The Genealogy of the Moral Modules

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Abstract. This paper defends a cognitive theory of those emotional reactions which motivate and constrain moral judgment. On this theory, moral emotions result from mental faculties specialized for automatically producing feelings of approval or disapproval in response to mental representations of various social situations and actions. These faculties are modules in Fodor's sense, since they are informationally encapsulated, specialized, and contain innate information about social situations. The paper also tries to shed light on which moral modules there are, which of these modules we share with non-human primates, and on the (pre-)history and development of this modular system from pre-humans through gatherer-hunters and on to modern (i.e. arablist) humans. The theory is not, however, meant to explain all moral reasoning. It is plausible that a non-modular intelligence at least sometimes play a role in conscious moral thought. However, even non-modular moral reasoning is initiated and constrained by moral emotions having modular sources.

Key words: faculty, mental representation, modularity, module, moral cognition, moral emotions, relational models theory

We have automatic emotional reactions of approval or disapproval to many social situations. In quite a few cases, moral judgments are nothing more than expressions of these automatic emotional responses. In other cases, moral judgments are less emotional, more a matter of calmly trying to arrive at general principles and deriving specific moral conclusions from them. However, even in these latter cases, automatic emotional responses help to shape our moral principles. Even if moral emotions do not strictly dictate plausible ethical principles, they do at least impose broad outer limits on their content. No matter how coherent and comprehensive in scope they may be, principles which do not correspond with our automatic emotional reactions in any way would not be accepted. This is why it would seem ludicrous to insist that all genuine ethical imperatives are reducible to the one categorical imperative that one should snap one's fingers and cough every 120 min or that one should do all one can to maximize the total amount of ultraviolet light in the universe. Moral emotions are at least the raw material and broad outer constraints for moral reasoning. The aim of this paper is to show that it is plausible that moral emotions result from a set of specialized and informationally encapsulated cognitive mechanisms containing innate information about social situations. That is, moral emotions do not result from general-purpose, cognitively penetrated, initially content-free mental mechanisms. This paper also contains suggestions concerning the origins and development of some of these moral emotional faculties.

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1. Innate Constraints on Moral Reasoning

Noam Chomsky has made some general points in favor of there being innate constraints on moral judgment. Before considering his argument, let us ask ourselves why someone would believe anything to be innate. Let us take something less controversial than mental representations. Why believe that our having hands and feet is genetically pre-programmed?

A human hand is a structure of great intricacy showing much uniformity from person to person while developing in the face of relatively unstructured and incomplete environmental influences. The structure of one's hand, and the structure of one's phenotype in general, are not simply a result of the environment. Chomsky points out that if the human phenotype were wholly the result of environmental shaping, we would expect the human form to differ wildly from person to person and to be highly malleable like a lump of clay. Since this is not so, we reason that the structure of the hand is largely under genetic control, the result of an innate set of instructions for organismic growth. This is not to deny that the environment plays a triggering role. Without a suitable environment, the human embryo might fail to develop hands and feet; but a radically different environment would never cause it to develop wings or tentacles or wheels. Innate endowment plays a crucial role in phenotypic development (Chomsky, 1987).

This argument for hands and feet being genetically pre-programmed is similar to what psychologists call a "poverty of the stimulus argument." According to a poverty of the stimulus argument, if a perceptual response contains more information than does the stimulus which elicited it, then the perception involves information which the organism had already represented. And if the sum total of the organism's stimuli lacks the information contained in the response, then, according to this argument, the information must be innately represented.

By way of example, here is a poverty of the stimulus argument for innate knowledge of physics: The psychologist Elizabeth Spelke performed experiments on babies, monitoring their preferential looking (noting which image the infant prefers to look at) and habituation (presenting the infant with a stimulus repeatedly until it starts to respond for shorter periods of time) (Spelke, 1991; Spelke et al., 1992). Preferential looking reflects interest or surprise, and so can be used to gauge expectancies about how physical objects should behave. Habituation can be used to measure the ability to make discriminations. Spelke discovered that 3–4 month old infants' expectancies and discriminations are informed by assumptions about boundedness, cohesion, rigidity, and there being no action at a distance for inanimate objects. It is hard to understand how infants could have learned these principles.

To say that infants grasp these principles without having learned them is not to say that they are born knowing them. Secondary sexual characteristics and senescence, for examples, are genetically pre-programmed, but babies are born neither pubescent nor elderly. So it is no counterexample to Spelke's thesis that newborns have been shown *not* to behave as though they know these physical principles (Slater et al., 1991).

Chomsky originally used a poverty of the stimulus argument with regard to language, especially syntax. A child develops knowledge of the many complex rules of a language, including syntactic rules, from the relatively limited utterances of parents and peers. The child's linguistic input is "degenerate" in the sense that many of the utterances heard would lead to false conclusions if used as the basis for inductions without the benefit of prior knowledge. In other words, the evidence presented to the child is dramatically incomplete. For example, if the child's mind were a dry sponge, one would expect it to infer inductively from hearing the sentences "The book is on the table," "Is the book on the table?," and "The red book is on the table" to the conclusion that "Book the red is on the table?" is a well-formed sentence. After all, it follows the "rule," or what appears from the first two sentences to be a rule, that moving the third word of a statement to the beginning forms a question. But the child already knows that one forms a question by following structural rules, rules sensitive to parts of speech. In fact, the child already knows that all sentential transformations are structural, and the child even has a good sense of what the options are for those structural rules. Many possible structural transformations, structural transformations that might seem plausible if the child were simply inducing from the data alone, are not uttered by children. (For systematic evidence strongly supporting this claim, see Stromswold, 2000.) By having prior knowledge, the child avoids making a lot of mistakes which it would make if it were simply reasoning inductively from available evidence. In the case of some children who are both blind and deaf, the available evidence can be little more than what one feels when placing one's hand over someone else's mouth, and yet the child still rapidly and efficiently makes correct conclusions about the syntax of the relevant language. Chomsky argues that the mind is genetically pre-programmed to include a "language acquisition device" or "language faculty" containing some basic rules of syntax which are universal to all languages (with the exception of some artificial languages) (Chomsky, 1965, 1982, 1988).

