *The Curious Incident of the Dog in the Nighttime* for a fictional account of a high-functioning autist which highlights the idiosyncrasies of the thought patterns of persons with autism.

characteristic development: the final requirement of Fodor's 9: characteristic ontogenetic development. That is, as children develop they generally understand desires first and only later beliefs. This general pattern of development, within theory of mind has been charted and found across numerous populations and cultures (Wellman, 1991). The pervasiveness and relative stability of the young child's understanding of folk-psychological concepts of 'belief,' 'desire' and 'intention' and the developmental trajectory this understanding takes is important. It is important because it shows that there is a domain of knowledge about which there is some type of structured learning. If our basic understanding of social interactions is holistic and belief sensitive as Fodor requires, and if such learning is part of the central system then we would not expect to see such uniformity across cultures and times. And as Fodor is fond of pointing out, our commonsense framework for understanding others is as effective now as it was 4,000 years ago; it's as effective in Kentucky as it is in Kamchatka.

However, there is one important reason that we should *not* want to treat ToM knowledge as being subserved by modules.[5] It seems exceptionally difficult to show that informational encapsulation is achieved in ToM processing. For example, my knowledge of someone's epistemic states will cause me to interpret their behavior differently.[6] In the false-belief task, if I know that Sally does not know where the candy has been moved to, I would predict that she would look for the candy in the old location. If I know that she has amnesia, I will predict that she won't remember that there was candy at all. It seems that much of what I know about others can be influenced by a variety of specific, environmentally unique, factors. This makes my coming to a proper belief about someone's epistemic position, not a matter best served by strict Fodorian modules. In short, ToM knowledge is not informationally encapsulated.

We are now confronted with a quandary. We have evidence that autism seems to show us an area of higher level cognitive processing which seems as if it is subtended by modules. However, we cannot even come close to meeting the requirement of encapsulation as strict modularity requires. Indeed, Fodor (2001) provides extensive arguments against relaxing the informational encapsulation requirement of modularity.[7] At this point we can maintain strict modularity and claim that ToM knowledge is indeed a central system product, but then an explanation as to why ToM knowledge seems modular is required and none are forthcoming. Or we could run a massively modular theory. However, instead of seeing the previous two options as the only available ones, I suggest, in keeping with the empirical nature of the modularity of mind thesis, we allow that their might be cognitive systems that are not fully encapsulated and thereby not fully modular. Instead of maintaining informational encapsulation as the defining feature and requiring it of higher level, "secondary modules" (Currie & Sterelny, 2000), we might choose to relax this encapsulation requirement.

Informational Encapsulation and Phenomenology

In the next section I focus on a different set of evidence I take to be related to modularity: the phenomenology of cognitive processes. I will argue that the phenomenology of known modular processes is importantly different than central system processes and an

[5] I am grateful to Bill Ramsey to pointing out the repercussions to computation of denying informational encapsulation.

[6] I will have more to say about this in the next section.

[7] Baron-Cohen (1995) recognizes the difficulties with using modules to support upper-level cognition, but does little in the way of treating these issues (see pp. 56–57).

investigation of this difference will support my overall contention that modules and central systems represent two ends of a cognitive spectrum. However, before I turn to this final section, we must speak directly about the issue of informational encapsulation.

I above noted that ToM processing does not seem to straightforwardly be a domain about which informational encapsulation and thereby modularity is easily reached. My knowledge of situation or my desires can often cloud my beliefs. Furthermore, what I know of a specific situation and what I know generally often will affect ToM beliefs. As Fodor (1998) is fond of pointing out, the range of inputs that can count as "social" is so vast that there is little plausibility that there is a module that could deal with those inputs. Language is a well-defined domain; ToM inputs certainly are not. Since the domain of ToM is so vast, this leads inexorably to the difficult Frame Problem. We cannot hope to, with the resources of traditional AI and computation, develop a database that would be large enough to account for the vast domain of ToM while maintaining the functional properties of modules. This isn't true of domains of vision and language processing. While it is true that there are attempts (Rittscher et al., 2003) underway to mathematically model various areas related to ToM processing, this does little to solve the general skeptical problem we are confronted with in the form of the Frame Problem. It is simply impossible, along traditional Turing style computational modeling, to form a plausible algorithm that could ever account for our upper-level belief formation. It seems then that all attempts at computational modeling of the social domain are a priori doomed to failure because of the restrictions of Turing style computational forms.

