SURFACES AND ESSENCES

ANALOGY AS THE FUEL AND FIRE OF THINKING

DOUGLAS HOFSTADTER & EMMANUEL SANDER

CHAPTER 1

The Evocation of Words

❧ ❧ ❧

How do Words Pop to Mind?

At every moment we are faced with a new situation. Actually, the truth is much more complicated than that. The truth is that, at every moment, we are simultaneously faced with an indefinite number of overlapping and intermingling situations.

In the airport, we are surrounded by strangers whom we casually observe. Some seem interesting to us, others less so. We see ads everywhere. We think vaguely about the cities whose names come blaring out through loudspeakers, yet at the same time we are absorbed in our private thoughts. We wonder if there's time enough to go get a frozen yogurt, we worry about the health problems of an old friend, we are troubled by the headline we read in someone's newspaper about a terrorist attack in the Middle East, we smile to ourselves at a clever piece of wordplay in an ad on a television screen, we are puzzled as to how the little birds flying around and scavenging food survive in such a weird environment… In short, far from being faced with *one* situation, we are faced with a seething multitude of ill-defined situations, none of which comes with a sharp frame delineating it, either spatially or temporally. Our poor besieged brain is constantly grappling with this unpredictable chaos, always trying to make sense of what surrounds it and swarms into it willy-nilly.

And what does "to make sense of" mean? It means the automatic triggering, or unconscious evocation, of certain familiar categories, which, once retrieved from dormancy, help us to find some order in this chaos. To a large extent, this means the spontaneous coming to mind of all sorts of *words*. Without any effort, one finds oneself thinking, "cute little girl", "funny-looking coot", "same dumb ad as at the airport I was at yesterday", "an Amish family", "sandals", "what's she reading?", "who's whistling?", "where is their nest?", "when are we going to board?", "what an annoying ring tone", "how could I have left my cell-phone charger at home?", "and I did it last time, too", "the air-conditioning is on too high in here", and so on.

All these words! No experience is more familiar to us than this ceaseless barrage of words popping up in our mind extremely efficiently and without ever being invited. But where do these words come from, and what kind of invisible mechanism makes them bubble up? What is going on when one merely thinks silently to oneself, "a mother and her daughter"?

It All Starts with Single-member Categories

To be able to attach the label "mother" to some entity without thinking about it, one has to be intimately familiar with the concept *mother*, which is denoted by the word. For most of us, this intimacy with the concept goes all the way back to our earliest childhood, to our first encounters with the notion. For one-year-old Tim, the core of the concept is clearly his own mother — a person who is much bigger than he is, who feeds him, comforts him when he cries, sings him lullabies, picks him up, plays with him in the park, and so forth. Once this first mental category bearing the name "Mommy" has a toehold, Tim will be able to see that in the world around him there are similar phenomena, or as we prefer to put it, analogous phenomena.

We take a momentary break here to explain a typographical convention of our book. When speaking about a word, we will put it in quotation marks ("table"), whereas when speaking about a concept, we will use italics (*table*). This is an important distinction, because whereas a word is a sequence of sounds, a set of printed letters, or a chunk of silent inner language, a concept is an abstract pattern in the brain that stands for some regular, recurrent aspect of the world, and to which any number of different words — for instance, its names in English, French, and so forth, or sometimes no word at all — can be attached. Words and concepts are different things. Although the distinction between them is crucial and often very clear, there will unavoidably be cases in our text where it will be ambiguous and blurry, and in such cases, we'll make a choice between italics and quotation marks that might seem a bit arbitrary. Another source of ambiguity is the fact that here and there we'll use italics for emphasis, just as we'll use quotation marks to suggest a sense of doubt or approximation (which could sometimes be conveyed equally well by the word "so-called"), and of course we will use quotation marks when we are making a quotation. Alas, the world is simply filled with traps, but we hope that the ambiguities are more theoretical than actual. And with that said, we return to our main story.

One day in the park, Tim, aged eighteen months, sees a tot playing in the sandbox and then notices a grown-up near her who is taking care of her. In a flash, Tim makes a little mental leap and thinks to himself more or less the following (although it's far from being fully verbalized): "That person is taking care of *her* just like Mommy takes care of *me*." That key moment marks the birth of the concept *mommy* with a small "m". The lowercase letter is because there are two members of this new category now (and of course using uppercase and lowercase letters is just *our* way of hinting at what's going on in Tim's head, not *his* way). From this point on, it won't take Tim long to notice yet other instances of this concept.