Controlled experimental results support this general picture. Four-month-old infants are sensitive to cues corresponding to clause boundaries in speech. Furthermore, infants raised in an English-speaking environment have been shown to be indifferently sensitive to those boundaries whether they occur in English or in Polish speech. It is not until six months of age that the infant loses sensitivity to clause boundaries in general and responds only to those of the language typically heard in his environment (Karmiloff-Smith, 1992, p. 37).

Not everyone is convinced, however, by these poverty of the stimulus considerations. Philosophers have raised objections to this sort of argument for many years, including Goodman (1967) and Putnam (1967), and more recently Fiona Cowie (1999). Stephen Laurence and Eric Margolis (2001) argue that these objections rest on misunderstandings of the poverty of the stimulus argument. The objections and replies are too many and subtle to be done justice here, except to say that Laurence and Margolis' presentation and defense of Chomsky's position is excellent. I will, however, briefly discuss one objection to Chomsky's reasoning due to the psychologist Annette Karmiloff-Smith who suggests that the experimental data about clause boundaries are compatible merely with innate attention biases rather than innate mental representations (1992; see also Elman et al., 1996). In other words, the infant may learn to respond to clause boundaries so quickly only because s/he has a stronger innate disposition to notice spoken sounds than other kinds of sound. There is, on Karmiloff-Smith's view, an innate component to acquiring a language, but this does not have to mean innate information.

But Jerry Fodor has argued that positing innate attention biases is not a genuine alternative to positing innate representations. "In neither Karmiloff-Smith's book nor Elman's is it explained how one could have a disposition (innate or otherwise) to concentrate on *X*s unless one *already* has the concept of an *X*. ('Pray, attend to the passing flubjumbs.' 'Can't.' 'Why not?' 'Don't know what a flubjumb is.') Postulating innate attentional biases doesn't dispense with the postulation of innate conceptual content; it just presupposes it" (1998, p. 129).

Chomsky makes a poverty of the stimulus case for innate constraints on judgments of moral right and wrong. As with hands and feet, he notes that each person's ethical values constitute a structure of great intricacy showing much uniformity from person to person while developing in the face of relatively unstructured and incomplete experience. This intricacy is often taken for granted because it seems so obvious to us, but it need not seem obvious to a creature from Alpha Centauri that, say, indignation is an appropriate response to a misdeed or an inappropriate one to a well-intentioned act of kindness. The child's ethical system is probably as complex and sophisticated as the geometry and algebra which he learns in school, although he does not need such explicit instruction in order to make moral judgments. He is seldom told explicitly what is right and what is wrong, and often sees misleading examples (e.g. someone being praised for their mischief). Many of the examples presented to him are also incomplete: For example, if it is proper to pay for the apple instead of just taking it, then isn't it also proper to pay for other things, such as answers to a quiz? Nonetheless, the typical, non-psychopathic child already has a strong sense of which actions are acceptable and which are not, and children tend to converge in these judgments.

> It cannot be merely a matter of convention that we find some things right, others wrong. Growing up in a particular society, a child acquires standards and principles of moral judgment. These are acquired on the basis of limited evidence, but they have broad and often precise applicability. It is often though not always true that people can discover or be convinced that their judgments about a particular case are wrong, in the sense that the judgments are inconsistent with the person's internalized principles. Moral argument is not always pointless, merely a matter of "I assert this" and "you assert that." The acquisition of a specific moral and ethical system, wide ranging and often precise in its consequences, cannot simply be the result of "shaping" and "control" by the

> social environment. (Chomsky, 1988, pp. 152–153; see also McGinn, 1997, pp. 44–49)

Just as the environment is too indeterminate to shape the human hand, so also the social environment is too indeterminate to shape one's values. Also like the hand, there is much in common from person to person – enough to make possible moral debates that are not simply pointless. Also like the growth of a hand, acquiring ethical principles requires very little intellectual labor. The same sort of reasoning which suggests that the hand is not simply the product of the environment but partly, even very largely, under genetic control, also suggests that our values are partly, even very largely, under genetic control.

It is worth noting that in describing the child's linguistic and moral inputs as "wrong," Chomsky never provides any quantitative estimates. That is, he does not say what percentage of utterances the child hears is grammatically misleading or what percentage of human behavior the child witnesses is misleading for discerning the nature of virtue. This may raise the question of how convincing Chomsky's case, either for an innate language faculty or for innate moral knowledge, really is. Has he shown that enough of the data are misleading for conceptual nativism to be the only rational conclusion? But Chomsky claims that even if only a tiny percentage of the data are misleading, as surely they are, this suffices to show that some knowledge is innate. "[S]uppose that a scientist were presented with data, two per cent of which are wrong (he doesn't know which two per cent). Then he faces some serious difficulties, which would be incomparably more serious if the data were simply uncontrolled experience, rather than the results of controlled experiment, devised for its relevance to theoretical hypotheses" (quoted in Lyons, 1991, pp. 135–136).

The psychologists David Premack and Ann James Premack (1994) review experimental data showing that infants easily interpret certain patterns of movement of dots on a screen as exhibiting intentionality and have certain strong expectancies about the behavior of these dots which seem moral or proto-moral, expectancies which can be gauged by noting preferential looking and habituation. For example, very young infants have the concepts of helping, hurting, and the expectancy of reciprocation for helping and hurting. They also have concepts of liberty, ownership, power, and belonging to a group. It is because of their expectation of reciprocity that we can tell that they have these other concepts. They expect the reciprocation of helping, or of hurting, or of liberating, etc.

Premack and Premack suggest that these are the only innate moral or proto-moral concepts, all the rest being learned. This is a dangerous inference. As noted earlier, the absence of a trait in infants does not mean that it is learned. Puberty and senescence are absent in infants, but they are clearly not learned. As will be discussed in the next section, there is reason to believe that the stock of innate moral ideas is richer than what Premack and Premack suppose.

