The Origin of Language As A Product of the Evolution of Modern Cognition

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To ask where language comes from is to raise the question of the origin of the cognitively modern human mind. Recent work in conceptual integration theory (CIT) shows that cognitively modern human beings are equipped with an advanced form of a basic mental operation that makes it possible for them to develop a number of human singularities: art, music, science, fashions of dress, dance, mathematics. This basic mental operation is *conceptual integration*, and the advanced form is *double-scope* integration. Human singularities are not independent. They precipitate as products of double-scope conceptual integration.

Here, we will explore the implications of these findings for the origin of language. There are many problems besetting theories of the origin of language. These problems include the absence of intermediate stages in the appearance of language, the absence of existing languages more rudimentary than others, the appeal to some extraordinary genetic event unlike any other we know of, and the difficulty of finding a defensible story of adaptation. CIT opens up a different way of looking at the origin of language that is free of such problems.

Conceptual integration[1] is an operation with principles and constraints. It creates dynamic networks. The mechanics of such networks and the emergent structure they produce are a complex branch of cognitive science that we cannot study here in any detail. The gist of the operation is that two or more mental spaces can be partially matched and their structure can be partially projected to a new, blended space that develops emergent structure. These mental spaces and

their relations constitute a conceptual integration network. Human beings are especially adept at creating and using such networks routinely in thought and action.

Here is a simple example: in *Aesop's Fables*, animals preach, complain, beseech, cajole, implore, and argue. When the shaman talks to animal spirits, or when the serpent whispers in Eve's ear, a similar integration is taking place. One input mental space has ordinary human beings, who eat, compete, talk, listen, preach, cajole. Another has animals, who eat, compete, vocalize, and interact. Partial matching connects humans with animals, talking with making noise, and so on. In the blended mental space ("blend" for short), we have talking animals! Such networks are found throughout all cultures. Whether it be the talking fox or the animal spirit, the emergent structure is both easily achieved and extremely complex if you begin to analyze it. Researchers have shown, as we survey in *The Way We Think* (2002), that exactly the same type of networks arise in the evolution of mathematics, scientific discovery, visual representation, and, as we will see, grammar. In the case of mathematics, which is so thoroughly admired, we have no difficulty imagining that there is creativity, discovery, and emergent structure. For example, complex numbers and non-Euclidean geometry, which are products of double-scope integration, were clearly great conceptual achievements. The talking fox is in every way as complex and creative—only our species can do it—but this complexity goes unnoticed precisely because everyone can do it.

CENTRAL DISCOVERIES OF CIT

Here are some of the findings from CIT that we will need in order to demonstrate how language originated as a product of the capacity for double-scope integration.

Finding 1: Thinkers have been fascinated and puzzled since even before the time of *Aesop's Fables* by mental patterns that are commonly classified under labels such as analogy, category extension, metaphor, framing, counterfactuals, and grammatical constructions. It has been assumed that these names refer to separate kinds of things. Typically, these things are considered part of distinct disciplines: counterfactuals in philosophy and logic, metaphor in literature, analogy in psychology, framing in sociology and artificial intelligence, grammatical constructions in linguistics. A remarkable result of CIT is that, at a deeper level, all of these patterns are products of conceptual integration networks. The mental principles of their origin are uniform.

Finding 2: A central feature of integration networks is their ability to compress diffuse conceptual structure into intelligible and manipulable human-scale situations in the blended space. These compressed blends are memorable and can be expanded flexibly to manage their integration networks. Compressions have been studied in great detail. They operate on a set of twenty or so vital conceptual relations, such as Cause-Effect, Analogy and Disanalogy, Time, Space, Change, Identity, Part-Whole, and Representation. Relations can be compressed into a human-scale version of themselves, or into different vital relations. As an example of compression, consider a statement like "Dinosaurs changed into birds," used to suggest the new theory according to which birds are descendants of dinosaurs. At one level, this evolutionary story spans millions of years, in which many organisms lived and died, none of them actually "changing" into anything. These organisms are connected by Cause-Effect

(progeneration), Analogy and Disanalogy (offspring are analogous and disanalogous to their ancestors), and Time. In the blend, the Analogy is compressed into Identity (a single dinosaur becomes a single bird) and the Disanalogy is compressed into Change. Time is compressed into the lifetime of an animal, which at the beginning is a dinosaur and at the end is a bird. There are many standard patterns of compression, and this is one of the most common. In ordinary language, we say "My tax return gets longer every year." A number of analogous tax returns at the end of every year, none of which gets longer, but each of which is longer than the previous one, are compressed in the blend into a single tax return that changes. Conceptual integration networks with useful compressions are the rule in human thought and action, as has been shown for domains as different as material anchors (Hutchins 2005), sign language (Liddell 2003), and magic and religious practices (Sørensen 2007).

Finding 3: Conceptual integration networks fall on a complexity gradient. There are some focal positions on this continuum: Simplex networks, Mirror networks, Single-Scope networks, and Double-Scope networks. The blended spaces of simplex networks provide framings, as in "Paul is the father of Sally." Mirror networks have inputs that have the same frame, and their blended spaces also have that frame, often with a slight extension. So, for example, the familiar behavior of talking to oneself is made possible by mirror networks. Single-scope and double-scope networks can work on inputs that have very different frames or even frames with clashes in their central structures. Double-scope networks, as we will see, are the most important for explaining the origin of language. Human beings became cognitively modern when they acquired the capacity to do double-scope integration. Human language, spoken or signed, is a product of that ability.