At the outset, Tim's concept of *mommy* still floats between singular and plural, and the analogies in his head will be quite concrete, a comparison always being made to the *first* mommy, which is to say, with Mommy (the one with the capital "M"), but as new instances of the concept *mommy* are superimposed and start to blur in his memory, the mental mapping that Tim will automatically carry out, each time he spots a new grown-up in the park, will start to be made not onto Mommy, but onto the nascent and growing concept of *mommy* — that is, onto a generalized, stereotyped, and even slightly abstract situation, centered on a generic grown-up (*i.e.*, stripped of specific details) and involving a generic child who is near the grown-up and whom the grown-up talks to, smiles at, picks up, comforts, watches out for, and so on.

It's not our goal here to lay out a definitive theory of the growth of the specific concept *mommy*, as our purpose is more general than that. What we are proposing is that the birth of *any* concept takes place more or less as described above. At the outset, there is a concrete situation with concrete components, and thus it is perceived as something unique and cleanly separable from the rest of the world. After a while, though — perhaps a day later, perhaps a year — one runs into another situation that one finds to be similar, and a link is made. From that moment onward, the mental representations of the two situations begin to be connected up, to be blurred together, thus giving rise to a new mental structure that, although it is less specific than either of its two sources (*i.e.*, less detailed), is not fundamentally different from them.

And so the primordial concept *Mommy* and the slightly more sophisticated concept *mommy* act in very similar ways. In particular, both of them are easily mapped onto newly encountered situations "out there", which leads both of them to extending themselves outwards — a snowball effect that will continue all throughout life. It's this idea of concepts extending themselves forever through a long series of spontaneous analogies that we wish to spell out more carefully in the next few sections.

Passing from *Mommy* to *mommy* and then to *mother*

One day, Tim, who sadly has never met his father, is playing in the park, and he runs into a little girl accompanied by a grown-up who is encouraging the girl to play with the other children. He thinks to himself that this grown-up is the *mommy* of the little girl. That is, Tim's mind makes a link between what he's observing and his new concept of *mommy*. This is an act of categorization. Perhaps the new person is not actually the child's mother but the child's father, or perhaps it's her grandmother, or even her older brother or sister, but even so, that doesn't make Tim's mapping of this new person onto the category *mommy* irrational, because his notion of *Mommy/mommy* is wider than ours is (not richer, of course, but less discriminating, due to his lack of experience). This simple analogy Tim has made is flawless; it's just that he hasn't taken into account certain details that an adult would have used. If Sue, his mother, explains to him that this person isn't the little girl's *mommy* but her *daddy*, then Tim may well modify his concept of *mommy*, thereby coming into closer alignment with the people around him.

Gradually, as Tim uses the word "mommy" more and more, his initial image — that of his own mother — will start to recede from view, like a root being grown over ever more as time passes. He will overlay his earliest image with traits of other people whom he assigns to this mental category, and the vivid and unique features of his own Mommy will become harder and harder to find in it. Nonetheless, even when Tim is himself a grown-up, there will remain in his concept of *mommy* some residual traces of his primordial concept *Mommy*.

One day, a friendly woman who's come all the way from her home in Canada turns up and treats Tim very sweetly. He hears the word "mommy" used several times to refer to this grown-up, and so for a while he concludes that maybe he has more than one mommy. For Tim this is conceivable, since he has not yet built up a set of expectations that would rule this possibility out. Sometimes his "second mommy" takes him to the park and she, too, chats with the other mommies. But after a week or so, Tim's second mommy vanishes, which quite understandably saddens him. The next day, one of the mommies in the park asks Tim, "Did your grandmother go back home?" Tim doesn't answer, because he doesn't yet know the concept of *grandmother*. So she reformulates her question: "Where's your mommy's mom today, Tim?" But this question makes even less sense to Tim. He knows perfectly well that *he's* the one who has the mommy (he even had two of them in the past few days!), and so his mommy (that is, the remaining one) can't have a mommy. After all, it's *children* who have mommies (and sometimes also daddies) whose purpose is to be sweet to them, to watch over them, and to help them, and Tim knows that his mommy *isn't* a child, and so she doesn't have a mommy. That's obvious! The woman doesn't push her strange question, and Tim goes back to his playing.