2. Relational Models Theory

There is evidence for mental faculties specialized for recognizing voices, recognizing faces, and detecting affect through hearing speech and looking at faces. The linguist Ray Jackendoff, using this evidence, makes a teleological case for specialized social faculties:

> [S]urely evolution would not have gone to the trouble of developing all this elaborate peripheral apparatus if there were not some important purpose for the information it provides. A central faculty of social cognition, served by the four distinct input modules of face recognition, voice recognition, and visual and auditory affect recognition, would be the right kind of candidate: given its concern with relations to other individuals, it would desperately need accurate information about who one is interacting with and that person's probable state of mind. (1992, pp. 73–74)

The evolutionary psychologist Leda Cosmides has discussed experimental evidence which she takes to support the existence of a faculty dedicated to recognizing acts of cheating and argues that this faculty is an adaptation for Paleolithic conditions of social exchange (1985; see also Cosmides and Tooby, 1992, 1994). The interpretation of Cosmides' experimental data, however, has been subject to controversy (Fetzer, 1990, Fodor, 2000 Appendix), so I will remain neutral in this paper over whether or not there is a cheater-detection faculty. Instead, other possible social faculties will be considered.

The anthropologist Alan Page Fiske's *relational models theory*, and the empirical data supporting it, are reason for believing in a surprisingly rich structure of innate ethical ideas which would be suited for informing specialized faculties of the general sort described by Jackendoff (Fiske, 1991, 1992). According to Fiske, humans are fundamentally social. We generally organize our lives in terms of relations with other people for the sake of those relations themselves, not for the sake of some further asocial end. Fiske postulates four psychological models which all non-pathological humans use to structure social relations, the realization of these models in human affairs being ends in themselves. The four models are:

Communal sharing: In this model all members of the group are equivalent and have a common identity. They are relatively undifferentiated from each other. Individual differences tend to be ignored. Within the group, there is an attitude of share and share alike. "In transactions, the group pools resources and operates on the principle, What's mine is yours" (Fiske et al., 1991, p. 657). This is because members of the group perceive themselves as being united together by some strong common bond, such as blood. The attitude toward those outside the group is one of fear and aggression. Examples are people intensely in love, food sharing in gatherer-hunter bands, people sharing a commons, the indiscriminate killing of any member of an enemy group as an act of retaliation.

Authority ranking: Relations among people are here ordered according to status with differences in power and possessions seeming natural and even inevitable.

Subordinates defer and obey. Superiors take precedence but also have pastoral duties to their inferiors. Examples are military hierarchies, monotheistic moralities, class or ethnic rankings in society.

Equality matching: People keep track of imbalances or differences between each other and try to maintain balance. Turn-taking, strict reciprocity, and eye-for-an-eye justice are the norms. Examples are voting, games which involve equal turn-taking, "first-come-first-serve" policy.

Market pricing: People organize their interactions according to a system of ratios and proportions such as wages, rents, taxes, etc. All pertinent aspects of a situation are made commensurate by being reduced to a single metric of value. This allows each individual or group of like-minded people to decide how to act and evaluate actions according to cost-benefit analyses. Examples are the capitalist market place, calculating how efficiently people spend their time in relation to each other, and even the libertine's attempt to maximize his sexual conquests.

It is also possible for people to interact asocially, one person simply manipulating another as a means to some asocial end. This is most likely to occur under extreme stress. People can also be non-social in relation to each other, simply not interacting at all, such as when strangers pass on the street without acknowledging each other.

There is a great deal of anthropological evidence indicating that these four models govern how people distribute and circulate things, organize their work, and give social meaning to objects, time, and land. Throughout the world, the models appear in diverse and historically unrelated cultures at all levels of social organization, structuring marriage and sexuality, decision processes, as well as people's interpretations of misfortune and transgression (Fiske, 1991).

Fiske's relational models theory can be understood as a response to a Chomskian problem. The complexity and diversity of social life present a challenge to the growing child or the foreigner learning how one is expected to live and function in a new society. The challenge becomes even more urgent when one considers the number of social domains to be mastered and coordinated: There are social relations of work, the social meanings of objects and places, forms of reward and punishment, exchange, and so on. If each domain is governed by a different set of rules, the learning problem would be insurmountable. The problem is further compounded by the "degeneracy" of the some of the stimuli. That is, the social data one has access to may be misleading or radically incomplete.

Fiske's solution is that these four models are innate. Each child is already prepared, without instruction, to apply some combination of them to any social situation. What is not innate, however, is which model is to be applied to which situation and how. Different models can be used to structure different parts of the same social interaction, or one model can be nested within another. "By combining the elementary forms in various concatenations and nested hierarchies, people produce complex social forms" (Fiske et al., 1991, p. 658). For example, in a corporation, maximizing profit is the final aim (market pricing). Orders are given according to rank (authority ranking). Some corporations may have a lounge area available to everyone (communal sharing). The board of directors may vote on whether or not to change the company's name (equality matching).

Which model is applied to which situation and how the models are nested in each other, the "parameter settings" in Chomskian terms, are not innate but learned and vary from culture to culture. In gatherer-hunter societies, food is acquired and distributed according to communal sharing. In fact, in some gatherer-hunter communities, work is entirely optional: If one is young and able-bodied but still chooses not to work, one can nonetheless expect to be fed by others (Woodburn, 1981). However, in contemporary Western societies, market pricing determines the distribution of food. In many gatherer-hunter societies, the economy is largely structured by reciprocal gift-giving (equality matching), whereas in ours it is structured mainly by market pricing. In industrialized societies, work is structured according to market pricing and authority ranking, while in a Hutterite colony (a North American religious sect) it is structured according to communal sharing and equality matching.

In addition to the Chomskian argument mentioned above, there are also more controlled data supporting Fiske's position. Studies show that the relational models theory can be used to predict inadvertent substitutions; for example, calling a familiar person by the wrong name, misremembering with whom one interacted, or mistakenly directing an action toward the wrong person. Fiske, Nick Haslam, and Susan Fiske discovered that, in addition to confusing people of the same gender, people tend to confuse those with whom they interact in the same relationship mode (1991). Other factors, such as age, race, similarity of names, and so on play less of a role. So, for example, if someone is your superior in an authority ranking relationship and you call them by someone else's name, you are likely to pick a name of someone who is or has also been an authority over you. This suggests that in social interactions, the four fundamental models structure much of our thinking. According to Haslam and the Fiskes, "it would be hard to devise a taxonomy of relationships that could predict these error substitutions much better than the categories of the relational-models theory. The only logical possibility is a set of finer distinctions that are subsets of the four relational models" (1991, p. 673).