THE MYSTERY OF LANGUAGE

Language is a mystery because it is a singularity: only human beings have grammar of the sort we find in natural languages. But language is not the only singularity: the considerable efforts of animal psychologists have uncovered no evidence that other species can reach very far in conceiving of counterfactual scenarios (like those underlying pretense), metaphors, analogies, or category extensions. Even the most impressive nonhuman species have very limited abilities to use tools, let alone design and make them. Human beings have elaborate rituals that constitute cultural meaning without being tied to immediate circumstances of feeding, fighting, or mating, but the nearest that other species can come to "rituals" are instinctive displays that are directly tied to such immediate circumstances. As Merlin Donald puts it, "Our genes may be largely identical to those of a chimp or gorilla, but our cognitive architecture is not. And having reached a critical point in our cognitive evolution, we are symbol-using, networked creatures, unlike any that went before us."[2]

It is hard to get an explanation of language that sees it as the product of gradual steps, each producing a grammar by making the previous grammar a little more complicated. Such an explanation would ask us to imagine that a group of human beings began with a very simple grammar that gradually, generation after generation, grew ever more complex, until it reached the level we see in the languages in the world today. Such an explanation runs up against the fact that we can point to no simple languages, or even ones that are simpler than others. There are many evolutionary developments for which it is relatively easy to see a gradual path: we can see gradual steps by which early mammals plausibly evolved into primates or cetaceans. But we do not see any gradual path

in mammalian history for the development over many generations of ever more complex grammars.

EXISTING THEORIES

The hunt is on for the origin of language. What could have caused this singularity to come into existence? One line of thinking looks at language as a very specific human production and asks how it could have arisen. The language faculty is viewed as distinct from other human capacities, and so the correlation with the other human singularities has no theoretical place: those other abilities are distinct from language and call for other explanations. This line of exploration has room for many different kinds of theories.

Nativist theories—Chomksy is the preeminent name here—place the distinctiveness of language in specific genetic endowment for a specifically genetically instructed language module. Under that view, there is minimal learning involved in acquiring a language. Most of the language module is already in place. Which language actually gets spoken—Chinese, Bantu, English—is relatively superficial: very thin exposure to a given language sets parameters that control the output of the language module, that is, gives us one language instead of an alternative language. But it is not clear what, in the evolution of the human brain, could have been the precursor of the language module. Nor is it clear what pressures from natural selection would have produced such a module, given that we find no intermediate stages. This is why many nativists have embraced the view that a sudden, dramatic, perhaps unique event in human evolutionary history produced in one leap a language module resembling nothing like the brain's previous resources.

Other nativist views of language see it as having arisen by gradual natural selection. Stephen Pinker and Paul Bloom argue that "there must have been a series of steps leading from no language at all to language as we now find it, each step small enough to have been produced by a random mutation or recombination."[3]

Although viewing language as a specific production distinct from other human capacities is associated with nativist theories of language as modular, neither nativism nor modularity is crucial for the view of language as a distinct capacity. A radical associative theorist who sees cognition as developing during childhood through the forming, strengthening, and weakening of connections between neurons might easily view language as a very special set of operations that arise in a network. On this view, language would be essentially distinct from other capacities of the network, even though all of them would share a common denominator in the basic associative operations. While the language faculty would not be localized in any area of the network, it would still be distinct operationally.

Some associative theories emphasize the role of evolution in developing powerful learning mechanisms that perform statistical inferences on experiences. In these views, the brain has evolved rich, specific architectures for statistical extraction, and language is one of the things that can be learned through those domain-general processes of statistical inferencing. Language is intricate and depends upon the evolution of those learning abilities, but the way we learn it is not specific to language. The language the child hears—far from impoverished—is adequate for the purpose of converging on grammatical patterns by doing statistical inferencing.[4] The evolutionary story here is that the brain evolved learning abilities with some bias for learning things like language, but did not evolve "language" or a neural "language module." As Terrence Deacon writes,

"The relevant biases must be unlike those of any other species, and exaggerated in peculiar ways, given the unusual nature of symbolic learning."[5] It remains a challenge, of course, to explain how those particular learning abilities and biases for language could have evolved, and it is still not clear under this explanation why we have no evidence of intermediate, simpler forms of language.

One line of thinking, associated with theorists like William Calvin and Derek Bickerton[6] in *Lingua ex Machina* and Frank R. Wilson[7] in *The Hand*, tries to find preadaptations for language—such as the development of the hand, of reciprocal altruism—that could have put in place some of the computational ability that language needs. In this way of thinking, there were gradual steps to language, but the early steps did not look like language because they weren't. They had some powers that later on made sophisticated language possible.

There are also coevolutionary proposals, including an influential recent proposal by Terrence Deacon.[8] Language, he argues, is not an instinct and there is no genetically installed linguistic black box in our brains. Language arose slowly through cognitive and cultural inventiveness. Two million years ago, australopithecines, equipped with nonlinguistic ape-like mental abilities, struggled to assemble, by fits and starts, an extremely crude symbolic system—fragile, difficult to learn, inefficient, slow, inflexible, and tied to ritual representation of social contracts like marriage. We would not have recognized it as language. Language then improved by two means. First, invented linguistic forms were subjected to a long process of selection. Generation after generation, the newborn brain deflected linguistic inventions it found uncongenial. The guessing abilities and intricate nonlinguistic biases of the newborn brain acted as filters on the products of linguistic invention. Today's languages are systems of linguistic forms that have survived. The child's mind does not embody innate

language structures. Rather, language has come to embody the predispositions of the child's mind.

The second, subordinate means by which language improved, in Deacon's view, had to do with changes in the brain. Crude and difficult language imposed the persistent cognitive burden of erecting and maintaining a relational network of symbols. That demanding environment favored genetic variations that rendered brains more adept at language. Language began as a cognitive adaptation and genetic assimilation then eased some of the burden. Cognitive effortand genetic assimilation interacted as language and brain co-evolved. In Deacon's view, language was "acquired with the aid of flexible ape-learning abilities." It was grafted onto an apelike brain. It is not walled off from other cognitive functions such as interpreting and reasoning. Grammatical form is not independent of conceptual meaning. There is no linguistic black box and there was no insertion.