And time passes. A few months later, Tim starts to realize that grown-ups are sometimes accompanied by other grown-ups that they refer to as their "mother". Suddenly everything starts to be clear… What children have are *mommies*, and what grown-ups have are *mothers*. That makes sense! And into the bargain, there's even an analogical bond between *mommy* and *mother*. Of course Tim isn't aware of having made an analogy — neither this concept nor the word for it will be known to him for another ten or more years! — but he has nonetheless made one. And as is often the case with analogies, this one helps clarify things for Tim but it also misleads him a little.

We now will skip over the details, simply adding that the two concepts of *mommy* and *mother* gradually merge to create a more complex concept at whose core there is the primordial concept of *Mommy*. This doesn't mean that the primordial image of Sue springs to Tim's mind every time that he hears the word "mother" or even the word "mommy", but merely that the invisible roots are structured in that manner.

As any concept grows in generality, it also becomes more discriminating, which means that at some point it's perfectly possible that some early members of the category might be demoted from membership while new members are being welcomed on board. Thus the dad at the park whom Tim had first taken for a *mommy* is stripped of the label, and although Tim's grandmother stays on as a member of the category *mother*, she winds up in a less central zone than the *mommy* zone, which is reserved for the

mothers of small children. And of course as time goes by, Tim will come to understand that his grandmother herself was once a member of the category *mommy* (just as his own Mommy was once a member of the category *small child*), but at present all of that is well beyond his grasp.

The Cloud of Concepts of *Mother*

One might think that the concept of *mother* is very precise — perhaps as precise as that of *prime number*. That would imply that to every question of the form "Is X a mother or not?", there would always be a correct, objective, black-and-white answer. But let's consider this for a moment. If a little girl is playing with two dolls, one bigger and one smaller, and she says that the big one is the small one's mother, is this an example of motherhood? Does the large doll belong to the category *mother*? Or contrariwise, could one state without risk of contradiction that she does *not* belong to that category?

And if we read a certain book in which a certain Sue is described as the mother of a certain Tim, then does this Sue, who is never anything but a made-up character in a book, truly belong to the category *mother*? Does it make any difference that Sue was modeled on a real person, and Tim on her son? Is Sue more of a mother than the doll is? What indeed is Sue? If in the book it states that she is 34 years old, that she has light brown hair, that she weighs 120 pounds, that she is five feet five inches tall, and that she's the mom of a small boy, does that mean that Sue has a body and once gave birth? A doll, at least, is a physical object, but what is Sue, when you come down to it? An abstract thought triggered by some words on a page, by some black marks on a white background. Does this thought even deserve the pronoun "she"?

When Tim gets to be six, if someone tells him that Lassie is Spot's mother, he certainly won't protest, but if he were told that the queen bee is the mother of all the bees in her hive, it's less clear what he would say, and in any case some mental effort would be needed before he could absorb this idea. And if he were told that a drop of water that he just watched dividing into two drops is the mother of the two new drops, he would almost surely find this suggestion very surprising. Everyone knows phrases that use the word "mother" in ways that go far beyond the senses that apply to Lassie, the queen bee, or even the splitting drop of water — for instance, "my motherland", "a mother cell", "the mother lode", "Mother Earth", "Greece is the mother of democracy", and "Necessity is the mother of invention". Are these true instances of the concept of *mother*, genuine cases of maternity? What is the proper way to understand such usages of the word?

Some readers may feel inclined to say that these are all "metaphorical mothers", and indeed, such a viewpoint is not without merit, but we have to point out that there is no sharp boundary that separates "true" mothers from those that are metaphorical, for categories in general don't have sharp boundaries; most of the time, metaphorical and literal meanings overlap so greatly that when one tries to draw a clear boundary, one discovers that things only get blurrier and blurrier.