Alan Page Fiske and Haslam also discovered that *deliberate* substitutions of one person for another tend to be guided by the four models (1997). That is, if you originally planned to do something with someone, such as going on a picnic, and then decided to go with someone else, sameness of social relation with you, as determined by the relevant model, tends to guide your choice. It is not immediately obvious that this should be so, since personal characteristics (personality, race, age, and so on) could conceivably have been the major factor.

Fiske also found that when people are asked to recall everyone with whom they interacted over the past month, their recall tends to exhibit clustering in which people having one sort of social relationship to the subject, as defined by relational models theory, are remembered together in a run and then people standing in some other relationship to the subject are remembered next (1995). Again, it is not a priori obvious that memory should work this way, since personal characteristics could conceivably govern the clustering instead. Finally, several of these studies have been replicated in non-European cultures with similar results (Fiske, 1993). The empirical evidence suggests that the relational models have a fundamental psychological reality, shaping much of our most basic thinking about people and their interactions.

These data suggest a system of moral faculties. At a minimum, there are five faculties, one for each of the models plus a sorting mechanism which assigns physical properties to a representation of a social situation thus determining to which relational-model faculty that representation will be channeled. This sorting faculty learns, usually at an early age, which property to assign to which representation so that representations of social situations are properly channeled depending on the learned parameter settings. The sorter will be discussed further in the final section.

3. The Genealogy of Moral Emotions

Most of these models can be found in other species. Many social mammals, including primates, exhibit communal sharing (van Lawick-Goodall and van Lawick-Goodall, 1970). Reciprocity characteristic of equality matching has been observed in the short-term coalitions and longer-term alliances found among primates (Haslam, 1997) and chimpanzees have been attributed something approaching fairness norms (de Waal, 1991). Dominance hierarchies in non-human primates are examples of authority ranking (Cheney and Seyfarth, 1990). The psychologist Denise Cummins (1996) has argued that our capacity to make moral judgments results from adaptations to the hierarchical dominance structures found in primates generally.

However, the relative absence of authority ranking among gatherer-hunters, and the fact that human existence has been almost entirely in the gatherer-hunter mode, leads one to question whether Cummins has wholly explained the innate component of moral emotions. There is no government in gatherer-hunter bands. The sexes are viewed either as equal or as very nearly equal, and even parents and children interact largely as equals. "Indeed, when compared both to non-human primates and to human non-foragers [i.e. humans who are not gatherer-hunters], there tends to be relative equality between the sexes, though with sexual differentiation in subsistence activities" (Barnard, 1999, p. 56; see also Leacock, 1978). In fact, only two models are clearly recognizable among gatherer-hunters: communal sharing and equality matching. The anthropologist Christopher Boehm has noted tendencies toward hierarchy in pre-agricultural societies, but these tendencies tend to be powerfully counteracted by egalitarian forces which more profoundly shape the political contours of such societies (1999). Boehm also notes that this egalitarianism cannot be explained in economic terms, since all pre-arablist cultures, be they gatherer-hunter pastoralist or horticulturalist, are fundamentally egalitarian despite their economic differences.

As noted earlier, in gatherer-hunter bands, the attitude of sharing with one's fellow band-members and ignoring individual differences, both features of communal sharing, can be so strong that some perfectly healthy members live well doing no work at all, simply living off the kindness of those who do bother to gather and hunt (Woodburn, 1981). By way of an example of gatherer-hunter equality matching, throughout such societies, there are rules for distributing meat so that the person who actually makes the kill only receives a small portion (Cashdan, 1989, pp. 37–38). Similarly, the African !Kung San have a gift-giving economy, in which one agrees with some of one's blood relatives to exchange gifts on a regular basis. Both giving and receiving in this system are based on need, and so one may give a large portion of one's possessions while receiving only a small amount in return much later. Since the !Kung are giving away substantial amounts of what they own, this practice tends toward equalizing wealth within the band (hence equality matching) and is *understood* by the !Kung to have this function (Wiessner, 1982, pp. 79–80).

It is puzzling that authority ranking would be found in non-human primates, be almost wholly absent in gatherer-hunters, and then reappear not long after the invention of the plough. It is also puzzling that market pricing would be absent among gatherer-hunters. What makes these things puzzling is that the gatherer-hunter mode of life represents over ninety-nine percent of human existence: Humans lived exclusively from gathering, and eventually from hunting as well, from 2 million years ago (with the first appearance of the genus *Homo*) to the emergence of arable farming approximately 11,000 years ago. If any mode of social thinking is found in contemporary humans but not in gatherer-hunters, and especially if this mode of thinking appears to be innate, this needs to be explained. Trying to understand the disappearance and reappearance of authority ranking and the sudden appearance of market pricing such a short time ago, seemingly out of thin air, will cast light on the inner structure of the system of moral faculties.

In order to conduct this investigation, it will help to consider who the gatherer-hunters were and are. "*Economically* we are referring to those people who have historically lived by gathering, hunting, and fishing, with minimal or no agriculture and with no domesticated animals except for the dog. *Politically* gatherer-hunters are usually labeled as 'band' or 'egalitarian' societies in which social groups are small, mobile, and unstratified, and in which differences of wealth and power are minimally developed" (Lee, 1998, p. 166). Gatherer-hunter societies are those in which people get their food from the wild, uncultivated products of nature by gathering roots, fruits, and honey, and by hunting and fishing. Such societies have no governments or hierarchies, and are economically structured by an ethic of sharing and sometimes also by giving gifts.