A RANGE OF ARRESTING HUMAN SINGULARITIES

Three of the biggest singularities that seem to enter explosively on the human stage around the same time in human prehistory are art, religion, and science. As Stephen Mithen writes in "A Creative Explosion?,"

> Art makes a dramatic appearance in the archaeological record. For over 2.5 million years after the first stone tools appear, the closest we get to art are a few scratches on unshaped pieces of bone and stone. It is possible that these scratches have symbolic significance—but this is highly unlikely. They may not even be intentionally made. And then, a mere 30,000 years ago, at least 70,000 years after the appearance of anatomically modern humans,

> we find cave paintings in southwest France—paintings that are technically masterful and full of emotive power.[9]

Mithen makes the same claim for religion and science, and naturally asks what could have led to these singularities. His answer is that human beings suddenly developed a totally new capacity for "cognitive fluidity," that is, a capacity for the "flow of knowledge and ideas between behavioral domains," such as "social intelligence" and "natural history intelligence." Although Mithen offers no theory about the principles or operation of "cognitive fluidity," and views it as a higher-order operation used for the special purpose of putting different domains together, there are interesting parallels between the general notion of cognitive fluidity and the idea of conceptual integration. What caused cognitive fluidity? In Mithen's view, there must have been some singular, explosive evolutionary event that produced a quite different sort of brain.

Mithen observes that time and again, theorists have confidently if vaguely located the exceptional cognitive abilities of human beings in their ability to put two things together. Aristotle wrote that metaphor is the hallmark of genius. Koestler proposed that the act of creation is the result of bisociating different matrices.

The prehistoric picture we are left with is one of mysterious singularities: explosions, some perhaps simultaneous, in new human performances. We also have, for all these singularities, the problem that there is essentially no record of intermediate stages between the absence of the ability and its full flowering. And this prehistoric story has, at least for language, its contemporary parallel: we find no human groups, however isolated, that have only rudimentary language. We find no primates with rudimentary language. At first glance, this is a completely abnormal situation. We find no parallels in evolution of species, for example—no complex organisms that leap without precursors out of the

slime. What kind of theory do we need in order to account for such a strange and unprecedented picture?

WHAT SHOULD A PROPER THEORY OF THE ORIGIN OF LANGUAGE LOOK LIKE?

As Darwin noted, evolution's main trick seems to be gradual change, so that an adaptationist account is obliged to show that each step would have been adaptive. Evolution is never allowed to think, "Well, if I could get to stage ten, it would be good, so give me a break while I go through the first nine." Other things being equal, we prefer an evolutionary account that shows continuity of change rather than a spectacular singularity. Even "punctuated equilibrium" theories propose only relatively minor jumps—not jumps that produce an eye or language out of nothing.

But we face a problem: how do we explain the arresting human singularities as arising out of relatively continuous changes in brain and cognition?

To think about this question, we must put aside two major fallacies. The first is the fallacy of Cause-Effect Isomorphism. Compressing cause and effect is indispensable to cognition, but it often has the bad consequence for scientific thinking that, recognizing an effect, we conceive of the cause as having much of the same status as the effect. So if the effect is dramatic, we expect a dramatic causal event. If the effect is unusual, we expect an unusual causal event. This way of thinking is so common that popular science accounts routinely offer entertaining demonstrations of the way in which unusual cases come from boring, routine causes. This is always the story for popular accounts of evolution or chaos theory—the beetle whose abdomen has grown into a covering costume

that makes it look like a termite so it can live in termite nests arose through the most routine operations of gradual natural selection.

The Cause-Effect Isomorphism fallacy leads us to think that a discontinuity in effects must come from a discontinuity in causes, and therefore that the sudden appearance of language must be linked to a catastrophic neural event. The only evidence we need against this fallacy is the straw that broke the camel's back, but we see such evidence everywhere in science. Under heat, there is a smooth continuity of causation as ice goes abruptly from solid to liquid. The change from solid to liquid is a singularity, but there is no underlying singularity in the causes or in the causal process. One more drop of water in a full cup causes a lot of water to flow suddenly out onto the table, not just the one drop that was added. One more gram of body fat can make it possible for you to float on your back without effort in the middle of the South Pacific; a gram fewer and you sink down. In this case, a life-and-death singularity arises from smooth continuity in causes and causal operations. Nothing has changed about the principles of hydrodynamics or buoyancy when you drown.

So, in principle, the sudden appearance of language is not evidence against evolutionary continuity. Singularity from continuity is a normal occurrence. The only remaining question is, can biological evolution also work this way? Are there specific evolutionary processes that give us remarkable singularities out of causal continuities? Here, we encounter a second major fallacy, the Function-Organ Isomorphism Fallacy. This is the well-known idea that the onset of a new organismic function requires the evolution of a new organ. Under this fallacy, because opossums hang from trees by their tails, tails are organs for performing the function of hanging from trees; because people speak with their tongues, tongues are organs for talking. As biologists routinely point out, as an organ evolves it may acquire new functions or lose old functions

or both. There were intricate mammalian tongues before there was language; the tongue did not need to be invented afresh. The ancestors of opossums had tails before opossums hung from trees. The continuous evolution of an organ does not necessarily correlate with a continuous evolution of a function. Functions can be singularities while the evolution of an organ is continuous. Like the body in the water, an organ may need only the tiniest increment of change to subserve a striking new function, like floating.