When he turns seven or eight, Tim will start to be able to handle phrases in which the word "mother" is used with greater fluidity than back in nursery school. He might run into the statement "Mary is the mother of the Lord Jesus" in a religious context. This is a mild extension of the usual meaning, since Mary is imagined as a woman whereas the Lord Jesus is imagined as a divine being, magical and omnipotent in some ways, even if also, in some sense, as a baby like all others. At age seven, though, Tim probably won't have much trouble envisioning Mary giving birth to the Lord Jesus.

On the other hand, having given physical birth to a baby is not a prerequisite for attributing motherhood to an entity, since even if no one ever teaches us this explicitly, we all come to know that motherhood pulls together several different properties, such as that of *female biological parent*, that of *female nurturer*, and that of *female protector*, and these properties do not all need to be present simultaneously. For example, the familiar fact of adoption reminds us that giving birth is only one possible route for becoming a mother.

If at age nine, Tim is reading a book on Egypt or on mythology and runs into the sentence "Isis is the mother of Nature", he'll have to extend his prior conceptions of motherhood at least slightly, because this time, Isis is not a human being but a deity who, in Tim's mind, looks much like a woman but in some sense is not one, and who is capable of giving birth to some rather abstract things, such as Nature, yet without anything emerging from her body. And yet Tim will rather easily absorb this new instance of motherhood, because she looks enough like hundreds of other members of the category *mother* that are already installed in his memory.

Moving right along, Tim will soon handle cases that are even more abstract, such as "Marie Curie is the mother of radioactivity", "The American revolution is the mother of the French revolution", "The American revolution is the mother of the Daughters of the American Revolution", "Judaism is the mother of Christianity", "Alchemy is the mother of chemistry", "Censorship is the mother of metaphor" (Jorge Luis Borges), "Leisure is the mother of philosophy" (Thomas Hobbes), and "Death is the mother of beauty" (a quote from Wallace Stevens, and also the title of a detailed study of the role of metaphor in thought by cognitive scientist Mark Turner).

And we can go yet further, to the idea of Nature as the mother of all living creatures ("Mother Nature"), or the idea of *Mother Superior* in a convent, or the idea of *den mother* for a Cub Scout pack, or the idea of a company that has a *mother company* from which it sprang at some earlier point, or the idea of the *mother board* in a computer, and so forth. A mother in a park, a mother in a soap opera, an adoptive mother, a den mother, a mother doll, a mother bee, a mother cell, a mother board, a mother drop of water, a mother deity, a mother company, the mother lode… Given that some mothers, such as Tim's mommy Sue, are certainly "real mothers", while others, like the mother board, are just as certainly "metaphorical mothers", the goal of drawing a sharp, objective boundary between the two distinct subcategories seems as if it might well be within reach. However, as we have shown with our list of blurry examples, such as the person in a novel, the doll mother, and the adoptive mother, that hope is but a beckoning mirage.

On the Categories and Analogies of Children

The story we've just told illustrates a central theme of our book — namely, that each category (in this book we use this term synonymously with the term "concept") is the outcome of a long series of spontaneous analogies, and that the categorization of the elements in a situation takes place exclusively through analogies, however trivial they might seem to an adult. A crucial part of this thesis is that analogies created between a freshly perceived stimulus (such as the mother of a little girl in the park, as seen by Tim) and a relatively new and sparse mental category that has only one single member (such as Tim's category *Mommy*) are no different from analogies created between a perceived stimulus (once again, take the same woman in the park) and a highly developed mental category to which thousands of analogies have already contributed (think of the very rich category *mother* in the mind of an adult).

This last statement is among the most important in our book, yet on first sight it might seem dubious. Is it really plausible that the very same mechanisms underlie the act whereby a two-year-old spots a Saint Bernard and exclaims "Sheep!" and the act whereby a physicist of great genius discovers a subtle and revelatory mapping between two highly abstract situations? Perhaps it seems implausible at first glance, but we hope to have made it convincing by the end of the book.

In the meantime, to facilitate building a pathway that will get us to this goal, we'll set up some intermediary bridges. Toward this end, it will be useful for us to take a look at a number of statements made by children, for these statements reveal hidden analogies that underlie their word choices. And so, without further ado, here is a small sampler of children's sentences, many of which were collected by developmental psychologist Karine Duvignau in her work with parents who were observing their children at home.

