HUMAN NATURE AND SOCIAL NETWORKS

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Introduction

This chapter argues that a variety of scientific discoveries are radically changing our understanding of human nature and that they offer new approaches to achieving effective command and control within edge organizations.

Different models of organization vary in their assumptions about how people are motivated to work together for a common purpose. To characterize the alternatives in the extreme, in one camp there is the "Hobbesean" view that people are primarily motivated through a combination of fear and self-interest. According to this view, the challenge of effective command is to align the enlightened self-interest of individuals with the overall goals of an organization. For these "social realists," human beings are not naturally trustworthy, but will "defect" to act on their own behalf unless appropriately monitored by authorities with special powers. This group sees hierarchical controls as a natural, necessary, and efficient means for achieving order, clarity, and accountability. In the opposing camp are the "social idealists" who argue that it is inherent in human nature to trust, to help one another, and to act for the common good. This group contends that hierarchy is not a prerequisite for effective control and that individuals will naturally act for a common good, given the proper conditions. Whereas this point of view is often dismissed as utopian, it is nonetheless one of the primary values of highly effective combat groups[1] and is found to be the principle motivator behind highly respected leaders in all sectors of society.[2]

The position taken here, however, is not to oscillate between these two extremes, but to attempt to identify the rationale for why some models of social organization are more effective than others under varying social circumstances. Fortunately, there is a growing body of research that is beginning to identify a repertoire of both innate and learned

[1] See: Rinaldo, Lt. Col. Richard J. "Combat." *Army Magazine*. July 2003.
[2] George, Bill. *Authentic Leadership: Rediscovering the Secrets to Creating Lasting Value*. San Francisco, CA: Jossey Bass. 2003.

social strategies that human beings use to build trust, identify cheaters and free riders, and cooperate within and across groups. Some of these are hierarchical in nature; others are peer-based, cooperative, and trust-based. In either case, it depends upon the context and the nature of the group task.

Human sociality as an evolutionary stable strategy (ESS)

A steady stream of research from the complexity sciences, evolutionary psychology, biology, and neuroscience are providing a new and detailed understanding of human nature. No longer a source of armchair speculation, today's understanding of human nature is becoming a precise experimental science, drawing upon many rigorous disciplines. Not only are these findings overturning many strongly held myths about human rationality and motivation, but they are also helping us to understand how spontaneous forms of human organization emerge and how large-scale, self-synchronizing organizations might be more effectively controlled.

One thing that the biological sciences are demonstrating is the extent that human beings are genetically linked to virtually all forms of life. Not only do we share 98 percent of our genetic code with our closest cousin, the chimpanzee, but also 46 percent of our genetic code with mice.[3] What is no less extraordinary is the extent to which human social behaviors are very similar to other social species—even those to whom we are not genetically linked.[4] How is it that very similar cooperative strategies and social behaviors emerge in genetically distinct species? The answer is intriguing because it argues that under certain environmental conditions, there are evolutionarily stable strategies (ESSs) that are independently discovered by different species and embedded in their respective genomes through the trial and error of thousands of generations of evolutionary testing.[5] What this means is that for certain forms of cooperative behavior, there are ESSs that naturally appear as the best solutions and that these are present in a variety of different social species: harvester ants, ravens, wolves, elephants, whales, chimpanzees, and

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[3] Healey, Justin ed. "Issues in Society." *Genetics*. Volume 149. 2001.
[4] Gaulin and McBurney. "Social Behavior." *Psychology: An Evolutionary Approach*. Upper Saddle River, NJ: Prentice Hall. 2000.
[5] An evolutionary stable strategy (ESS) is a circumstance of a species where there is no incentive for any other strategy to displace them, because this is the best that a species can do given the circumstances.

human beings. Therefore, one can argue that there are certain underlying laws—a kind of social physics—that can be abstracted for complex forms of collective behavior and cooperation, independent of the kind of species involved. Indeed, understanding what these laws might be has been the focus of research in evolutionary game theory, multi-agent simulations, and models of artificial life. The fact that highly stable strategies of collective behavior emerge over time indicates that highly fit organizations would benefit from such strategies as well.[6]

But that is only part of the picture. Human beings are unique in evolutionary history in having discovered certain survival ESSs that no other species has obtained. Therefore, it is not only important to understand how we are behaviorally similar to many other social species with similar social survival strategies, but also how we are uniquely different. Although the architecture and functionality of the human brain and limbic systems are similar to their reptilian, mammalian, and primate ancestors, there are new additions including the neo-cortex, which is unique in its size and functionality. Although the human brain is composed of a large, ancient "legacy" system, which like software code is patched one layer upon another without any apparent design, it is this new layer that enables a very powerful and species-specific capability.