Although conspicuously present in non-human primates, authority ranking is conspicuously absent among gatherer-hunters. (Perhaps authority ranking became psychologically weaker in deference to equality matching because of the importance to human survival of sharing food.) The re-emergence of authority ranking with the introduction of ploughing 11,000 years ago was a reactivation of a hitherto dormant capacity, a capacity possessed by humans because of the biological heritage they share with other primates, but evidently unnecessary in structuring social relations before the pre-arablist mode of life came to an end. Why did authority ranking become necessary for humans, what precipitated the authority ranking faculty changing from a dormant mental appendix to being once again a useful cognitive organ? A plausible answer can be found by considering the relation between the sizes of primate brains and the sizes of primate groups.

It has long been known that the neocortex is much larger in humans than in other primates, even when one factors in the brain/body ratio. The anthropologist Robin Dunbar noted that a primate species' neocortex size correlates with the size of its typical social group: the larger the group, the larger the neocortex. He hypothesized that the neocortex grows larger in order to handle social complexities, such as remembering which individual has which personality, knows which information, has which debtors, has which friends or enemies, etc. Dunbar devised a formula for correlating the size of the neocortex and the size of the group to which a member of that species would belong in its natural habitat. For humans, he calculated that the group size should be no more than 147.8 (1992, 1993, 1996). "The figure of [approximately] 150 seems to represent the maximum number of individuals with whom we can have a genuinely social relationship, the kind of relationship that goes with knowing who they are and how they relate to us" (Dunbar, 1996, p. 77).

The number of people a typical gatherer-hunter knows is also less than 150 – except perhaps in times of great abundance. Although the family is the only enduring unit of organization among gatherer-hunters, they form larger groups, "bands," which are temporary and flexible. A band usually consists of less than 100 people (a "microband"), but in some cases it can be as large as 200 (a "macroband") (Smith and Young, 1998, pp. 140 and 147). Macrobands form when food and water are extremely plentiful. They break up into microbands when there is scarcity. In other words, gatherer-hunters only live in groups greater than 150 when resources are especially abundant (Cashdan, 1989, pp. 22 and 33–34).

This changed with the introduction of arable farming. Ploughing demands the replacement of the nomadic way of life typical of gatherer-hunters with a sedentary way of life. Instead of bands breaking into smaller groups once they reach a cognitively unmanageable size, the sedentary life encourages the ever greater accretion of people around the particular ground and animals to be tended. The sedentary life also gives people more opportunities to have children, and it gives the very old and very young more of a chance to live without being subject to the physical challenge of nomadism (Bates and Fratkin, 1999, p. 162f). The result is that arable farming introduced unprecedented group sizes and thereby created a burden for social cognition which the gatherer-hunter had not faced.

As noted, gatherer-hunter groups would sometimes be as large as 200, but this was only during times of plenty in which less social cognition would have been necessary. More specifically, fewer questions of distribution would have arisen in such times; politics would be less needed. Hume notes that because air and water are plentiful, there is no need to apply principles of justice to their use (1983 edition, p. 21). Hume's examples may be outdated, but his point remains valid. It is the limitedness of resources that makes justice necessary. The advent of arable farming, however, marks not only increased population densities but *decreased* plenty. Since arable farming is a less efficient means of extracting resources from the environment than is the gatherer-hunter method (Sahlins, 1972/1998, Cohen and Armelagos, 1984), the birth of land cultivation marked an unprecedented combination: high population densities and scarcity. People in the first largish ploughing societies faced an urgent problem in social cognition; namely, how to decide what should go to whom while being unable to remember and process information about the personal characteristics and interrelations of all members of the community.

It is most plain that this would have been a great challenge to equality matching. Keeping track of and correcting imbalances becomes more difficult the larger the group. It is perhaps less obvious that there would have been a cognitive problem with regard to communal sharing. However, there are anecdotal reasons for believing that communal sharing requires a degree of empathy and sympathy which becomes psychologically unrealistic once the number of 150 is exceeded.

In support of this point, consider the Hutterites, a religious sect originating in Europe in the sixteenth century and migrating to North America in the nineteenth. "The Hutterites view themselves as the human equivalent of a bee colony. They practice community of goods (no private ownership) and also cultivate a psychological attitude of extreme selflessness... Nepotism and reciprocity... are scorned by the Hutterites as immoral. Giving must be without regard to relatedness and without any expectation of return" (Wilson and Sober, 1994, p. 602). That is, the Hutterites structure most of their relations according to communal sharing, and perhaps equality matching as well, and consciously hold up this ethic as an ideal.

However, the Hutterites are only able to maintain this high level of generosity by keeping the size of each colony below 150 members. According to Bill Gross, the leader of a Hutterite colony near Spokane,

> Keeping things under 150 just seems to be the best and most efficient way to manage a group of people. When things get larger than that, people become strangers to one another... If you get too large, you don't have enough work in common. You don't have enough things in common, and then you start to become strangers and that close-knit fellowship starts to get lost. What happens when you get that big is that the group starts, just on its own, to form a sort of clan. You get two or three groups within the larger group. That is something you really try to prevent, and when it happens it is a good time to branch out (quoted in Gladwell, 2000, p. 181; see also Dunbar, 1996, p. 72).

When a Hutterite colony reaches 150, it splits into two colonies of 75; one group remaining at the original site, while the other moves to a new area (Wilson and Sober, 1994, p. 604).

With the increased population densities and decreased resources inaugurated by arable farming, some method of simplification was necessary for social cognition; and it was at this point that humans had no choice but to reactivate the quasi-vestigial authority ranking faculty. One need not remember all social alliances and character traits so long as one can instantly identify an individual as belonging to a certain social stratum by their manner of dress, form of speech, etc. This is a great simplifying scheme for social cognition, one for which humans were already capable given their primate biological heritage. According to Dunbar (1996, p. 72), there is a well-established principle in sociology that social groupings larger than 150-200 become increasingly hierarchical.