Camille, age two, proudly announces: "I undressed the banana!"
    She talks about the banana as she would talk about a person or a doll, seeing the peel as an article of clothing that she has removed from it. The banana has thus been "laid bare" (a near neighbor of what Camille said).

Joane, age two, says to her mother: "Come on, Mommy, turn your eyes on!"
    Here a little girl speaks to her mother as if she were dealing with an electrical device having an on–off switch.

Lenni, age two, says about a broken toy: "Gotta nurse the truck!"
    Here, as in the case of Camille, we see a personification of an inanimate object. The truck is "sick" and so the child wants to help it "get well".

Talia, three years old, says: "Dentists patch people's teeth."
    This represents the flip side of the coin, where the child speaks of something alive as if it were an inanimate object (as we just saw Joane do as well).

Jules, three years old, exclaims: "They turned off the rain!"

For Jules, rain is like a television set or a lamp that a person or people can turn on or off with a switch.

Danny, aged five, says to his nursery-school teacher: "I want to eat some water."

In this case, Danny was not speaking his native language but one he was just starting to learn, so he reached out and grabbed the nearest word he knew.

Talia, aged six, says to her mother, "Are you going to go scold the neighbors today?"

The night before, the upstairs neighbors had held a very noisy party, and her mother had told Talia that the next morning she would go knock on their door and complain about their noisemaking. In using the word "scold", Talia was unconsciously revealing her egalitarian value system: any person, whether it's an adult or a child, may sometimes have to be scolded.

Tom, aged eight, asks: "Dad, how long does a guinea pig last?"

While it's true that Tom talks here about his guinea pig in a most materialistic manner, the tenderness with which he treats his pet shows unmistakably that his category *entity of limited duration* is much broader in scope than that of most adults.

At the same age, Tom asks his parents, "How do you cook water?"

This question gets uttered when Tom has generously decided to fix some coffee for his parents one morning, but isn't sure how to start. The distinctions between such kitchen-bound concepts as *to heat up*, *to boil*, *to cook*, and *to fix* are not yet very clear in his mind, but since he announces to anyone who'll listen that he aspires to be a chef in a top-flight restaurant someday, it's to be hoped that this blur won't last too long.

Once again Tom, still eight, says to his uncle, "You know, your cigarette is melting."

This is stated when Tom's uncle is so involved in a conversation that he seems unaware that his cigarette is slowly being consumed in the ashtray. Although Tom knows cigarettes are not for consumption by children, here he links them with certain foods that he knows well, such as ice cream and candy, which can melt.

Tom tips over a wineglass, goes to get a sponge, and chirps, "Here, I'll erase it!"

Part of the tablecloth has just been colored dark, much as paper is colored by pencils or a blackboard is colored by chalk, and so to Tom it makes sense that the sponge will act as an eraser, eliminating all traces of the spilled liquid.

Mica, age twelve, asks his mother, "Mom, could you please roll up your hair?"

He wants to take a snapshot of her and what he means is, "Could you please put your hair up in a bun?", but his thought comes out in a more picturesque way.

Very similar examples are provided by Corentin, who says, "You can stop, Mom, your hair's all cooked now" (meaning it's now dry), or Ethan who observes, "I broke the book" (meaning he's torn it), or Tiffany who declares, "I want to get my nails permed" (meaning she wants a manicure), or little Alexia, who asks, "Mom, can you glue my button back on?" (of course meaning "sew it back on"), and last but not least by Joane, who poses the classic conundrum, "Do buses eat gas?"

Impressive Heights of Abstraction by Children

In each of the cases shown above, one can ask if the child actually was making an error. The key question is, what would constitute an error? If Danny knows the word "drink" but it simply doesn't come to mind, and if he realizes that "to eat" isn't really what he means to say, then saying "I want to eat water" would be an error. But if he has the feeling that what he said is perfectly fine, and if he would be surprised to hear the nursery-school teacher correct him, then we'd say that his statement was correct, at least from his own point of view. Most likely Camille, who "undressed the banana", Ethan, who "broke the book", and Alexia, who wanted the button to be "glued back on", had little or no idea of the existence of the verbs "to peel", "to tear", and "to sew". From their viewpoint, what they were saying was correct, because their concepts of *undressing*, *breaking*, and *gluing* were more inclusive than those concepts are in the mind of an adult, and they could thus be applied to situations having a wider range of diversity. For example, Ethan could almost certainly have said, given the proper conditions, "the curtains are broken", "I broke a loaf of bread", or "they broke the house".