For many years, anthropologists argued that what made human beings unique was their ability to make tools, with some anthropologists even going so far as to argue that *Homo sapiens* should more correctly renamed *Homo fabens*, the tool maker. More recently, it has been argued that it was the "language instinct," a human being's innate and unique ability to create language systems that differentiate us from all other species. Yet, as more and more research became available on the linguistic abilities of other species, especially primates, there seemed to be no definitive point dividing human linguistic or communicative abilities from those of other primates.[7]

Now evolutionary psychologists and anthropologists offer a new explanation of the "human difference" that takes into account language creation, tool making, and social

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[6] This is an example of what is known as *convergent evolution*.
[7] Dunbar, Robin. *Grooming, Gossip, and the Evolution of Language*. Cambridge, MA: Harvard University Press. 1996. p. 66.

cooperation. For the last 50 years, evolutionary theory was confined by a set of theoretical blinders that looked at fitness selection only on the individual level and contended that the individual was the only unit of selection. In contrast to Darwin's original writings, these scientists contended that there was no selection for group traits. Now that point of view is in dispute, with many evolutionary biologists arguing that natural selection does function at the group level and the evolutionary success of *Homo sapiens* can in large measure be attributed to its ability to manage complex social relationships. In other words, the ability of different species to function cooperatively has tremendous survival value. Those that manage the most complex and flexible forms of social cooperation enjoy a reproductive advantage. Hence, group cooperation was a vector of natural selection for these species, including primates and our ancestors, the early hominids.

Robin Dunbar and his colleagues conducted a study of the fossil record of the brain sizes of hominids that showed that the size of the neo-cortex—the part of the brain concerned with thinking and problem solving—increased with the size of the hominid social groups. He argued that the ability to coordinate behaviors and manage relationships in groups was so important that it accounted for the growth of the neo-cortex not only in primates, but other mammals as well.

> All of our analyses so far had been built on the assumption that the problem each animal has to face is keeping track of the constantly changing social world of which it is a part. It needs to know who is in and who is out, and who is friends with whom, who is the best ally of the day. In the social turmoil, these things were in a permanent state of flux, changing almost day-by-day. The animal has to keep track of all these, constantly updating its social map with each day's new observations.
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> But there are other possibilities. One is that the relationship between the neo-cortex size and the group size actually has more to do with the quality of the relationships involved rather than their quantity. This much is implied by the Machiavellian hypothesis itself, which suggested that the key to understanding brain size evolution in primates lies in the use primates make of their knowledge of other animals.[8]

[8] Ibid, p. 66.

It is interesting to note that given the evolutionary significance of managing the quality of social relationships, it is only natural that human beings would evolve reputation rating systems for large-scale digital communities. According to Dunbar's analysis of the human neo-cortex, he predicted that the upper limit on the number of different relationships that people can manage is between 150 and 200. Indeed, the sociological literature seems to bear out his predictions. For example, groups as diverse as the Hutterites, Mormons, Anglican Church, military units, and Australian Aboriginal clans all set an upper limit to their group size at around 150 members. Social groupings above 150-200 members become hierarchical in structure, whereas smaller groups rely upon personal contacts. According to Dunbar, most businesses seem to obey the 150-200 rule.

> Businesses with fewer than 150-200 people can be organized on entirely informal lines, relying on personal contacts between employees to ensure the proper exchange of information. But larger businesses require formal management structures to channel contracts and ensure that each employee knows what he or she is responsible for and whom they should report to.[9]

As Rob Cross and Nitin Nohria have shown in their analysis of informal social networks within businesses, the problem with many formal and *impersonal* reporting structures in large organizations is that they are not transparent and are not trusted. Hence, much of the real work within large enterprises is still conducted through informal networks.[10] This is not surprising if people are wired to coordinate their behaviors through social protocols that are essentially innate. There is growing neurological and experimental evidence that not only are the brains of human beings indeed wired for reciprocal exchange, but that many of the emotions associated with governing social behavior—shame, pride, anger, guilt, compassion—are also biologically based and characteristic of most mammalian social species, including wolves and vampire bats![11]

Altruism, for example, is not limited to human beings, but is typical of many different social species. Experiments with rhesus monkeys have shown that they would refrain from pulling a chain to deliver food if it would result in shocking other monkeys. This

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[9] Ibid, p. 72.
[10] Cross, Rob, and Nitin Nohria. "Six Myths about Informal Networks: How to Overcome Them." *MIT Sloan Management Review*. Spring 2002.
[11] Damasio, Antonio. *Looking for Spinoza, Joy, Sorrow and the Feeling Brain*. Orlando, FL: Harcourt. 2003. p. 160.

suggests that empathy and reciprocity are not merely ideals, but rather ESSs that seem to be the encoded behaviors of many species. The highly respected neuroscientist Antonio Damasio has argued that social emotions have an identifiable physiology and measurable role in the behavior of the human brain. "Anger, fear, shame, indignation, jealousy, pride, compassion, gratitude, sorrow, and joy appear to be part of an overall program of bio-regulation."[12]

Leda Cosmides and John Tooby are among a growing number of evolutionary sociologists and psychologists who have argued that social exchange algorithms are the innate competencies that enable human collectivities to function as communities.[13] Such algorithms include a person's sense of justice and guilt, social reciprocity, gift giving, and an ability to interpret social cues. Sometimes called *reciprocal altruism*,[14] it is an adaptive trait because it benefits the collective.