We see this in the case of the proposed theory of how dinosaurs evolved into birds. Nobody proposes a theory of discontinuity for the organ (wings) but nobody proposes a theory of continuity for the function (flight). According to all these theories, wings came gradually—scales seem to have developed slowly into feathers, feathers provided warmth, the existence of longer arms and feathers made it possible to flap for a little extra ground speed and so the arms got longer and more feathery. Flight in all these theories came at one swoop—at a critical point, the organism could become truly airborne, and so now it could fly after the dragonfly and gobble it up. It occurs to no one to propose that flight—a spectacular singularity of function—came about because an organ for flight suddenly evolved from scratch. It also occurs to no one to propose that since modern birds fly higher than one hundred feet, there must have been intermediate stages in which birds could attain heights of first of one foot, then many generations later two feet, and so on up to one hundred feet. Being truly airborne is all-or-nothing, and so the behavior of flying is also basically all-or-nothing. An organism either flies or does not.

In thinking about the origin of language, we must put aside the fallacies of Cause-Effect Isomorphism and Function-Organ Isomorphism. Language is not an organ. The brain is the organ, and language is a function subserved by it, with the help of various other organs. Language is the surface manifestation of

a capacity. It is a singularity of function, and so nothing prevents it from having arisen from a basically continuous and adaptive process of evolution. The function can have arisen recently in human evolution even though the continuous changes that brought it about can have been working for many millions of years. The causes are very old but one particular effect showed up just yesterday. This is what we propose.

The best theory of the origin of language would have the following features:

—A recognition of the singularity of language. There is no evidence of sustained intermediate stages phylogenetically, and no evidence of present human languages that are rudimentary.

—Rejection of an extraordinary event as responsible for the extraordinary capacity. In other words, no Cause-Effect Isomorphism.

—A continuous path of evolutionary change over a very long period as the cause of language, since that is how evolution almost always works.

—A path that is a plausible adaptive story: each change along the path must have been adaptive in itself, regardless of where the path ultimately led.

—Hence a continuous evolutionary path that produces singularities.

—A model of what mental operations developed along that path, and in what order.

—An explicit account of what continuous changes produced what singularities, and how they did it.

—Robust evidence from many quarters that human beings actually perform the mental operations on that hypothetical path.
—Intermediate steps not for the function of language itself but for the cognitive abilities that finally led to the precipitation of language as a product.
—Evidence in the anatomy or behavior of today's human beings pointing to the history of these steps, just as anatomical evidence in today's human beings points to our once having had tails.
—Other things being equal, a parsimonious way of explaining the emergence of many related human singularities as products that arise along the same continuous evolutionary path.

THE CENTRAL PROBLEM OF LANGUAGE

The world of human meaning is incomparably richer than language forms. Although it is sometimes said that language makes an infinite number of forms available, it is a lesser infinity than the infinity of situations offered by the very rich physical mental world that we live in. To see that, take any form, like "My cow is brown" and try to imagine all the possible people, cows, shades of brown to which it might apply, as well as the different uses of the phrase as ironic or categorial or metaphoric, including its use as an example in this paragraph.

A word like "food" or "there" must apply very widely if it is to do its job. The same is true of grammatical patterns independent of the words we put in them. Take the Resultative construction in English, which has the form A-Verb-B-Adjective, where the Adjective denotes a property C.[10] It means *A do something to B with the result that B have property C*, as in "Kathy painted the wall white." We

want it to prompt for conceptions of actions and results over vast ranges of human life: "She kissed him unconscious," "Last night's meal made me sick," "He hammered it flat," "I boiled the pan dry," "The earthquake shook the building apart," "Roman imperialism made Latin universal." We find it obvious that the meaning of the resultative construction could apply to all these different domains, but applying it thus requires complex cognitive operations. The events described here are in completely different domains (Roman politics versus blacksmithing) and have strikingly different time spans (the era in which a language rises versus a few seconds of earthquake), different spatial environments (most of Europe versus the stovetop), different degrees of intentionality (Roman imperialism versus a forgetful cook versus an earthquake), and very different kinds of connection between cause and effect (the hammerblow causes the immediate flatness of the object, but eating the meal one day causes sickness later through a long chain of biological events).

This very simple grammatical construction allows us to perform a complex conceptual integration which in effect compresses over Identity (e.g. Roman imperialism), Time, Space, Change, Cause-Effect, and Intentionality. The grammatical construction provides a compressed input space with a corresponding language form. It is then blended in a network with another input that typically contains an unintegrated and relatively diffuse chain of events. So, if it is our job to turn off the burner under the pan that has zucchini in boiling water, and we forget about it and all the water evaporates, we can say, confessionally, "No zucchini tonight. I boiled the pan dry. Sorry." In the diffuse input, the causal chain runs from forgetting to the invariant position of the burner knob, to the flow of gas, to the flame, to the temperature of the pan, to the temperature of the water, to the level of the water, to the dryness of the pan. The agent performs no direct or indirect action on the pan at all. But in the blend, the

compressed structure associated with the grammatical construction is projected together with some selected participants from the diffuse chain of events in the diffuse input. In the blend, the agent acts directly on the pan. Moreover, although the boiling of the water is an event and its cause was something the agent did or did not do, there is cause-effect compression in the blend so that in the blend, although not in the input spaces, *boiling* is an action the agent performed on the pan. As this example shows, the simplest grammatical constructions require high abstraction over domains and complex double-scope integration.

Paradoxically, language is possible only if it allows a limited number of combinable language forms to cover a very large number of meaningful situations.

There is every reason to think that some species are able to operate efficiently in separate domains of, say, tool use, mating, and eating without being able to perform these abstractions and integrations. If that is so, then grammar would be of no use to them, because they cannot perform the conceptual integrations that grammar serves to prompt. But couldn't they just have a simpler grammar? The only way they could have a simpler grammar and yet have descriptions in language for what happens would be by having separate forms and words for everything that happens in all the different domains. But the world is infinitely too rich for that to be of any use. Trying to carry around "language" of that size would be crippling. The evidence does not suggest that primates have compensated for lack of language by developing, for example, one million special-purpose words, each conveying a special scenario. On the contrary, while primate species have some specific "vocalizations" (e.g., in response to a potential predator), the best efforts to teach words to chimpanzees cannot get them past a vocabulary of about two hundred items. Having a

handful of vocalizations is clearly a help, but evolution has found no use in trying to extend that strategy very far. The extraordinary evolutionary advantage of language lies in its amazing ability to be put to use in *any* situation. We will call this crucial property of language "equipotentiality." For any situation, real or imaginary, there is always a way to use language to express thoughts about that situation. Double-scope conceptual integration is the key to the amazing power of the equipotentiality of language, which we take for granted and use effortlessly in all circumstances.