What I propose we do, for purposes here, is that we bracket the issue of the Frame Problem. It seems obvious that a strict modularity theorist like Fodor will simply proffer the Frame Problem and simply be unconvinced by researchers like Rittscher et al. (2003) and Currie and Sterelny (2000) and their attempts. Instead of attempting to show that there are plausible accounts which might, under traditional Turing style approaches solve the Frame Problem, I would like to take a different tact. Let us see if there are facts about known modular and central system products that might interestingly tell us something about the nature and structure of the cognitive system. Using this information will give forth evidence that will support relaxing the informational encapsulation restriction that has bedeviled the investigation thus far. I take up such a tactic in the following section.

Phenomenology and Modularity

In a recent article, Currie and Sterelny (2000, p. 148) note that the encapsulation of a modular system is "...evidenced directly by the fact that perception does not change when it conflicts with belief..." They note that this idea goes all the way back to Fodor (1983). If this statement is accurate, then there is an implication that the outputs of fully modular processes have a certain phenomenal salience. That is, the outputs of modular processes are forward, or felt more strongly, in conscious thought. As I will argue, perceptions that are the result of modular processes have a stronger phenomenological force than higher-order beliefs.[8] For instance, in the case of certain illusions such as the Muller-Lyre or others of that ilk, it simply seems to be the case that what the perception seems to be (the lines seeming to be different in length) is in fact an accurate sensory representation of the object.

[8] By "higher-order belief" I do not mean beliefs about beliefs. I use the term to denote consciously arrived at beliefs, e.g., my car is in the parking lot: my thanks to Bob Schroer for pointing out this terminological difficulty.

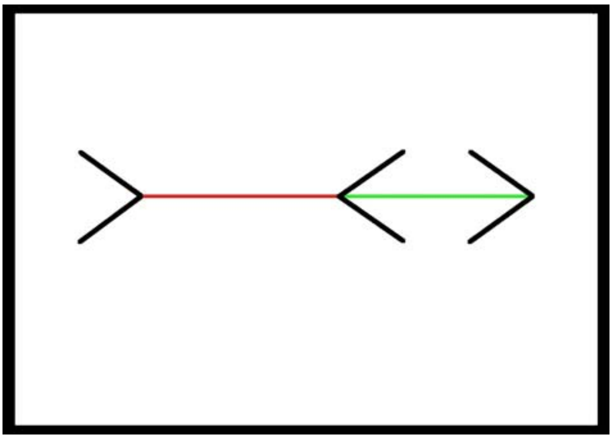
Non-modular products do not have as strong an attendant phenomenal force. For example the belief that 'the cat is on the mat' does not push itself into consciousness, regardless of whether we see the cat on the mat, in the same way the illusions do.

Since I have argued that social cognition or ToM processing seems to be modular, though it violates informational encapsulation, it might be the case that there is a sort of intermediary sort of processing level that is behaves in many ways as if it's modular, but is not fully so. If phenomenological strength varies with type of processing, we might then use phenomenology as a guide to our investigations of the sorts of processing that may be occurring. If attendant phenomenal force is a marker of cognitive processing, the range of phenomenological feel seen when comparing sorts of phenomenal feel of modular outputs, central system products and intermediate socio-cognitive or ToM processing is further support for the notion of a continuum of modules to central systems.

Let us begin with the claim that modular processes are typically more phenomenologically salient than other cognitive processes. There is nothing explicit in the literature that mentions the phenomenological force of modular processes and phenomenology is not something that Fodor (1983) lists as a typical property of modules, but there are some interesting hints. Modularity is typically used to explain the persistence of certain perceptual illusions. For instance, the Muller-Lyre illusion (Fig. 1). Whenever I look at this figure, it always seems that the one line is longer than the other. This seeming is powerful and impossible to ignore. It is impervious to my desires to experience the figure otherwise. The reason for this is simple. Since the visual module is fully encapsulated, my knowledge of the "facts of the matter" has no effects on the processing of the input by the modules. The same strength of phenomenological feel is attached to other visual illusions as well.