On the other hand, it's very unlikely, even in our society, filled as it is to the brim with technological gadgets, that Joane ("Come on, Mommy, turn your eyes on!") would be familiar with the verb "to turn on" and yet unfamiliar with the verb "to open". Likewise, it's extremely unlikely that Jules ("They turned off the rain!") knows the verb "to turn off" but is unaware of the verb "to stop". And so we ask: are these children making errors, or not?

The line between what is and what is not an error is less precise than one might think. What these children are doing is making semantic approximations, stretching their personal concepts in a way that adults would not feel comfortable doing, because the concepts *to turn on*, *to turn off*, *to open*, and *to close* in these children's minds have not yet reached their adult forms — no more than (to switch from verbs to nouns momentarily) the categories *horse* and *cat* had reached their relatively stable adult stages in the mind of little Abby when, at age three, she saw some greyhounds and called them "horses", and soon thereafter saw a chihuahua and called it a "cat". The concepts silently hidden behind these words will continue to develop in the minds of all these children, just as will the category *mother* in Tim's mind.

The utterances made by such children are not terribly different from the semantic approximations of adults who say "I broke my DVD" instead of "I scratched it", or "I broke my head getting out of the car" instead of "I banged it"; it's just that adults' concepts are a little bit more sophisticated than children's. And then (sticking with the

verb "to break" for a moment) there are many usages that are often labeled "metaphorical", such as "to break bread", "to break one's fast", "to break one's silence", "to break one's brain", "to break somebody's neck", "to break the ice", "to break wind", "to break ground", "to break the news", "to break someone's heart", "to break a habit", "to break away", "to break a code", "to break the law", "to break a world record", and on and on. Such usages are obviously built upon analogical extensions of the verb "to break" that go way beyond anything that a child does who says "the book is broken".

Our tale of children's usage of verbs hasn't "turned off" yet. Let's look at little Joane's use of the verb "Come on!" ("Come on, Mommy, turn your eyes on!"). This usage is undeniably a correct one, and it reveals a deep understanding of the situation that this two-year-old is in. What does "Come on" mean? Firstly, it's a verb that indicates that the speaker wants some change to come about, and it's directed at another person who the speaker feels would be able to make that change happen. Secondly, it's spoken as a kind of urging — stronger than and less polite than "please", almost reaching the intensity of "I insist". Thirdly, although it's an imperative based on the verb "to come", it has nothing to do with physical motion. In fact, "Come on!" is such a frozen expression that one might even argue that it is no longer a genuine verb but more of an interjection, rather like "Hey!" After all, no one would reply to the exhortation "Come on!" by saying "Okay, I'm coming on!" But grammar aside, we are dealing with a subtle word choice made by a toddler. She clearly had put her finger on the situation's essence — namely, she wanted her mother to open her eyes — and that desire led to an eager hope that she could achieve this goal by whining.

To put it in another way, already at the tender age of two, Joane had understood that there is a certain class of situations in life that match and that evoke the label "Come on!" This mental category of *Come on!* situations had gained a solid toehold in her mind. One of the situations belonging to this category was the current one, with her napping mother. To put it succinctly, then, we are saying that *Come on!* situations constitute a mental category that is every bit as real and as important as categories such as *eyes*, *truck*, and *Mommy*, which refer to physical entities in the world. The acquisition of the abstract category of *Come on!* situations by a two-year-old child is a small cognitive miracle and is thus an excellent challenge for anyone who has the goal of deeply understanding human thought.

We might equally well focus on the choice of the verb "gotta" by Lenni ("Gotta nurse the truck!"). This two-year-old boy has understood the essence of situations that are labeled with the pseudo-word "gotta" — namely, something is needed in a hurry, there's no time to lose, and so on. It's very likely that Lenni thinks that "gotta" is just one single word (which is why we didn't write "got to" or "I've got to" or "we've got to", etc.), and this would suggest that he hasn't fully understood that it is a verb, even if in different circumstances he might say, "You don't gotta do it" or "I gotted to do it", and other variants, which are clearly attempts to use it as a verb. So once again we observe a case of a high degree of abstraction carried out by a human being who belongs to the category *toddler*.