GRADIENTS OF CONCEPTUAL INTEGRATION AND THE EMERGENCE OF LANGUAGE

On independent grounds, we must grant that human beings today have powerful and general abilities of conceptual integration. In particular, double-scope networks are the kind of mental feat that human beings perform with the greatest of ease but that other species are unable to achieve. Blending research has shown how double scope networks play a role in grammatical constructions, the invention of scientific and mathematical concepts, religious rituals, counterfactual scenarios, persuasive representations, and vital relation compressions.

It has also shown that networks of conceptual integration fall along gradients of complexity. At the top end are networks whose inputs have clashing organizing frames and blends that draw on both of those frames, the Double Scopes. At the bottom end are Simplex networks with conventional frames and ordinary values for their roles.

Our hypothesis for the origin of language is as follows:

—Double-scope conceptual integration is characteristic of human beings as compared with other species and is indispensable across art, religion, reasoning, science, and the other singular mental feats that are characteristic of human beings.

—The hallmark virtue of advanced blending capacity is its provision of efficient, intelligible, strong compressions across ranges of meaning that are otherwise diffuse and unmanageable. There are many scenes that are immediately apprehensible to human beings: throwing a stone in a direction, breaking open a nut to get the meat, grabbing an object, walking to a visible location, killing an animal, recognizing a mate, distinguishing friend from foe. Double-scope blending gives us the supremely valuable, perhaps species-defining cognitive instrument of anchoring other meanings in a highly compressed blend that is like the immediately apprehensible basic human scenes, often because those scenes are used to help frame the blend.

—The development of blending capacity was gradual and required a long expanse of evolutionary time: basic blending is evident as far back as the evolution of mammals.

—Each step in the development of blending capacity was adaptive. From very simple Simplex blends to very creative Double-Scopes, each step of the capacity would have been adaptive because each step gives increasing cognitive ability to compress, remember, reason, categorize, and analogize.

—There is ample evidence of intermediate stages in the development of blending capacity. Some species, for example,

seem able to do only simple Simplex networks. Others seem able to do slightly more unusual Simplex networks.

—There is also ample evidence of intermediate stages in human beings, in the sense that although we can do Double-Scope blending, we can of course still do Simplex blending.

—A special level of capacity for conceptual integration must be achieved before a system of expression with a limited number of combinable forms can cover an open-ended number of situations and framings.

—The indispensable capacity needed for language is the capacity to do Double-Scope blending.

—The development of double-scope blending is not a cataclysmic event but rather an achievement along a continuous scale of blending capacity, and so there is no Cause-Effect Isomorphism in the origin of language: the cause was continuous but the effect was a singularity.

—Language arose as a singularity. It was a new behavior that emerged naturally once the capacity of blending had developed to the critical level of Double-Scope blending.

—Language is like flight: an all-or-nothing behavior. If the species has not reached the stage of Double-Scope blending, it will not develop language at all, since the least aspects of grammar require it. But if it has reached the stage of Double-Scope blending, it can very rapidly develop a full language in cultural time because it has *all* the necessary prerequisites for a full set of grammatical integrations. The culture cannot stop at a "simpler" language, for example one that has only the Subject-Verb clausal construction. A

grammatical system, to meet the crucial condition of equipotentiality, must be a full set of possible integrations and corresponding forms that can combine to give expressions suitable for any situation. Therefore, language will automatically be multiply double-scope and complex. And there will be no stopping the development of language from achieving that level, since the engine of double-scope blending that produces equipotentiality will be fully in place.

—The story of the origin of language does have room for intermediate stages, in the capacity: human beings still have the capacity to do simple forms of blending. But no intermediate stages will be found in the languages because full grammar precipitates quickly as a singular product of the blending capacity once it reaches the critical stage. "Quickly" here does not mean instantaneously, but within cultural rather than evolutionary time.

—The hallmark virtue of language is its ability to use grammatical patterns suitable for basic human scenes to capture and convey much less tidy meanings. This is done through the massive compression offered by double-scope blending, which can achieve blends that fit the grammatical patterns associated with those basic human scenes. Language, in the strong sense, must be equipotential. It must be serviceable for the new situations we encounter. The only way for it to be equipotential is for the human mind to be able to blend those new situations with what we already know to give us intelligible blends with attached grammatical patterns so those existing grammatical patterns can express the new situations. To say something new, we do not

> need to invent new grammar—and a good thing, too! Rather, we need to conceive of a blend that lets existing grammar come into play. Only in this way can an individual with a small, relatively fixed vocabulary of words and basic grammatical patterns cope with an extremely rich and open-ended world.
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> —If we follow the view of Stephen Mithen, according to which other singular explosions in human capacity and society, such as tool design, art, religion, and scientific knowledge, were the result of "cognitive fluidity," then it is plausible that all these spectacular changes in human performance came about once the continuous improvement of blending capacity reached the critical level of double-scope blending. Mithen explicitly places the origin of language far before the development of "cognitive fluidity." For him, it is an input to "cognitive fluidity." For us, by contrast, it is the most impressive behavioral product of double-scope blending.