> This mutual provisioning of benefits, each conditional on the others' compliance, is rare in the animal kingdom. Social exchange cannot be generated by a simple general learning mechanism, such as classical or operant conditioning…. This strongly suggests that engaging in social exchange requires specific cognitive machinery, which some species have and others lack.[15]

This same point is echoed by Dunbar in discussing brain evolution when he argues that the "mind doesn't work like an all-purpose computer" but rather "consists of a number of separate modules, each designed to do a particular task."[16]

One other compelling bit of evidence that social exchange is a universal trait for all human societies is a study that compared the ability to detect deceit among Harvard undergraduates and the Shiwiar, an isolated Amazonian tribe of hunter-horticulturalists.[17] If the ability to identify cheating is the product of culture or economic development, clear differences in this competence should be discernible. But the study found that "cheater

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[12] Ibid.
[13] Cosmides, Leda and John Tooby. *Evolutionary Psychology: A Primer.* Center for Evolutionary Psychology. Santa Barbara, CA: University of CA. 2002.
[14] Axelrod, R. and Hamilton W.D. "The Evolution of Cooperation." *Science*. 1981. p. 211.
Trivers, R. "The Evolution of Reciprocal Altruism." *Quarterly Journal of Biology*. 46:35–57. 1971.
[15] Sugiyama, Tooby, and Cosmides. "Cross-Cultural Evidence of Cognitive Adaptations for Social Exchange among the Shiwiar of Ecuadorian Amazonia." PNAS. #3529.
[16] Dunbar, *Grooming*. p. 61.
[17] Ibid.

detection reasoning" was present in all of the developed and developing countries included in the study.

This is significant because cheater detection—along with our ability to recognize facial expressions, intentions and emotions, our ability to make friends, our sense of loyalty and protectiveness, our ability to detect injustice, calculate our own self-interests, create a new language, etc.—are highly specialized brain functions, not general-purpose capacities. When the regions of the brain that carry out these functions are injured, no other competencies are impeded, only these highly specific capabilities.[18]

This suggests that our specialized cognitive instincts for enacting social exchange are deeply rooted products of natural selection. The evidence from hunter-gatherer archaeology is that hominids have carried on social exchange for at least two million years. The history of culture shows that social exchange is universally human and not a recent cultural invention.[19]

Mirror neurons

The ability to coordinate actions and infer mutual intentions may not just be due to effective communications, but our having evolved equivalent brain circuitry, in effect, being of a common mind. According to the cognitive linguist George Lakoff,

> we know from psychology professor Paul Ekman's research that configurations of facial muscles express certain emotions. Presumably, our mirror neurons fire when we see the same configurations of facial muscles on someone else that our facial muscles would make. And that firing can activate our own emotional centers. In short, that allows us to empathize—to feel someone else's pain or joy…We have evolved to be empathetic (via mirror neurons and connections to the emotional centers of the brain) and to be connected to the world (via canonical

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[18] "Humans evolved cheat detection as a separate mental component, says evolutionary psychologist John Tooby of the University of California, Santa Barbara. "Our brains have specialized programs like computer programs, specific for various applications," he says. Powell, Kendall. "Brains sniff out scam artists: Evolution might have programmed us to compute fairness." Nature. August 13, 2002. http://www.nature.com/nsu/020812/020812-1.html (June 2004)
Also see: Young, Emma. "Brain's 'cheat detector' is revealed." New Scientist. August 12, 2002. http://www.newscientist.com/news/news.jsp?id=ns99992663 (June 2004)

[19] Dunbar, Robin, Chris Knight, and Camilla Power. *The Evolution of Culture*. New Brunswick, NJ: Rutgers University Press. 1999.

> neurons). Empathy and connection to the other and to the physical environment are central aspects of human nature![20]

Arguing whether human social exchange behavior is selfish or altruistic misses the point.[21] We behave the way we do because it has survival value. The neuroscientist Damasio makes this point:

> The biological reality of self-preservation leads to virtue because in our inalienable need to maintain ourselves we must, of necessity, help preserve others. If we fail to do so, we perish and are thus violating the foundational principle, and relinquishing the virtue that lies in self-preservation. The secondary foundation of virtue then is the reality of a social structure and the presence of other livings organisms in a complex system of interdependence with our own organism.[22]

But the unique human evolutionary trait is not just a highly proficient form of social organization or the ability to manage complex social relationships. It is also the capacity to symbolize, that is, construct new systems of meaning out of arbitrary tags, thereby separating the representation of a thing from the thing itself.[23] In other words, people construct highly malleable models of reality and experience that they can communicate and share with others.[24] Rather than being the artifact of an inherent language instinct, which Steven Pinker[25] and Noam Chomsky[26] have argued, language probably began as a social coordination capability, a kind of rudimentary "handshaking protocol" that enabled multiple participants to create conventions for sharing information and coordinating their behaviors. Whereas many computational and generative linguists have treated language as a logical system for transmitting "well-formed propositions," in effect, what is called its *depth structure*, the great bulk of linguistic apparatus—words, prosody, voice, modals, deixis, discourse, and thematic devices—are concerned with expressing social roles and

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[20] Personal correspondence from George Lakoff. 2003.
[21] There is debate between those who espouse the "selfish gene" model of Richard Dawkins (*Selfish Gene*, Oxford University Press, 1976) and those who take the cooperative or altruistic view of evolution (Sober, Eliot and David Sloan Wilson. *Unto Others: The Evolution and Psychology of Unselfish Behavior*. Cambridge, MA: Harvard University Press. 1998.)
[22] Damasio, *Looking for Spinoza*. p. 161.
[23] Clippinger, John H. *Biology of Business: Decoding Natural Laws of Enterprise*. San Francisco, CA: Jossey Bass. 1999.
[24] Deacon, Terence. *The Symbolic Species: The Coevolution of Language and the Brain*. New York, NY: Norton. 1997.
[25] Pinker, Steven. *The Language Instinct*. New York, NY: HarperCollins. 1994.
[26] Chomsky, Noam. *New Horizons in the Study of Language and the Mind*. Cambridge, MA: Cambridge University Press. 2000.