There is much anecdotal evidence that humans do not need hierarchy in groups of 150 or less. Consider the company of Gore Associates, a manufacturer of fabric, cable insulation, and tubes for automobiles and medical equipment. Gore Associates follows the policy of limiting the number of people working in each factory to 150. They have found that by limiting factories to this number, peer pressure is so powerful that there is no need for management. Jim Buckley, an associate of the firm, remarks that "The pressure that comes to bear if we are not efficient at a plant, if we are not creating good earnings for the company, the peer pressure is unbelievable. This is what you get when you have small teams, where everybody knows everybody. Peer pressure is much more powerful than the concept of a boss. Many, many times more powerful" (quoted in Gladwell, 2000, p. 186). Peer pressure also plays a role in gatherer-hunter economics. If a !Kung is perceived as being wealthier than others but still refuses to give up large portions of his property, he is shamed and badgered until he does so. As a result, a stingy !Kung feels miserable (Wiessner, 1982, pp. 80–82). The need to maintain strong peer pressure also figures in the Hutterite practice of limiting the size of communities: "The Hutterites say that once a community exceeds 150 people, it becomes increasingly difficult to control its members by peer pressure alone. With smaller groups, a quiet word in the corner field is enough to persuade an offender not to behave badly in future. But with larger groups that quiet word is more likely to elicit a brusque and dismissive response" (Dunbar, 1996, p. 72; see also Hardin, 1988).

Therefore, a case can be made that the authority ranking faculty remained in humans but was little used before the advent of ploughing because the communal sharing and equality matching faculties alone could process social information. However, arable farming forced people to allocate meager resources in large groups. This made it necessary to reactivate the authority ranking faculty in order to simplify social relations, it being no longer necessary with authority ranking to remember the identity of a person (including remembered obligations) in order to know how to interact with them. Communal sharing and equality matching continued to be used, but could normally only be applied within smaller groups of people, such as friends family co-workers, groups small enough so that one could remember the identity and obligations of each.

It is also a burden of this paper to defend the existence of a market pricing faculty. One possible objection to there being a market pricing faculty is that neither gatherer-hunter societies nor non-human primates exhibit market pricing thinking. In the case of the authority ranking faculty, one could plausibly say that it remained dormant through much of human existence but was then reactivated due to increased population densities' overwhelming one's ability to process social information using communal sharing and equality matching alone. However, no such response is available when defending the existence of the market pricing faculty. Unlike authority ranking, market pricing is wholly absent among non-human primates. A market pricing faculty does look suspiciously like something that just popped into existence out of nothing. (Gatherer-hunters are, however, capable of understanding market pricing reasoning when they encounter it, but they express contempt for it (Fiske, 1991).) Does this mean that the capacity for market pricing reasoning does not depend upon a specialized mechanism but instead results from some general reasoning mechanism?

Not necessarily. Even though all biologically normal humans can understand market pricing reasoning easily and even though it has been absent through nearly all of human existence, as well as all non-human primate existence, it does not follow that market pricing thinking is the product of a general reasoning capacity. In order to see why this does not follow, let's consider why non-human primates do not exercise market pricing reasoning.

Market pricing requires the ability to count, something which non-human primates cannot do. Any exercise of market pricing requires some standard of value, such as price or utility, so that all costs and benefits can be calculated and compared in terms of ratios. In short, market pricing requires the technique of arithmetical calculation. The anumeracy of non-human primates sufficiently explains their not using market pricing reasoning. (By contrast, equality matching does not strictly require the ability to count. Instead, it only requires the ability to judge that each person has received "the same thing." Of course, equality matching reasoning *can* utilize the ability to count in making such a judgment.)

All human children have the capacity to learn how to use numbers. However, as with writing, it was only with the invention of ploughing that the number system was developed. Ownership of crops, land, and animals (including humans) required the ability to calculate gains in comparison to losses for the sake of a maximal yield. The ease with which children can learn to count and the absence of mathematics through most of human existence is strikingly parallel to the ease with which children can learn to think in market pricing terms and *its* absence through most of human existence. Given that market pricing reasoning requires numeracy, the parallels are none too surprising. However, this does not mean that the numeracy which market pricing requires results from a general-purpose, non-specialized reasoning mechanism which was only applied to mathematics with the dawn of land cultivation.

Chomsky suggests that there is indeed a number faculty, a specialized device, but that this device is an "exaptation" (1988, p. 169f). An *exaptation* occurs when an organ is adapted for one use but, as the environmental demands change, is appropriated for some other use (Gould and Vrba, 1981). The notion of exaptation answers the question of how new organs can arise seemingly without antecedents. For example, mammals have three middle-ear bones: the hammer, anvil, and stirrup. The stirrup evolved from a bone in fish which braces the jaw against the braincase. That bone, in turn, evolved from a bone which supports the gill in jawless fishes (Gould, 1993, Chapter 6). What was originally a gill support came to function as a way to brace the jaw against the braincase and then came to play a role in mammalian hearing. The transition from jaw brace to hearing organ occurred because of the fortuitous positioning and composition of the bone: It happened to lie next to the otic capsule of the inner ear, and bone just happens to transmit sound well. 360 million years ago, *Acanthostega* had a stapes (stirrup) which served both functions.

Chomsky suggests that the evolution of the number capacity is similar. Since humans have only been counting for 11,000 years and since that is not enough time for selection forces to act, it cannot be that some humans were born with a faculty *exclusively* dedicated to number, while some were born without, and that only the former lived long enough to reproduce. Chomsky suggests that the number faculty is actually part of or an abstraction from the language faculty, that number is an unforseen application to which the language faculty has been put. The language faculty is the only known cognitive mechanism to employ the property of *discrete infinity*, i.e. each sentence has a discrete number of meaningful units (words, affixes), and there is no upper limit to how many such units a sentence may have. Communication systems found in other species lack this property, e.g. the system of ape calls consists of a discrete repertoire of signals but is finite, the bee dance is potentially infinite in what it can convey but not discrete: The bee uses quantities which vary along a continuum to signal the location of food, e.g. the greater the distance from the hive, the greater the bee exhibits a certain kind of motion.