In summary, continuous improvement of blending capacity reached the critical level of double-scope blending, and language precipitated as a singularity. Why should double-scope blending have been the critical level of blending that made language possible? The central problem of expression is that we and perhaps other mammals have a vast, open-ended number of frames and provisional conceptual assemblies that we manipulate. Even if we had only one word per frame, the result would be too many words to manage. Double-scope integration permits us to use vocabulary and grammar for one frame or domain or conceptual assembly to say things about others. It brings a level of efficiency and generality that suddenly makes the challenging mental logistics of expression tractable. The forms of language work not because we have managed to encode in them these vast and open-ended ranges of meaning, but because

they make it possible to prompt for high-level integrations over conceptual arrays we already command. Neither the conceptual operations nor the conceptual arrays are encoded, carried, contained, or otherwise captured by the forms of language. The forms need not and cannot carry the full construal of the specific situation, but instead consist of prompts for thinking about situations in the appropriate way to arrive at a construal.

Our proposal would explain the apparent discontinuity of the appearance of language: no "fossils" of early simple language have been found because there were none. The appearance of language is a singularity like rapid crystallization in a super-saturated solution when a dust speck is dropped into it. When a community graduates to double-scope integration at the conceptual level, any local problem of expression that is solved by a specific double-scope integration gives the pattern for solving the general problem of expression, making that general problem tractable, and resulting in the complex singularity of the appearance of a system that uses a limited number of combinable forms to cover an open-ended number of situations. It "covers" these situations not by encoding construals of them (through, for example, truth-conditional compositionality) but rather by using a limited number of forms to prompt for on-line inventive integrations that are full construals.

THE ORIGIN OF COGNITIVELY MODERN HUMANS

Here are some fascinating individual truths about evolution and the origin of modern human beings that have been widely, if disparately, recognized but that have never been combined into a single coherent story:

—Biological evolution happens gradually.

—Human language appears, in evolutionary terms, very suddenly in recent prehistory.

—Art, science, religion, and tool use also appear very suddenly in recent prehistory.

—Human beings differ strikingly from all other species in having these behavioral singularities, and their performances in these areas are extraordinarily advanced.

—Anatomically modern human beings arose 150,000 years ago.

—But behaviorally modern human beings date from around 50,000 years ago. That is, evidence of advanced modern behavior in tool use, art, and religious practices appears in the archeological record around 50,000 years ago.

—There is no evidence of "simple" languages in other species.

—There is no evidence of "simpler" languages in other human groups.

—Children learn complex languages remarkably easily. But they go through what look like intermediate stages.

None of the previous theories puts all these truths together, and the theories that do exist conflict with each other, sometimes in extreme ways.

Some theorists propose that a dramatic biological event produced dramatically different human beings who had language. Chomsky is one of them. Mithen, by contrast, proposes a neurological "big bang" for cognitive fluidity but *not* for language. According to Mithen, the earliest anatomically modern human beings already have language, but it takes them another hundred thousand years to get art, religion, science, and elaborate tool use, and when they do get those performances, it happens overnight. That change in behavior is triggered by an exceptional, singular change in the human brain that was highly adaptive. For Mithen, that dramatic biological change is unrelated to the origin of

language but instead produces remarkable and noticeable human creative abilities. Language, already available, latches on to these new abilities. It is a beneficiary of "cognitive fluidity" but is not in itself creative under this account. For Chomsky, by contrast, the dramatic biological event has only syntax as its direct product. He is also skeptical of accounts that adaptation played any role in the appearance of language. Both Chomsky and Mithen look at a singular result or results and explain them by postulating a singular biological cause. In this way, they deal efficiently with the absence of intermediate stages—the full results followed quickly from the causes. For Chomsky, the singular result of the dramatic biological change is language, which appears explosively on the human stage. For Mithen, art, science, and religion appear explosively on the human stage, but not language. But these theories do not come without cost. They go against the principle of gradualism in evolution. Chomsky even seems to go against natural selection. Both pull a speculative, catastrophic, indeterminate, but all-powerful biological event out of a hat. The explanations have built-in limits and cannot be pushed beyond them. Chomsky would need an extra theory for all the other human singularities, and Mithen would need an extra theory for language. These theories are driven by Cause-Effect Isomorphism. Chomsky additionally adds Function-Organ Isomorphism of the strongest possible sort. Since these isomorphisms give us compressions and hence global insights, they are seductive.

Some theories, like those of Terrence Deacon on one hand and Steven Pinker and Paul Bloom on the other, propose gradual evolutionary or co-evolutionary development of language ability. These theories avoid the trap of proposing dramatic biological causes, but they do face the problem of explaining why there are no surviving intermediate stages. Both theories propose that there were intermediate stages, but that the people who had them are gone and left no

trace of those stages. Pinker and Bloom additionally face the difficulty of explaining the other human singularities—their theory, like Chomsky's, is directed exclusively at the origin of language and not at the development of certain forms of conceptual thought. Deacon is the one theorist in our list who leaves ample room for relating the origin of language to the origin of other cultural behaviors. He proposes the gradual, adaptive evolution of a relational ability that underlies a range of human performances. Those performances then co-evolved with that mental and biological capacity. From our point of view, Deacon has the right overall frame for the origin of language, but his theory is missing an explanation of the mental operations underlying this relational ability. The findings we present in this book were not available when Deacon was developing his views. More generally, the notion that human mental feats as disparate as simple framing, counterfactual thinking, and event integration could fall out of the same cognitive ability and lie on a common continuum was unavailable in the cognitive neuroscience community. We have seen that conceptual blending is a good candidate for a continually evolving mental ability that could produce the singularity of language. This opens up possibilities that Deacon could not have considered. Another consequence of our findings is that language would have precipitated much more quickly than Deacon proposes, over a span of thousands of years rather than millions. But on the other hand, the evolution of the cognitive capacity that yields language as a singularity could have begun long before there were human beings, hominids, or even primates.