relationships through variations in "surface structure." This fact is not lost on Dunbar in his analysis of the evolution of language:

> We do seem to use language in establishing and servicing our relationships. Could it be that language evolved as a kind of vocal grooming to allow us to bond larger groups than was possible using the conventional primate mechanism of physical grooming? …If conversation serves the same function as grooming, then modern humans can at least "groom" with several others simultaneously. A second is that language allows us to exchange information over a wider network of individuals that is possible for monkeys and apes. If the main function of grooming for monkeys and apes is to build up trust and personal knowledge of allies, then language has an added advantage. It allows you to say a great deal about yourself, your likes and dislikes, the kind of person you are; it also allows you to convey numerous subtle ways something about your reliability as a friend and ally.[27]

Sociality and command and control

It is important at this point to relate the prior discussion to the fundamental concern of this book: how do you have effective and accountable command and control in a distributed, networked organization? In practical terms, how do you control something over which you do not have direct authority? The findings summarized in this chapter show that humans have evolved as a social species and have consequently developed highly sophisticated social signaling and enforcement mechanisms that reward and enforce complex forms of cooperative behaviors. The implications for command and control structures are profound. Instead of having to impose such cooperative mechanisms from above or through formal monitoring and intervention processes, highly sophisticated cooperative behaviors can be evoked by creating a context in which the appropriate social signaling takes place. Once given the appropriate signals and rules, groups can spontaneously self-organize and control themselves. Moreover, as presented in Chapters Six and Seven, there is evidence that people self-select to identify a social network role to accomplish critical tasks and preserve the integrity of the group. As the behavioral economist Paul Zak[28] has shown in a number of his experiments on trust, subjects do not act to maximize their own self-interest as would be predicted by classic economic theory (the social realist), but engage in trust-building behaviors to develop cooperative strategies. Such strategies for forming self-synchronizing groups have

[27] Dunbar, *Grooming*. p. 78.
[28] Zak, Paul. "Trust." Capco Institute. *Journal of Financial Transformation*. pp. 17-23.

survived because they have been shown to have enormous survival value. Indeed they are not utopian, but highly pragmatic in ensuring group or species survival.

Language and symbolization

Many social species have assessment protocols for evaluating the threat of a predator, the strength of a competitor, or the health of a potential mate. In this respect, human beings are no different in using assessment protocols to assess risks and opportunities. However, human beings are unique among all species in that we can construct new and arbitrarily complex conventions for mediating and coordinating interactions between members of large groups. What separates humans from all other animals is an ability to extract a symbolic representation from a set of physical interactions and then give this symbolic representation its own social reality that can direct and orient behaviors independent of the physical objects or actions that gave rise to it in the first place. This is what the noted philosopher and linguist John Searle sees as the critical function of language: the competency to arbitrarily construct what he calls *social* and *institutional* realities out of social and institutional facts. He contrasts "brute facts," such as the fact that the earth is 93 million miles from the sun, from "institutional facts," such as the fact that a person is a citizen of the United States. Social facts are any facts involving two or more agents who have what he calls collective intentionality, such as:

> animals hunting together, birds cooperating in building a nest, and presumably so-called social insects such as ants and bees, manifest collective intentional and have social facts…. Human beings have a remarkable ability that enables them to get beyond mere social facts to institutional facts. Humans engage in more than just sheer physical cooperation; they also talk together, own property, get married, form governments, and so on.[29]

In order to illustrate his point about how institutional facts and realities arise out of linguistic abilities to symbolize human interactions, Searle cites the example of money. He argues that, originally, currency entailed the negotiated exchange of objects of inherent comparable value—a barter system that was wedded to the inherent value of the physical object. The second kind of money was "contract money," which consisted of contracts to pay the bearer with something valuable on demand. This entailed the

[29] Searle, John. *Mind, Language, and Society*. New York, NY: Basic Books. 1998. p. 121.

exchange of valuable commodities such as gold and silver whose value was more *imposed*, to use Searle's term, than intrinsic. Instead of exchanging objects that were highly cumbersome and whose comparable values were tedious to compute and benchmark, precious coins representing the value of the objects were used. And then, as the transport of these coins became cumbersome, another layer of abstraction was added, paper currency, which was a contract to redeem the face value of the paper currency with a tangible, precious metal. Next, "fiat currency" emerged, another invention of convenience and efficiency. This unit of exchange was not redeemable, but simply declared by an issuing body to be a currency. Just recently, there has been a further innovation in efficiency and convenience, the further abstraction and virtualization of money: digital currency, which is no more than 0 and 1 substitution symbols about the status of the relationship between agents to a transaction. Here, no physical object has to be redeemed at all, as the "social reality" is captured in the digital representation.