By contrast, the human number capacity has the property of discrete infinity. "In fact, we might think of the human number faculty as essentially an 'abstraction' from human language, preserving the mechanism of discrete infinity and eliminating the other special features of language" (Chomsky, 1988, p. 169). This would explain both the inherent human capacity to use number even though gatherer-hunters do not exercise it. This would also mean that "civilized" (i.e., agricultural) humans are much like the ancient *Acanthostega*. Just as its stapes was fortuitously positioned and constituted so as to perform more than one function in response to multiple environmental demands, so our language faculty is fortuitously constituted so as to perform more than one function due to its use of discrete infinity and due to unprecedented environmental demands. The emergence of arable farming is the environmental demand here in question, since it requires the ability to count.

Arable farming involves a kind of non-social market pricing reasoning: One interacts with one's environment so as to maximize ratios of production over loss. Why was this sort of agricultural reasoning extended to social relations? I suggest that agriculture itself made the extension necessary. Calculating for the sake of maximizing utilities was extended to the social realm for the same reason that it became necessary to reactivate the authority ranking faculty: The increased population densities which agriculture spawned made the communal sharing and equality matching faculties inadequate for coordinating social interactions. Simplification measures were necessary for the human mind to process information about larger social groups. The broad social divisions of authority ranking were one means, but the exaptation of the language faculty for market pricing reasoning was another. One can simplify one's relations to a large group of people by thinking like a capitalist; namely, by interacting with others for the sake of maximizing one's own gain. Like a shopkeeper, a single individual can interact with a large number of people in this manner without having to remember the obligations unique to each one. Whereas authority ranking reasoning in humans required the reactivation of a quasi-vestigial mechanism, the appearance of market pricing required an exaptation of part of the language faculty for the sake of calculating utilities.

The reactivation of the authority ranking faculty helped make it possible to use market pricing reasoning as a means of structuring interpersonal relations. Market pricing, as Fiske characterizes, need not involve selfishness. After all, he provides a minimal characterization of market pricing in terms of cognizing social relations in terms of ratios and proportions, leaving open whether the motivation is selfish or altruistic. However, most market pricing relations require that people make agreements with each other for the sake of each party's gain. But, as Hobbes pointed out, agreements are only binding if there is some person or group with authority over the parties to the agreement, someone with the power to punish those who break their agreements. Otherwise, the agreements are meaningless. So the reactivation of the authority ranking faculty made market pricing, in its typically self-interested form, possible; and, like authority ranking, market pricing was also helpful in simplifying the individual's interactions with groups of people in excess of 150.

Given the possibility that the market pricing faculty is an exaptation, it is interesting to note that in the substitution experiments discussed earlier, there were fewer substitutions within the market pricing mode than within any of the other three modes. This is consistent with the market pricing faculty playing less of a fundamental role in structuring social cognition than do the other three faculties, perhaps because it is actually part of the language faculty and hence not functioning as efficiently as the others for social cognition. Haslam and the Fiskes, however, have suggested that this effect may simply be due to the fact that market pricing relations are more likely to be anonymous than are other relations (1991, p. 671).

4. The Moral Faculties Within the Larger Cognitive System

In this paper, there has been discussion of the inner structure of the system of moral faculties, namely that it is divisible into at least four faculties, one for each relational model. However, the question of how these faculties are connected to the rest of the cognitive economy also needs to be addressed.

Dan Sperber has made an important distinction between perceptual and conceptual cognitive processes. "Perceptual processes have, as input, information provided by sensory receptors and, as output, a conceptual representation categorizing the object perceived. Conceptual processes have conceptual representations both as input and as output. Thus seeing a cloud and thinking 'here is a cloud' is a perceptual process. Inferring from this perception 'it might rain' is a conceptual process" (1994, p. 40). The processes taking place in the moral faculties are conceptual. One does not simply see a moral transgression, instead one sees or comes to learn of actions or behavior and then one classifies accordingly. Even if one is having a moral reaction to a situation being observed right at that time, the situation must first be conceptualized in some way, e.g. harming, helping, punishing, and so on.

Sperber claims that the mind is nothing but a system of interconnected "modules," some of which are perceptual and some of which are conceptual. In addition to specialization, a *module* is a faculty exhibiting "informational encapsulation" (Fodor, 1983). A system is *informationally encapsulated* just in case it can only access a limited range of information in performing its computations. That information may consist of data stored within the module or an external data base so long as the module is constrained as to which data bases it can scan. Informational encapsulation is the opposite of "cognitive penetration" (Pylyshyn, 1980). A mental sub-system is *cognitively penetrable* to the extent that there are no principled limits on what other representations in the system it can access. Modules are also "specialized," a term which, when applied to the module itself (as opposed to a data base external to it) means that the module is limited as to what sorts of inputs it receives. A social module is specialized in that it only receives as inputs mental representations of social situations and not, say, of mushroom growth. Jackendoff's case for the specialization of the social faculties has already been discussed.

The moral faculties are encapsulated. They generate certain expectancies just as do the naive physics faculties discussed earlier. That is, the individual will expect a certain consequent given a certain antecedent, e.g. "If a baseball strikes a window, then the window will break." Some expectancies are based on experience, but those resulting from faculties containing innate information are not. As a general rule, these non-empirical expectancies are highly resistant to change. For example, the infant's expectancy that one solid object will block the passage of another is an expectancy which resists change (Baillargeon et al., 1985). Unlike empirical expectancies, non-empirical expectancies cannot be altered by changing the individual's experiences (Premack and Premack, 1994, p. 158f). If repeatedly shown what appears to be one solid object passing through another, the infant will stubbornly continue to expect this sort of thing *not* to happen. This is encapsulation. The expectancy results from a mental process which is not able to revise its picture of the world by accessing new representations. Since the social faculties generate non-empirical expectancies, they too should be encapsulated.

A teleological case can also be made for any innate mental representation being accessed by an encapsulated and specialized mechanism: Innate information should be insulated from any other representations which might interfere with its function. There would be little point in placing innate information into a system without protecting it from the effects of environmental shaping. Even if the innate information cannot be erased by environmental shaping, without encapsulation and specialization, there is nothing to stop learned representations from overriding the effects of the innate ones. Given their specialization and their encapsulation, the social faculties are modules.