Traditionally, when a module computes type-token relations the results are quick and then, barring any mechanistic failure, pushed forward into the central system. The output is foundation of my belief. In the case of the Muller-Lyre illusion we see this process clearly. Upon viewing the figure, it simply seems to me that the one line is longer than the other. When I first see the illusion it surprises me to find out the lines are of equivalent distances. I can take out a ruler and measure the lines to see if they are indeed the same size. I can even recheck the measurements. However, and this is important for modularity and its attendant phenomenal strength, it still *seems* to me that the one line is longer than the other. I may not, after experience with the illusion, "believe" that the lines are different in size, but this

Figure 1 Muller-Lyre illusion.



belief is unable to stop the fact that it seems to me that the one line is longer than another. This experience nicely demonstrates the independence of modular processes from the rest of the cognitive system.

The Muller-Lyre illusion is not the only evidence of the phenomenological salience of modularity. Let us take the oft-used example of language processing: a Fodor favorite. In describing the language processing module, Fodor notes that

> ...we apparently have no choice but to take up this computational burden whenever it is offered. In short, the operation of the input systems appears to be, in this respect, inflexibly sensitive to the characters off one's utilities. You can't hear speech as noise *even if you would prefer to.* (Fodor, 1983, p. 53, italics original)

So we can readily imagine a situation where we come across someone we would rather not hear, an annoying acquaintance, an angry coworker, etc. In each case, again barring mechanical troubles with the module, we simply must hear the person's voice as language. If they speak to me, try as I might, I will hear what they have to say. I may ignore them or attempt to leave, but I hear what they are saying. I take in and process the content of the linguistic expressions and form beliefs about what is said, and based on that I recognize that I *really* didn't want to listen to them.

As with the visual module, the processing of linguistic input is mandatory and the output is pushed into the central system. I simply, by virtue of the modular processing and despite my utilities, know what is being said to me. Similar to the visual processing module, my beliefs about the situation depend, in great part, to the processing occurring within the module. Once I hear the words I understand why I might have wanted to avoid this person. A further sense of the phenomenological power of the language module comes from the following example, given by Fodor himself.

I can hear various foreign languages and note that Japanese sounds different than Chinese which sounds different still from Gaelic. These languages have a distinct prosody and acoustic structure that I can distinguish and I can use this if I want to imitate that particular language. However, no such "sounding like" judgment is made when I hear English. "What does *English* sound like?" Fodor asks (Fodor, 1983, p. 54, italics original). For Fodor, English doesn't sound like anything; it simply sounds to us as English because we process the bulk of linguistic input in the language module. Phenomenally, English is English (to English speakers) and not like anything else.

The phenomenal strength of our perception of language, specifically our native tongue and that it *doesn't seem or sound like anything*, cannot be overlooked. The modular processing that occurs within the language module, in a sense, forces our understanding of the utterance – the computational burden is forced upon us. It doesn't seem to us to be English; it *is* English. As with the case of visual modules where we see the lines as different in length, we hear the utterance as English. There is no careful decision making process where we weigh evidence. We simply have the resulting experiences as experiences of the English language.

What I have tried to elucidate from the prior examples is that certain well known modular processes and the experiences that accompany them have a certain phenomenological strength. When I learn the lines in the Muller-Lyre illusion are of differing lengths, this plays a large part in my later held belief that they are indeed of differing lengths. After I learn of the illusory nature of the effect, I change my belief, but that doesn't change the way they lines look to me. In fact, it often seems to me that I'm ignoring an important factor when I later believe that the lines are equivalent. When I hear the utterance as English I simply hear the words and know their meaning. The phenomenological force of these experiences is very different from other beliefs that I might have.

All of these perceptual beliefs have a certain phenomenal strength. I sometimes, in the case of the Muller-Lyre illusion, base my belief about the world solely on the phenomenal feel.[9] It seems to me that the lines look different, so I believe them to be of differing lengths. If I never learn about the Muller-Lyre illusion and the actual properties of the lines, I may always believe that the lines are of differing lengths based in large part on the seeming. However, I might change my belief as I learn of the various effects due to the type of creature I am psychologically, but I do so with knowledge of the functioning of the modules responsible for the effect and my knowledge that the seeming would lead me to a wrong belief.[10] Regardless of how I come to discount the weight of phenomenal feel, it still feels as if this I am somehow ignoring an important source of information. The function of the modules is unaffected by the later knowledge of the stimulus.

What we can take from the above examples, is that in each case of purported modular processing, there is an attendant phenomenal feel that plays an important role in our judgments of experience. In all cases I am, in a very real sense, compelled to form the judgment that I have. In the case of language processing, I simply understand what is being said to me. Furthermore, when I ignore what my senses seem to be telling me about the world, there is a nagging feel or suspicion that occupies me. While I may know the lines of the Muller-Lyre illusion are the same, the lines appear different in length. Thus, it seems that modular processes can readily be thought to have a specific and strong attendant phenomenal force important belief formation.