Here are a couple of other childish pearls that do not involve verbs. Six-year-old Talia announced, "Dad, we have to get some deodorant for the refrigerator!" (since it reeked of seafood), and her two-and-a-half-year-old cousin Hannah, having just licked all the chocolate off her Eskimo Pie, exclaimed with delight, "Look, now the ice cream is naked!"

Even with nouns that denote the most ordinary and concrete of objects, there remain many subtleties. Lenni said, "Gotta nurse the truck!", but what truck was he speaking of? There was no truck in the apartment; there was just a broken toy. Was that object really a truck? Well, yes and no. Lenni knows perfectly well that the trucks he sees on highways are hugely bigger than *his* truck, but for him those are distant abstractions; he's never even touched one. By contrast, his little toy truck is a physical object that drives down the invisible highways on the floor of his apartment. In that sense, this toy is, for Lenni, just as central a member of the category *truck* as are those "real" trucks that drive down the "real" highways — indeed, for him, it's probably more central than those are. Ironically, for Lenni, it's *real* trucks that are metaphorical.

Shining Light on the Moon

Earlier we suggested that there is a strong resemblance between the concrete perceptions of a small child and the abstract mental leaps made by a sophisticated physicist. We wish now to illustrate this thesis by means of a concrete example.

In 1610, Galileo Galilei, having just constructed his first telescope, turned it toward the heavens and peered at various celestial bodies. Recall that at that time, the distinction between planets and stars, which today is quite sharp, was still blurry. Certain celestial lights seemed to wander against a backdrop formed by others, but the reason for this movement was not at all clear. Galileo's choice to focus on Jupiter did not mean he knew what it was; it was probably because Jupiter was one of the brightest and thus most inviting objects in the sky to look at.

Galileo's first surprise was that in his telescope Jupiter appeared not as a mere point but as a small circle, which suggested that this "point of light" might well be a solid object with a definite size. Galileo had certainly had the experience of seeing someone with a lantern approaching him. From afar, the lantern seems to be just a dot without size, but then, little by little, the dot acquires a diameter. By analogy with this familiar phenomenon, Galileo could thus imagine that Jupiter, up till then just a dot of light, was in fact a physical object, much like the objects he knew all around him. A second surprise was that against the background of this small white circle he observed some tiny black points, and moreover — a third surprise — these tiny points moved across the circle in a straight line, some taking a few hours, others a few days. Furthermore, whenever one of these points reached the edge of the white circle, it would change color, becoming white against the backdrop of the blackness of space, and would continue moving along the same straight line, then it would slow down, stop, and reverse tracks; when it returned to the edge of the white circle, it would disappear totally, and after a while would reappear on the far side of the white circle.

We won't go into great detail about Galileo's epoch-making discovery; we want, rather, to focus on the way in which the great scientist interpreted what he was observing through his telescope. He decided that Jupiter was a roughly spherical object around which other, smaller objects were rotating perfectly periodically (with periods ranging from about two days to about fifteen days, depending on which dot he was paying attention to). Galileo knew that the Earth was round and that the Moon rotated around it in a periodic fashion, with a period of about thirty days. All these factors added up and suddenly something clicked in his mind. All at once, Galileo was "seeing" a second Earth in the sky, accompanied by several Moons. We put "seeing" in quotation marks to remind readers of the fact that the key moment of "perception" was Galileo's act of interpretation, since the light stimuli arriving at his eyes hadn't changed in the slightest. The analogy between the Moon and a spot of light (or a black point, depending on where the dot was with respect to the white circle of Jupiter itself) was a stroke of genius — a "vision" of a visionary, so to speak.