Language and social institutions

Both philosopher John Searle and anthropologist Terrence Deacon contend that this unique human ability to construct social realities that result in highly sophisticated institutions is based upon some relatively simple rules. Consistent with the arguments made by John Holland, Stuart Kaufman, Stephan Wolfram,[30] and other major figures in the complexity sciences, highly complex behaviors can come from the repeated application of simple rules. According to Searle, the rule "X counts as Y in C" (where X or Y can be any thing or proposition and C is a marked context) cannot only account for the evolution of money from a tangible currency to a fiat currency, but also for the creation of "institutional structures such as governments, armies, universities, banks, and so on…and even such general institutions as private property, marriage, and political power."[31] Without this symbolic capability of language, Searle believes that there would be no human culture or social institutions.

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[30] See: Holland, John. *Hidden Order: How Adaptation Builds Complexity*. Addison-Wesley. 1995.
Kauffman, Stuart. *The Origins of Order: Self-Organization and Selection in Evolution*. Oxford University Press. 1993.
Wolfram, *A New Kind of Science*.
[31] Ibid, p. 129.

> I believe that language is the fundamental human institution in the sense that other institutions such as money, government, private property, marriage, and games require language, or at least language-like forms of symbolism, in a way that language does not require other institutions for its existence.[32]

Terrence Deacon makes a very similar point, but from the vantage point of an anthropologist who has studied the evolution of language and the brain over a 2-million-year period.

> All symbolizing hominids are linked via a common pool of symbolic information, one that is as inaccessible to other species as are human genes. We are all heirs of symbolic forms that were passed down from one generation to the next, from one group to another, forming a single unbroken tradition. We derive all our symbolic "traits" from this common pool and contribute to its promulgation. Being a part of this symbolic information lineage is in many respects a more diagnostic trait for "humanness" than any physical trait. Evolutionary phylogenies are denied in terms of inheritance of information, but not all the information that determines a species' defining characteristics is coded as genes.[33]

Searle's X-Y-C rule is especially intriguing because it hints at explaining how new layers of social organization naturally emerge and take on a life of their own. For example, by enabling one symbol to stand for another and by creating contextually marked substitution options, it is possible to create new systems of meaning and social construction that on the one hand are part of the old order and preserve those relationships, and on the other hand, introduce new possibilities of behavior at a separate but differentiated level. Searle's example of the evolution of money is one of many social institutional examples, such as the institution of marriage property rights, which began as one set of relationships and evolved over time to become something quite different. (Hence, the impossibility of retroactively "reconstructing original intent" from a set of founding institutional principles, and the inadvisability, indeed the maladaptiveness, of adhering to fixed initial institutional rules.) This capacity to generate emergent layers of organization is functionally equivalent to what occurs in the morphological development in biological evolution, and is therefore arguably a deep-seated ESS that has been captured and exploited in the organization of the human brain. Whereas other species

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[32] Ibid, p. 159.
[33] Deacon, *The Symbolic Species*. p. 343.

may have discovered specific instances of social contracts, human beings appear to have captured and embodied the engine that generates all forms of social contracts.

Returning to Searle's observation about the priority of language, it is clear that although there are many disagreements about how linguistic universals came into being and whether or not they were encoded biologically, there does appear to be a general consensus on some of the primitives underlying all languages. Without getting into the nuances of the debate over the biological origins and innateness of language, suffice it to say that all languages appear to have what is called an operator/operand component, or in linguistic terms, a kind of predicate/argument grammar where verbs act as logical operators, and can take nouns and complex embedded phrases as their arguments. What language allows for, as a form of symbolic communication, is the invention and communication of arbitrarily complex layers of meaning and representation: Searle's X-Y-C rule. The ability to express complex forms of embedded relationships, such as in the sentence,

"The cat that ate the rat that ate the cheese went out the door."

is an example of what linguists and computer scientists call "context sensitive grammars," a uniquely human ability.

What makes such grammars especially relevant to the discussion of social cooperation is that they have the computational or expressive power of a Turing Machine,[34] which suggests that Searle's institutional "grammars, and the grammars of all languages, and the grammars for all computers are mathematically equivalent."[35] Turing Machines represent the upper limit to what is computable and are the theoretical basis for the design of all computers today. If Searle's X-Y-C rule is correct and social institutions are constructs of language, then in the future they can be analyzed, designed, and evolved computationally as variants of Turing Machines. Instead of treating multi-agent simulation models of

[34] Developed by the mathematician Alan Turing, it is a representation of all that is computable. See: Dyson, George. *Darwin Among the Machines: The evolution of global intelligence*. Addison–Wesley. 1997. pp. 70-73.

[35] Zhong, Ning and Klaus Weihrauch. "Computability Theory of Generalized Functions." Association for Computing Machinery. *Journal of the Association for Computing Machinery*. Vol 50, Issue 4. New York, NY. 2003. p. 469.

social phenomena[36] as kinds of approximations, it may be possible to make the far stronger claim that social and institutional realities are indeed kinds of Turing Machines! If such is the case, and this is certainly highly speculative at this point, then there is the prospect for creating normative criteria for assessing the computational efficacy and power of different forms of social and institutional organization.

With this new view of human nature and the evolutionary importance of social cooperation in the sections to follow, we briefly examine some widely held beliefs about how people collaborate and share resources. Much of the current research on social networks and collaboration tends to treat social networks as static networks, drawing on examples of flocking animals and swarming insects as metaphors for certain forms of human collective action. It is important to bear in mind that these are examples of what Searle calls *social realties* and do not account for a major aspect of human collective behavior: *institutional reality* construction, a dynamic and creative process that is uniquely human.