The above description of the phenomenal strength of modular products is all well and good, but more needs to be said about other judgments: judgments that are less perceptually based and more reason based. If Fodor is correct, and on this part he likely is, then most of our beliefs are not of the perceptual sort. Many of our beliefs are the result of chains of inference. When arriving at many of our beliefs we look at evidence, evaluate sources, etc. This type of belief (higher-order) is very different than the sort I have about the Muller-Lyre illusion. These beliefs differ in not only their etiology, but also in the phenomenal components they have or, as I will argue, lack.

Higher-order beliefs do not have the same phenomenological strength as the above mentioned perceptual ones. Take the belief that “the person who will get the promotion is in my office and has 10 coins in his pocket.” I come to this belief only after a process of reasoning based on facts (and a certain famous paper in epistemology). It has no particular phenomenal strength associated with it. And it is certainly not the case that I am almost forced into having it. There is no real “seeming” to the belief that “the person who will get the promotion is in my office and has 10 coins in his pocket,” I simply have it based on a certain set of evidence – logic tells me this. If it turns out that I am wrong about this belief, I can readily be shown what went wrong in my reasoning process. I might have miscounted the number of coins. I may have been lied to about the upcoming promotion. Whatever the issue, I can change my belief about who will get the promotion without the same type of lingering feeling that I am ignoring something when I choose to believe that the lines of the Muller-Lyre illusion are of the same length. When I come to a new higher-order belief, I

[9] This way of speaking seems a bit infelicitous to the actual process I take to be occurring. In the Muller-Lyre case I do not come to a belief via a rational procedure of evidentiary evaluation; I simply believe that the lines look different in length. It’s only after I learn of the illusion, that I begin a “rational” checking

[10] See Fodor (1983, p. 54) for an interesting and related discussion on attention and modular processing.

may be suspicious of the new belief, uncomfortable with it, but I am not somehow under the impression that I am ignoring something.

Many of our higher-order beliefs seem to lack most of the phenomenal features I have just described as commonly attaching to perceptual beliefs. When I come to the belief that the lines of the Muller-Lyre illusion are of the same length, I do so as a result of how it seems to me. When I come to the belief that the person who will get the promotion has 10 coins in her pocket, I do so based on a long chain of inference and logic. Changing the latter is an easy thing. If I learn some relevant new information I change my belief accordingly. However, even when I learn about the equivalent length of the lines, and perhaps in spite of it, I cannot ignore the persistent feel that the lines seem different in length. While, it is surely the case that the phenomenal force of certain beliefs is not necessary to correctness of any belief, it is an important part of the process by which we come to have certain beliefs.

I will now turn to social cognition. What I will argue is that social beliefs, of the "quick and dirty" sort seem to occupy a middle ground with respect to phenomenology. The attendant phenomenal strength of social belief is not as phenomenally weak as higher-order beliefs, but is not nearly as strong as perceptual beliefs. The phenomenology of social interactions is different than perceptual illusions on the one hand, and more traditional beliefs on the other. They seem to occupy a middle ground.

For example, when I see someone looking at me or monitoring my activity, I can often figure out if their intent towards me is good or ill. I might not be right about their intentions, but that is not a problem. However, when people talk about their quick and dirty impressions of others' behavior they often use words like "feeling" or "gut-impression." I suspect someone has a certain disposition towards me based on certain cues such as body language, or facial expression. It simply feels, akin to the feeling of the lines looking longer, to me as if this person has the certain attitude I take them to have. The feel is relevant in my arriving at a particular belief. I take into account what my feeling is of this person's look and then, based in large part on that feeling, I come to my belief that they do or do not have a particular intention towards me. However, the phenomenology of social beliefs isn't as strong as perceptual illusions and, unlike perceptual beliefs, can be removed in accord with my utilities.

Imagine the following sort of case. There are certain conditions (palsy, paralysis, Parkinson's, etc.) that limit the expressivity of those with the condition. If I interact with someone who has diminished non-verbal cues it is difficult for me to pick up how they might be regarding me. So, if I tell a joke and do not get a smile, I might worry that the joke was offensive, or that I delivered it poorly, etc. Initially, or the first time I interact with this person in this way I feel as if something has gone wrong. It seems apparent that some important part of the joke, i.e., that it was funny, has not been recognized. However, if the person who has the condition is well known to me, I might not have this type of reaction at all. I realize that they might not be able to smile as a result of their condition. I might then look to other cues that I have learned to be more predictive.