Fodor has argued for the existence of perceptual modules, including modules for low-level language perception (1983); however, he disputes Sperber's wholly modular picture of cognitive architecture. Fodor argues that if there are conceptual modules in addition to perceptual ones, then the conceptual ones must get some inputs from processes which are not specialized (2000, p. 71f). That is, the mind must consist of general-purpose processes in addition to specialized ones. In order to illustrate Fodor's argument, let's consider a mind with a relatively simple system of moral modules, one in which there is a communal sharing module and an authority ranking module but no more. Each of these modules only turns on in response to some social situations, i.e. one will be inclined to have or make communal sharing emotions or judgments in response to some social situations while being inclined to have or make authority ranking emotions or judgments in response to other social situations. That is, the communal sharing module accepts as input mental representations proper to it (e.g., a mental representation of a mother and her infant), while the authority ranking module processes representations proper to it (e.g., a mental representation of males negotiating over access to an estrous female).

But how does the mental architecture know which representation to channel to which module? How does the system assign physical features to the various representations so that they are accepted as input by the right module? There could be another faculty which sorts mental representations and then dutifully and efficiently assigns them physical properties which will cause them each to go to its proper destination. But, to continue with Fodor's argument, this faculty would be less specialized than the communal sharing and authority ranking faculties. Patently, it would be sensitive to a broader range of inputs than either one of those faculties alone would process. It could still be specialized in the sense of not being potentially sensitive to *all* representations in the system. That is, the sorter may be specialized and should perhaps even be considered part of the system of moral modules, that system being thus decomposable into several sub-modules: one for each relational model and the sorter. But then the same problem arises again when comparing the sorter to other modules in the general cognitive system: There would have to be another sorting device which is *even less* specialized than the moral/social sorting device first mentioned. After all, the moral sorter only takes representations of social situations as input, so the system must have some preliminary way of sorting social representations from other sorts of representations. This regress continues until one is forced to acknowledge at least one general-purpose faculty.

Fodor notes that this issue does not arise for perceptual processes. For perceptual modules, distinctions in the sensory apparatus itself (different patterns of retinal irradiation, for example) could determine the physical properties of each representation which are responsible for its being directed to the proper module(s). A sorting device would not be necessary if features of the representation itself determine its course through the cognitive system. So if one wanted to defend a wholly modular cognitive architecture, one might be tempted to do so by saying that information in the system always percolates from the "bottom up," i.e. that all information travels from the perceptual level to levels that are increasingly more conceptual, further removed from the perceptual level. (In fact, such a view seems implicit in Sperber, 1994.) In this way, the features of a representation which cause it to be channeled into one conceptual module, as opposed to another, are already determined at the perceptual level. On this view, no sorter would be necessary, since each representation already has distinctive properties which determine its path.

But Fodor notes how implausible this "solution" really is. On such a view, representations reach different destinations at the conceptual level because of physical differences among the representations already found at the perceptual level. So such an architecture assumes that any conceptual distinction the mind makes must be reflected in some observable distinction. The moral system, considered as one big module, for example, will only go off when one thinks about a social situation, not when one is thinking about situations understood to be wholly non-social, e.g. Martian rock slides. But what differences *at the sensory level* distinguish social from non-social situations? The sort of cognitive task here is patently unlike, say, recognizing facial expressions. A mind consisting wholly of specialists, as Fodor notes, demands an implausible empiricism. There seems to be no choice but to abandon such a view. The upshot is that the mind contains at least one general-purpose mechanism.

So much for specialization, what about encapsulation? Couldn't the mind still consist entirely of mechanisms which are limited as to which data bases they can search in doing their computations? Arnold J. Chien has argued that an unencapsulated system is needed for explaining how a listener interprets quantifier scoping (1996). For example, there is no principled limit to the information one may have to access in order to figure out that the sentence "Sam served one beer to all customers" does not mean that all the customers gathered around a single glass of beer. "Quantifier scoping is unencapsulated: it is based on information which in principle could come from anywhere in a cognitive inventory, not merely a subset" (p. 4). Chien's argument is not a priori but is based on his own failed attempts to produce a computer model for interpreting scoping which would have principled limits on the information it could search or which is decomposable into programs each of which has such a limit.

Granted that there is an argument for a general-purpose intelligence as well as an argument for an unencapsulated interpreter of quantifier scoping, it doesn't immediately follow that these two systems are one and the same. It remains logically open that the general-purpose intelligence is restricted as to which databases it can search, and that the cognitively penetrable system which interprets scoping is specialized. However, these arguments should be seen as blows to Sperber's view that the mind is wholly modular, and they should also at the very least raise the serious possibility of a single unencapsulated, general-purpose intelligence.

Viewing the mind as containing both social/moral modules as well as a nonmodular intelligence fits well with our own experience in reasoning about morality. In moral reasoning, there is an element of automatic, effortless emotional response. Sometimes that is all there is, but there can also be an element of reflection on such responses in the light of reason. That kind of thinking is neither automatic nor effortless. Instead of viewing moral reasoning as wholly automatic and unconscious – as a naive reading of the modularity view might suggest – a more sophisticated and flexible conception of moral reasoning would fit better with our actual experiences of coming to a moral judgment (Bolender, 2001). Moral judgment may in some cases be wholly knee-jerk, wholly the result of modules; but humans are capable of more than this. In addition to specialized, informationally encapsulated modules which automatically generate moral emotions, there appear to be general-purpose, cognitively penetrable processes enabling moral judgments which are sensitive to the agent's general fund of knowledge. Moral emotions are the starting points for moral judgments, but they need not strictly dictate their endpoints. It is plausible that the outputs of the moral modules serve merely as data which non-modular thought processes can use in formulating moral theories and policies. With great conscious effort and time, one can arrive at moral theories and policies which may even contradict some of one's own emotional reactions, even though a supposedly moral principle violating too many of those emotions would probably seem grossly implausible. That is, non-modular thought processes enable one to construct moral views which are more systematic, comprehensive, and consistent than are the raw outputs of the modules. This is the task, and hopefully sometimes the achievement, of moral philosophy.

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