Language, command intent, and social construction

In the United Kingdom, there is an instance of a labor union bringing a company to the bargaining table simply by literally following the work rules. Similar literalness of interpretation of an order or task can be crippling to any organization. Common sense would dictate that only in the rarest of circumstances can orders be literally interpreted. But then, how is it possible to be precise in communicating the intent of an order without being literal about an order? How is it that effective teams can know command intent without having to be told it and can get it correct for a variety of circumstances? In edge organizations where command is dispersed and pushed out to the edge, the reliable, replicable, and scaleable understanding of command intent is essential.

The literature on the social use of language is very clear on the matter of how people communicate intent and may provide significant insight into how to design effective orders and tasks. Language is both the product and the instrument of highly creative,

[36] Page, Scott and Lu Hong. "Diversity and Optimality." Working Paper. University of Michigan. May 22, 2002. www.pscs.umich.edu/diversity (June 2004)

dynamic, and social processes. The English language, for example, has two types of "registers": a low register that is essentially the colloquial use of everyday terms that are underspecified, and a high register often made of Latinate terms that are technical and highly specified.[37] Register is based upon the classical notion of decorum, whereby certain levels of usage are considered appropriate (or inappropriate) to particular topics and social situations.[38] The higher the register is, the less subject the term is to interpretation by the listener, and hence, the more formal and prescriptive it is. Associated with a term is a semantic field of meanings that move from slang and colloquial interpretations up to scientific and technical interpretations—the most impersonal and highly specified.

The following table contains examples of high and low register terms for "mad" behavior. Notice how the higher register terms differ on a dimension of the *type* of mad behavior (a kind of diagnostic distinction) whereas the lower register terms reflect a kind social acceptance or distancing distinction.

High Register Terms	**Low Register Terms**
Melancholic	Demented
Hypochondriac	Insane
Catatonic	Mad
Manic	Mental
Schizoid	Bonkers
Non compos mentis	Cuckoo
Schizophrenic	Loony
Psychotic	Crazy
Neurotic	Nuts

Table 1. High and Low Register Terms for "Mad" Behavior

Often in an attempt to be more precise and therefore less subject to misinterpretation, high register terms are used to issue orders and tasks on the mistaken assumption that the more specified a term is, the better command intent is communicated.

[37] Hughes, Geoffrey. *A History of English Words*. Blackwell Publishers. 2000.
[38] Ibid. page 4.

Unless the task is very technical and well-specified (which even many technical tasks are not), the more effective and reliable course is to use low register terms. Low register terms provide clear signaling, whereas high register terms require the recipient to interpret and improvise within the context that the commander has identified. The reason that people are able to infer command intent is that, over tens of thousands of years, they have evolved mirror neurons and the ability to construct and confirm "common theories of mind" through shared experiences. These are extremely important and often undervalued competences that are overlooked because of the mistaken assumption that interpersonal directives can be fully and unambiguously specified through high register communications, or less graciously, "bureaucratese." The challenge from an edge command and control perspective is to understand those conditions whereby intent can be most readily and deliberately framed—appropriate language registers, shared experiences, and internalized social protocols.

A possible insight into how command intent can both evolve over time and yet preserve its original purpose is the example of Searle's X-Y-C rule to account for how the meaning of money as an exchange currency evolved over time. This example shows how the social intent of providing an effective method of exchange can express itself through new circumstances and technologies while still preserving its original definition and purpose. Virtually everything about money has changed—from bartering to gold and silver to paper monies to digital currency—and yet these are all recognizable as forms of exchange. This ability to improvise and create new social facts and institutions within "intent preserving" boundaries is a unique human capability, and one that might be better understood and augmented to achieve more effective distributed command and control structures. If appropriately understood, a variety of technologies could be built to express command intent more precisely and provide support technologies for the dynamic generation of context-specific metadata that would recognize and categorize terms appropriate to command contexts.

Trust and transparency

As Dunbar noted, the ability to evaluate the quality of a social relationship is a precondition for social self-organization. Trust is the consequence or state when one or

more members of a network perform according to mutual expectation. It is not an abstract moral virtue, but a network property—a byproduct of the quality of interactions between parties.[39] Trust requires measurement, feedback, and accountability. In most social networks, the consequences of low trust are high transaction costs: the need to enforce breaches, to create alternatives, or simply the failure to execute some kinds of interactions or exchange. In such social groups, low-trust individuals are identified and excluded from the group. Again, as Dunbar pointed out in his analysis of grooming and gossip behaviors among primates and humans, the need to constantly contact and confirm relations is a way of achieving social cohesion. If members find that they are being excluded or have not been receiving their normal number of grooming contacts, they can correctly infer this as a rebuke, and that they need to re-earn the group's interest and trust.[40] The ability to build and leverage trust among members of a group builds *social capital* and significantly reduces transaction costs because such networks become self-synchronizing and self-enforcing.