Now let us compare the two cases of ToM knowledge. In the first case, based on some cues such as body language or gaze, I register these cues and come to a belief about what the intent is. One of the dominant factors in my arriving at a belief is my gut reaction: my phenomenal feel and what it signals to me. Without any other evidence I use it as the basis for my belief about this person's intention. In the case where I am aware of my friend's condition this plays an important role in my belief about their reaction. If I know they have difficulty expressing emotion, then I will likely not become worried, upset or embarrassed as the result of an assumption that my particular humor is unappreciated.

The interesting point to draw from these two cases is the role phenomenal feel plays. In the former case, I use phenomenal feel, or the "gut reaction" as the basis for my belief. In the latter, there is no phenomenal feel present upon which to base my belief. I simply, as a result of my knowledge of my friend's condition, do not have the same sort of gut level response. It will not do to argue that I only ignore the "gut reaction" in lieu of the information I have on this person. We can and often times do ignore our initial reactions in favor of a more reasoned approach. But it seems equally true that I simply do not feel the same way I would have as a result of this knowledge. In fact, this is analogous to cases where we experience fiction. As Currie and Sterelny (2000) argue, our responses to fictional tragedy could not be modular since we would be unable to override the belief that tragic event x was actually occurring and we know that it's not. Since we often times are not compelled into believing what is actually occurring on stage is real, (or else I might run up on stage and interrupt) the phenomenal feel of the belief in x is not strong enough to compel us to believe. This is in distinction to the case of a perceptual illusion where, based on the phenomenal feel, I am compelled into a certain belief.

What we now have a range in cases of belief. What distinguished each case from one another is the relative force and vivacity of the beliefs. In the first case, we have perceptual beliefs which highly phenomenally salient. This salience plays an important role in belief formation. We next have higher-order beliefs where there seems to be a distinct lack of phenomenal force and phenomenal force plays little to no role in our resulting belief formation. We can ignore certain facts in light of others and not have the concurrent worry that I am somehow ignoring a salient cue as in the case of more perceptual beliefs. Finally we have social beliefs. These beliefs seem to occupy an intermediate position. My appraisal of another person's intentions has a certain phenomenal component that often plays a substantial role in my coming to a particular belief. However, when I have evidence that would somehow change my original appraisal it changes my reaction. The processing seems to respond directly to my utilities. I don't, as in the case of the knowledgeable illusion perceiver, ignore my feels, they simply are not there.

I am now in a position to indicate what I take this evidence to show. By focusing on the level of phenomenal salience of three sets of beliefs it seems that we have a continuum from the phenomenally strong to the weak. If central systems and modules were totally different in kind then such a continuity would be unexpected and prima facie difficult to account for. The evidence from phenomenology is thus best explained by a view that modules and central systems represent ends of a spectrum of cognitive processing and not thoroughly distinct modes of cognitive processing. If modules and central systems were different in kind, such a continuum would be unexpected.

Coda

It is now time to collect the various themes of this paper and unify them. My purpose was argue for the idea that modules and central systems represent two ends of a continuum of cognitive processing with fully informationally encapsulated modules on the one hand and fully holistic central systems on the other and that social cognitions occupy a sort of middle ground. I began with a review of current research into ToM cognition and showed that it strongly indicates that ToM is subserved by modular processing. Couple this evidence to the clinical syndrome of autism and we have an even stronger cast that ToM cognitive activity is highly modular. I then noted that ToM cognitions violate the informational encapsulation requirement of Fodorian modules. Instead of then simply claiming that ToM cognitions had to thereby be central system products, since they violate encapsulation, I introduced the idea there might be a spectrum of cognitive function with modules on the one hand and central systems on the other. As a result, we would then *expect* to see cognitive processes that resemble modular processes without necessarily being fully modular.

To support this conjecture further I then turned to an argument involving the phenomenal strength of purported modular products. I established the relation among phenomenal strength and modular processes and showed that there is a relation of between the type of cognitive processing occurring and the strength of phenomenal feel. This relation indicates that the initial hypothesis concerning a continuum of cognitive processing of which modules are one end and central systems another is more accurate than the competing massively or minimally modular theories.