Some other theories, like the *Lingua ex Machina* proposal of William Calvin and Derek Bickerton, offer a preadaptation story. In these theories, evolution labored long to produce abilities that ended up subserving syntax. These theories thereby avoid postulating a singular cataclysmic cause. On the contrary, they are gradualist stories. Calvin and Bickerton also go into the details of what

those evolved capacities were—e.g., the ability to throw a projectile, the ability for reciprocal altruism—and what computational abilities they could provide to syntax. There is certainly nothing wrong with thinking that preadaptations played an important role in making the origin of language possible. In fact, the capacity we invoke, conceptual blending, far from being limited to language, extends to action, reasoning, social interaction, and so on. The emergence of conceptual blending would have been favored by preadaptations. Where we differ with Calvin and Bickerton is that they propose that evolution delivered an ability for grammar, while we propose that evolution delivered an ability for conceptual blending which, once it reached the stage of double-scope integrations, had grammar as a product.

None of the proposals we have seen explicitly links all the singularities — language, science, religion, the arts—as deriving from a common cause. But there are other accounts that do see that linking as a priority. For example, Richard Klein, in *The Human Career*, offers the hypothesis that there was a dramatic mutation that produced neurological change about 50,000 years ago, and that this neurological change gave human beings some signal capacity such as language. Once that particular capacity was in place, it led to the development of advanced tool use and the invention of art and perhaps other abilities, and these neurologically advanced human beings spread throughout the world.[11]

Our proposal for the origin of language has ample room for full linkage across the singularities in human performance that arose around 50,000 years ago, but does not require any one of them to have been the cause of the others. On the contrary, there is a deeper, underlying cause, namely the continuous development of blending capacity until it arrived at the critical point of double-scope blending, and all these staggering new performances of human beings fall

out of that capacity as products developed in parallel. On our view, these new performances reinforced each other in cultural time. The evolutionary achievement of double-scope blending still needs cultural time in which to bear all its fruit. The visible products of the new cognitive capacity are all social and external—art, religion, language, tool use. There is every reason to think that once the capacity was achieved and the cultural products started to emerge, they reinforced each other. Language assisted social interaction, social interaction assisted the cultural development of language and language assisted the elaboration of tool use, as the tree of culture put forward these exceptional new products. Language and art became part of religion, religion part of art, language part of the technology of tools, all intertwined. Certainly this is the picture we see when we look at human beings today.

We agree with Klein that the singularities are linked, but this does not imply that one of them caused the others. They are all products of the underlying evolution of the capacity for double-scope blending. There is another aspect of Klein's work, however, that is crucial to our account. He places the origin of language near in date to the origin of the other singularities. Why would a theorist like Mithen, who saw cognitive fluidity as the "big bang of human evolution," not have considered language as part of the constellation of singularities like art, science, and religion that resulted from that big bang? The answer is simple: he assumes that language falls out of a combination of big brains and modern vocal apparatus. Mithen writes, "During the last few years the argument that both archaic *H. sapiens* and Neanderthals had the brain capacity, neural structure and vocal apparatus for an advanced form of vocalization, that should be called language, is compelling."[12] This would place the origin of language in the range of 100,000 to 400,000 years ago, and perhaps even as much as 780,000 years ago. Therefore, language must have arisen, on his

view, at least 50,000 years before the explosion of art, science, and religion in the human record.

Yet Mithen himself takes the view that human beings about 50,000 years ago developed striking new mental abilities that did not require a change in brain size or in anatomy. We think that is exactly right, but that language was part of the suite of products that flowed from that evolution. This unifying hypothesis receives strong support from recent archeological and genetic studies that were not available to Mithen.

Klein provides archeological evidence that there are two distinct types of modern human beings—anatomically modern and behaviorally modern. Anatomically modern humans have our anatomy, but not our characteristic behaviors. Behaviorally modern humans have both. The anatomically modern human beings, dating from about 200,000 years ago, at some point cohabited with more archaic human beings, like Neanderthals. The behaviorally modern human beings originated much more recently, say about 50,000 years ago, and dispersed eastward from Africa, ultimately supplanting all other human beings.

Klein's view receives even stronger support from two genetics studies, one by Silvana Santachiara-Benerecetti, the other by Russell Thomson, Jonathan Pritchard, Peidong Shen, Peter Oefner, and Marcus Feldman. Santachiara-Benerecetti's work on mitochondrial DNA leads her to the conclusion that behaviorally modern human beings arose about 50,000 years ago out of Africa and migrated eastward into Asia, not northward into Europe as had been previously found for the more ancient anatomically modern human beings.[13] The study by Russell Thomson and his colleagues looked at Y chromosomes in people around the world today and computed an expected time on the order of 50,000 years to our most recent common ancestor.[14] That dating falls within a large range of uncertainty, but in any event moves the origin of behaviorally

modern human beings closer to us by many tens of thousands of years. Luigi Luca Cavalli-Sforza takes the final step and locates language as an invention of behaviorally modern human beings.[15] He places it alongside the invention of boats and rafts and Aurignacian technology, which is to say, beads and pendants and other items of personal decoration used for social and ritual purposes. While Cavalli-Sforza brings the origin of language forward to about 50,000 years ago, other researchers would push the date of the invention of craft technologies like making string and weaving back by several tens of thousand years. James M. Adavaso, an anthropologist specializing in textiles, estimates that weaving and cord-making probably date from 40,000 BC, "at a minimum," and possibly much further. [16]

These new findings converge to suggest the rapid cultural invention of a coordinated suite of modern human performances, dating from the same epoch, perhaps about 50,000 years ago. We have argued that all of these modern human performances, which appear as singularities in human evolution, are the common consequence of the human mind's reaching a critical level of blending capacity, double-scope conceptual integration.

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*The present chapter is adapted from Chapter nine of *The Way We Think* (Fauconnier and Turner 2002).

[1] See Fauconnier & Turner 2002 and http://blending.stanford.edu for an extensive bibliography.

[2] Donald 1991, p. 382.