The other key component for self-organization is transparency. Everyone in a social network needs to see what the others are doing so that there are no hidden agendas or false measures, and each can adjust their behaviors to the others. Transparency is not only a precondition for effective markets, but organizations as well, and becomes the basis for applying peer pressure, one of the most effective means for enforcing social norms. Peer pressure is also so pervasive and cuts across so many social species that it is very likely to be an ESS and a biologically innate algorithm.

Bounded and unbounded rationality

Another established way to look at collaboration and coordination in organizations is from an economics perspective, whereby independent actors are seen as making rational choices based upon their informed self-interest. Such economic analyses presume that every decisionmaker possesses a combination of *unbounded rationality*, *unbounded*

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[39] Sober, Elliot and David Sloan Wilson. *Unto Others: The Evolution and Psychology and Unselfish Behavior*. Cambridge, MA: Harvard University Press. 1998.

[40] See: Flack, J. and F.B.M. de Waal. "Any Animal Whatever: Darwinian building blocks of morality in monkeys and apes." *Journal of Consciousness Studies*. 7 (1-2). 2000. pp. 1–29.
DeWaal, F.B.M. "The chimpanzee's service economy: Food for grooming, evolution, and human behavior." 1997. pp. 375-86.

greed, and *unbounded will power*.[41] While such notions are recognized as simplifications, they are, nonetheless, considered to be sufficiently accurate to be retained and asserted. Economic rationality is computed in terms of tradeoffs between risks and prices, with the presumption that preferences and utility functions can be expressed in terms of price. The rational actor is one who always pays the right price given his preferences and uncertainty.

However, the results of recent experimental and behavioral economic studies[42] have provided a growing body of evidence refuting classic economic assumptions about human behavior and rationality. A new generation of experimentally oriented economists, including Noble Laureates Vernon Smith and Daniel Kahneman,[43] have experimentally challenged the core tenants of classical economics—unbounded rationality, selfishness, and willpower—and are forging more complex models of cooperation and decisionmaking based upon cross-cultural studies, neuroscience, game theory, evolutionary biology, and multi-agent simulation. The results of these studies are highly germane to understanding the failure of classic notions of collaborative decisionmaking because they tell us that rather than being independent agents, people have socially constructed identities[44] and innate, biologically set protocols for cooperation and social exchange. Furthermore, rather than the rule sets of selfishness and zero sum competition being the formative principles of human organization, the rule sets of *altruistic reciprocity* not only seem to be far more pervasive cross culturally than the principles of *Homo economicus*, but according to evolutionary biologists and game theorists,[45] yet another example of ESS.

Consistent with the points referenced earlier by Damasio, Searle, Deacon, Lakoff, and Dunbar, two prominent behavioral economists, Mullanianthan and Thaler, characterized

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[41] Mullainathan, Sendhil and Richard H. Thaler. "Behavior Economics." *International Encyclopedia of the Social and Behavioral Sciences.* San Leandro, CA: Elsevier Science. 2001.
[42] Bowles, S. and H. Gintis. *The Origins of Human Cooperation*. Working Paper. Santa Fe Institute. 2002.
Thaler, R. *Advances In Behavioral Finance*. Russell Sage Foundation. 1993.
[43] Smith, Vernon. "Mind, Reciprocity, and Markets in the Laboratory." *Wirtschaft.* 10. August 2001. p. 21.
Kahneman, Daniel and Amos Tversky. *Choice, Values, and Frames*. Cambridge, MA: Cambridge University Press. 2000.
[44] Bowles, *The Origins of Human Cooperation*.
[45] Trivers, "The Evolution of Reciprocal Altruism."
Page, "Diversity and Optimality."

the essence of human decisionmaking not as an optimization strategy of trying to get the most and best information, but rather a rule of thumb strategy, much like turning to friends or trusted peers in small world networks.

> Since we have only so much brainpower, and only so much time, we cannot be expected to solve difficult problems optimally. It is eminently "rational" for people to adopt rules of thumb as a way to economize on cognitive faculties.[46]

The reality of the world is that people do not live in the economist's world of perfect information, but always have to make decisions with imperfect information. From the perspective of social networks, local information is a form of *bounded* rationality and the ability to approximate the power of global information, or *unbounded* rationality in the economist's sense, is achieved through the interconnection of trusted peer social networks. Global knowledge and collective rationality are an emergent phenomenon arising from the interactions and the protocols of the different peer networks. Instead of unbounded selfishness—the presumption of classic economic theory—being a prerequisite for rational decisionmaking and efficient functioning of a social exchange network, the opposite in many cases is true; trust across networks and even among strangers is a prerequisite for effective exchange.[47]

Therefore, it is not surprising that recent research by behavioral economists such as Smith, Kahneman, Thaler, and neuro-economist McCabe[48] have found that reciprocity, the ability to interpret each other's behaviors and intentions, and trust appear to be highly effective social exchange algorithms that underlie many forms of economic behaviors including corporate finance, trading, and savings.[49] What is especially compelling about these kinds of results is that the findings from such diverse fields of inquiry—neuroscience, anthropology, evolutionary biology, complexity sciences, cognitive science, behavioral economics—all seem to be converging towards a common picture of how people act and organize to cooperatively solve complex problems.