I take it that the work I have done here adds to the already existing chorus of voices which do not sing in unison on the topic of modularity. There is evidence still to uncover and research is ongoing. In spite of that, I hope to have added, in some part, to the view that the division of the cognitive system is more than a simple division into modules and central systems. The resultant skepticism that central systems cannot be studied due to modern researchers' inability to proffer a theory of central system function seems to inappropriately remove resources for thinking about upper-level cognitive activity. I hope to have supported the view that the centrally system might be understood with the resources of modularity in an empirically and theoretically faithful fashion.

References

Appelbaum, I. (1998). Fodor, modularity, and speech perception. *Philosophical Psychology, 11*, 317–330.

Barkow, J., Cosmides, L., & Tooby, J. (1992). *The adapted mind*. New York: Oxford University Press.

Baron-Cohen, S. (1995). *Mindblindness*. Cambridge, Massachusetts: MIT.

Batki, A., Baron-Cohen, S., Wheelwright, S., Connellan, & Ahluwalia, J. (2000). Is there and innate gaze module? Evidence from human neonates. *Infant Behavior and Development, 23*, 223–229.

Botterill, G., & Carruthers, P. (1999). *The philosophy of psychology.* Cambridge: Cambridge University Press.

Currie, G., & Sterelny, K. (2000). How to think about the modularity of mindreading. *Philosophical Quarterly, 50*, 145–162.

Fodor, J. (1983). *The modularity of mind*. Cambridge, Massachusetts: MIT.

Fodor, J. (1998). *The mind doesn't work that way.* Cambridge, Massachusetts: MIT.

Fodor, J. (2001). *The mind doesn't work that way.* Cambridge, Massachusetts: MIT.

Gerrans, P. (2002). Modularity reconsidered. *Journal of Language and Communication, 22*, 259–268.

Gopnik, A., & Meltzoff, A. (1996). *Words, thoughts and theories*. Cambridge, Massachusetts: MIT.

Johansson, G. (1973). Visual perception of biological motion. *Perception Psychophysics, 14*, 202–211.

Johnson, S. (2003). Detecting agents. *Philosophical Transactions of the Royal Society of London, 358*, 549–559.

Malle, B., Moses, L., & Baldwin, D. (2003). *Intentions and intentionality: Foundations of social cognition*. Cambridge, Massachusetts: MIT.

Meltzoff, A., & Brooks, R. (2003). "Like me" as building block for understanding other minds: Bodily acts, attention, and intention. In Malle et al. (Eds.), *Intentions and intentionality.* Cambridge, Massachusetts: MIT.

Ozonoff, S., & Strayer, D. (2001). Further evidence of intact working memory in autism. *Journal of Autism and Developmental Disorders, 31*, 257–263.

Pierce, K., Muller, R., Ambrose, J., Allen, G., & Courchesne, E. (2001). Face processing occurs outside the fusiform 'face area' in autists: Evidence from functional MRI. *Brain, 124*, 2059–2073.

Pinker, S. (1997). *How the mind w*orks. New York: Norton.

Puce, A., & Perrett, D. (2003). Electrophysiology and brain imaging of biological motion. *Philosophical Transactions of the Royal Society of London, 358*, 435–445.

Reddy, V., Williams, E., & Vaughan, A. (2002). Sharing humour and laughter in autism and Down's syndrome. *British Journal of Psychology, 93*(2), 219–242.
Rittscher, J., Blake, A., Hoogs, A., & Stein, G. (2003). Mathematical modeling of animate and intentional motion. *Philosophical Transactions of the Royal Society of London, 358*, 475–490.
Rose, H., & Rose, S. (2000). *Alas, poor Darwin*. New York, New York: Harmony.
Russell, T, & Shamara, T. (2001). Social cognition at the neural level: Investigations is autism, psychopathy and schizophrenia. In M. Brune, H. Ribbert & W. Schiefenhovel (Eds.), *The social brain: Evolution and pathology*. West Sussex: Wiley.
Sterelny, K. (2003). *Thought in a hostile world*. Malden, Massachusetts: Blackwell.
Wellman, H. M. (1991). *The child's theory of mind*. Cambridge, Massachusetts: MIT.
Woodward, A., Sommerville, J., & Guajardo, J. (2003). How infants make sense of intentional action. In Malle et al. (Eds.), *Intentions and intentionality*. Cambridge, Massachusetts: MIT.