[3] Pinker & Bloom 1990.

[4] Elman et al. 1996.

[5] Deacon 1997, page 142.

[6] Calvin & Bickerton 2000.

[7] Wilson 1999.

[8] Deacon 1997.

[9] Mithen 1998, page 165.

[10] See Goldberg, 1994.

[11] "Thus," says Klein, "the text argues that after an initial human dispersal from Africa by 1 million years ago, at least three geographically distinct human lineages emerged. These culminated in three separate species: *Homo sapiens* in Africa, *Homo neanderthalensis* in Europe, and *Homo erectus* in eastern Asia. *Homo sapiens* then spread from Africa, beginning perhaps 50,000 years ago to extinguish or swamp its archaic Eurasian contemporaries. The spread was prompted by the development of the uniquely modern ability to innovate and to manipulate culture in adaptation. This ability may have followed on a neural transformation or on social and technological changes among Africans who already had modern brains. Whichever alternative is favored, the fossil, archeological, and genetic data now show that African *H. sapiens* largely or wholly replaced European *H. neanderthalensis.*" Richard Klein 1999, page xxiv.) Klein further argues that "only fully modern humans after 50 ky ago possessed fully modern language ability, and that the development of this ability may underlie their modernity" (page 348). He also writes: "But even if important details remain to be fixed, the significance of modern human origins cannot be overstated. Before the emergence of modern people, the human form and human behavior evolved together slowly, hand in hand. Afterward, fundamental evolutionary change in body form ceased, while behavioral (cultural) evolution accelerated dramatically. The most likely explanation is that

the modern human form—or more precisely the modern human brain—permitted the full development of culture in the modern sense and that culture then became the primary means by which people responded to natural selective pressures. As an adaptive mechanism, not only is culture far more malleable than the body, but cultural innovations can accumulate far more rapidly than genetic ones, and this explains how, in a remarkably short time, the human species has transformed itself from a relatively rare, even insignificant large mammal to the dominant life form on the planet" (1999, page 494). In an earlier work, Klein similarly notes that"[t]he archeological record is geographically uneven, but where it is most complete and best-dated, it implies that a radical transformation in human behavior occurred 50,000 to 40,000 years ago, the exact time perhaps depending on the place. Arguably, barring the development of those typically human traits that produced the oldest known archeological sites between 2.5 and 2 million years ago, this transformation represents the most dramatic behavioral shift that archaeologists will ever detect" (1992, page 5). "Thus, while both Mousterians and Upper Paleolithic people buried their dead, Upper Paleolithic graves tend to be significantly more elaborate. These graves are the first to suggest a burial ritual or ceremony, with its obvious implications of religion or ideology in the ethnographic sense of the term" (1992, 7). "The list of contrasts can be extended, and in each case the conclusion is not just that Upper Paleolithic people were qualitatively different, but also that they were behaviorally more advanced than Mousterians and earlier people in the same way that living people are. The evidence does not demonstrate that every known Upper Paleolithic trait was present from the very beginning. It is, in fact,

only logical that many features, particularly those involving advances in technology, took time to accumulate. What the evidence does show is that, compared to their antecedents, Upper Paleolithic people were remarkably innovative and inventive; this characteristic, more than any other, is their hallmark. In the broad sweep of European prehistory, they were the first people for whom archeology clearly implies the presence of both 'Culture' and 'cultures' (or ethnicity) in the classic anthropological sense." (1992, page 7).

[12] Mithen 1996, p. 142.

[13] We quote from "Out of Africa: Part 2," a website press release from *Nature Genetics* dated November 29, 1999: "Fossil evidence indicates that modern humans originated in Africa and then expanded from North Africa into the Middle East about 100,000 years ago. Silvana Santachiara-Benerecetti (of the University of Pavia) and colleagues now provide evidence that supports a second route of exit from Africa, whereby ancient peoples dispersed from eastern Africa and migrated along the coast to South Asia.

"Mitochondria are tiny intracellular bodies that generate the energy needed to drive the activities of a cell. They have their own DNA, distinct and independent from nuclear DNA. Mitochondrial DNA can be 'fingerprinted' according to small variations in sequence and, because mitochondria are only inherited from the mother, used to trace maternal ancestry. Closely related mitochondrial DNA sequences fall within the same 'haplogroup', and insinuate -- but do not prove -- a close genetic relationship between the people who carry them. People in Asia and Ethiopia carry the 'M' mitochondrial haplogroup, which raises the question: how has this come about? Have their mitochondrial

DNAs evolved independently, but, through coincidence, converged onto the same haplotype? Or does the similarity reflect a genetic relationship?

"On scrutinizing the region of mitochondrial sequence in Africans and Indians, Santachiara-Benerecetti and coworkers ruled out the possibility that the M haplogroups in eastern-African and Asian populations arose independently — rather, they have a common African origin. These findings, together with the observation that the M haplogroup is virtually absent in Middle-Eastern populations, support the idea that there was a second route of migration out of Africa, approximately 60,000 years ago, exiting from eastern Africa along the coast towards Southeast Asia, Australia and the Pacific Islands. "Out of Africa: Part 2." Press release from *Nature Genetics* (web site), November 29, 1999, page 437.

[14] "We focused on estimating the expected time to the most recent common ancestor and the expected ages of certain mutations with interesting geographic distributions. Although the geographic structure of the inferred haplotype tree is reminiscent of that obtained for other loci (the root is in Africa, and most of the oldest non-African lineages are Asian), the expected time to the most recent common ancestor is remarkably short, on the order of 50,000 years. Thus, although previous studies have noted that Y chromosome variation shows extreme geographic structure, we estimate that the spread of Y chromosomes out of Africa is much more recent than previously was thought." (Thomson et al. 2000 p. 7360).

[15] Cavalli-Sforza 2000.

[16] As reported in Angier, 1999.

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