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[46] Mullainathan, Sendhil and Richard H. Thaler. "Behavior Economics." *International Encyclopedia of the Social and Behavioral Sciences*. San Leandro, CA: Elsevier Science. 2001.
[47] Grimes, Ken. "Neuro-economics: To Trust is Human." *New Scientist*. May 10, 2003.
[48] McCabe, K. and Vernon Smith eds. *Bounded Rationality: The Adaptive Toolbox*. Cambridge, MA: MIT Press. 2000.
[49] Thaler, *Advances in Behavioral Finance*.

Cooperation, decision rights, and social contracts

Another, related perspective on the debate over effective coordination comes from Nobel Laureate economist Ronald Coase's classic analysis[50] of the conditions when cooperation is best left to the "nimble fingers" of the market versus when it requires "the thick thumbs" of management. Coase argued that when the contracting and information transfer costs were sufficiently low and were supported by pricing mechanisms, markets resulted in far fewer "agency costs" and hence were preferable to management's hierarchical controls. However, the reason that there are so many firms is that the cost of knowledge transfer across organizational boundaries often can be prohibitive, and hence the hierarchical controls of firms are more efficient than markets. According to Michael Jensen,[51] a Coase-influenced organizational economist, "vast amounts of information are specific" (what we have termed *local*) and the cost of transferring specific information among agents is prohibitive. Jensen elaborates:

> In such cases, the common managerial tactic of moving the knowledge to the decisionmaker is not likely to work. Instead, we must *place the decision rights for which that knowledge is valuable in the hands of the person with the knowledge.* (This is the real economic advantage inherent in the modern empowerment movement.) We can then also move the "general" knowledge, which can be moved at lower costs to the decentralized decisionmaker.[52]

Jensen's critique of centralized decisionmaking is similar to the critique that we made earlier about hierarchical decisionmaking. Although Jensen is a rational economist of the classical school (adhering to notions of unbounded self-interest and rationality), he nonetheless makes an argument for the power of peer networks over the more common hub-and-spoke models.

A key platform for his argument is the notion of the "alienability" of decision rights, which he defines as

> the right to choose an action and to take an action, in a context where the police powers of the state will be used to ensure the party's ability to take the action. An

[50] Coase, R. "The Nature of the Firm." 4 *Economica* (n.s.) 386. 1937.
[51] Jensen, M. *Foundations of Organizational Strategy*. Cambridge, MA: Harvard University Press. 1998.
[52] Ibid.

> alienable decision right is the one that can be sold or exchanged by the owner with the owner pocketing the proceeds offered in the exchange.[53]

Put in the terms of our earlier discussion of social exchange theory, the alienability or assignability of decision rights is similar to the notion of social protocols that provide mechanisms for assigning and routing the control points for authorizing and enabling different types of exchange and interaction.[54]

The combination of insights arising from the existence of evolutionarily stable, innate human social exchange algorithms such as altruistic reciprocity and specialized social exchange competencies (e.g., the ability to detect cheaters or read other peoples' intentions)[55] suggests that as a species, we have evolved highly efficient methods for reducing the "social contracting" costs of collaboration and social exchange. As will be discussed later, digital peer-to-peer networks hold the promise of dramatically reducing the agency costs of transferring specialized information and achieving organizational networks with the scale and efficiencies of markets for the exchange of non-economic goods and services.

Conclusion

The biological, evolutionary, and neurological sciences are rapidly developing a scientific and rigorous understanding of how people think, feel, interact, and conduct themselves as social beings. Not only will scientific knowledge replace speculation and superstition, but new forms of intervention—genetic, cognitive, pharmaceutical, and social technological—will greatly enhance our abilities to create more effective social organizations and institutions. The genie is out of the bottle. Fields such as neuro-economics and evolutionary psychology are beginning to understand the neuro-scientific and evolutionary significance of market, trust, social coordination, and risk-sharing behaviors. These findings are making it possible to understand how social networks naturally self-organize to leverage innate human capacities and proclivities for trust and

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[53] Ibid.
[54] Skeptics of this new type of organizational structure and information handling can be found in many countries. For example: Flaherty, Christopher. "Relevance of the U.S. Transformation Paradigm for the Australian Defense Forces." Presented at the 8th ICCRTS at NDU. June 2003. http://www.dodccrp.org/events/2003/8th_ICCRTS/Tracks/track_5.htm (Feb 2004)
[55] Cosmides, *Evolutionary Psychology*.

community building. Moreover, by understanding how different social networks evolved to resolve complex social coordination and cooperation problems, it may also become feasible to design organizations that represent evolutionary stable strategies, which in effect, says that they are highly adaptive under different fitness conditions.

In terms of the overall mission of this book (which is to provide the principles, techniques and justification for transforming hierarchical, command and control organizations, into highly agile, self-synchronizing networks), recent research findings on human nature are very encouraging. In contrast to well-entrenched economic and organizational models that assumed human beings to be selfish, individualistic, and rational actors, human beings are innately cooperative and have evolved innate strategies of collaboration, trust, and reciprocity that have proven to be highly adaptive. Not only are such peer-based strategies of collaboration prevalent among human groups, but they seem to represent more general evolutionary strategies that are stable for a variety of species. Moreover, human beings seem to have evolved unique capacities for interpreting one another's signals, and novel forms of representation, reciprocation, and symbolization. By understanding how such innate human social exchange competencies function, networked organizations might be designed and implemented that scale human trust and create flexible organizations that can rapidly learn and adapt to change.