Not everyone would have seen what Galileo saw, even if they had been given a telescope, even if they had observed the celestial lights over several weeks, and even if they had focused on Jupiter in particular. The reason is that until that moment, the word "Moon" had been applied to only one object, and the fantasy of "pluralizing" that object was well beyond the imagination of anyone alive at that time (and if someone original had the audacity to think such a thought, that was sufficient to bring about their swift demise: it suffices to recall the case of poor Giordano Bruno, who was burned at the stake in Rome in 1600 for his fantasies about worlds like our own spread throughout space). Moreover, Galileo's daring act of pluralization was the fruit of an analogy that might have seemed laughable to most people — after all, it was an analogy between the entire world, on the one hand (since for most people back then, the terms "Earth" and "world" were synonyms), and on the other hand, an infinitesimal dot of light. This analogy, which might seem far-fetched, nonetheless led to the pluralization of the Earth, since it began by taking Jupiter to be another Earth, and it was rapidly followed by the pluralization of the Moon, which naturally led to the lower-casing of the initial "M". The concept of *moon* had been born, and from that moment on it was possible to imagine one or more moons circling around any celestial body, even around moons themselves.

What Galileo envisioned, in hypothesizing that some small objects in the heavens were rotating around a larger object, was a replica, on an unknown scale, of numerous earthbound situations that were familiar to him, in which one or more objects rotated around a central object. Galileo's stroke of genius was to bank seriously on the daring heliocentric hypothesis of Copernicus and to think to himself that the sky, far from being merely a pretty two-dimensional mural whose purpose was solely to make human life more pleasant, was a genuine *place* that is completely independent of humanity, similar to the places he knew on Earth but much vaster, and as such, capable of housing entities having unknown sizes, and capable of being the site of their movement. In fact, Galileo was completely ignorant of the size of Jupiter and its moons; of course he could imagine a sphere roughly the Earth's size, but doing so would be no more than

guesswork, since all he had access to was a set of tiny points. For all he knew, Jupiter might be no larger than the town of Padova, in which he was doing his stargazing, or it might be a hundred times larger than the Earth. Galileo's analogy was an analogy created (or rather, perceived) between something vast and concrete (the Earth and the Moon) and something else that was extremely tiny and immaterial (a circle and some points), but which was nonetheless imaginable as another vast and concrete thing.

Is this profound vision of Galileo's all that different from the vision of the child who sees a very small toy as being a member of the category *truck*, whose other members are so enormous that they are almost inconceivable to the child? One thing is certain — namely, that in both cases, there is a very small object that is imagined as being a very large object, and in both cases, the perceiver uses familiar phenomena in order to understand what is not familiar.

And what about the analogy that *we* are drawing between what Galileo did and what the small child does — is this, too, not just a leap between one scale of sizes and another? Isn't the small cognitive leap by the child, which links a silent, odorless plastic toy truck on the floor with a loud, smoke-belching truck on the highway, simply a small-scale version of the sophisticated cognitive leap by Galileo, which linked the Earth under his feet with the imagined, distant Jupiter, and which linked our familiar Moon with the imagined, distant Jovian moons? Could it in fact be the case that the tiny child's act of calling an everyday object by its standard name is a close cousin of the genius's act of creating a new concept that revolutionizes human life? For the time being, we won't press the point, but we've planted the seed. To go further will require that we look more closely at the subtlety of the most ordinary categories.

Analogies in the Corridors and Behind the Scenes

Some years back, the senior author of this book went to Italy for a sabbatical year. When he arrived, he had a decent command of Italian but, like everyone in such a situation, he made plenty of mistakes — sometimes subtle, sometimes not — most of which were based on unconsciously drawn analogies to his native culture and language. The research institute where his office was located was a building in which some three hundred people worked — professors, researchers, students, writers, secretaries, administrators, technicians, cafeteria workers, and so forth. During his first few weeks, he met several dozen people, whose names he instantly forgot but whom he would continually bump into in the wide, austere corridors of the building, each time he ventured out of his small office. What to say to all these friendly folks who instantly recognized the newly arrived foreigner, the *professore americano*, and who greeted him warmly (or at least politely) whenever their paths crossed in the hallways? And what to say to the people he saw every day but whom he had never actually met?

His initial assumption, coming from his native culture, was that the proper thing to say to anyone and everyone was "Ciao!", even if it was someone that he wasn't sure he'd ever seen before. This was an innocent assumption based on the American way of saying "Hi", and perhaps it seemed charming to those who received such spontaneous

greetings and who were naturally inclined to humor their sender because of his status as a foreign guest, but *il professore* soon noticed that his monosyllabic choice did not coincide with that of the majority of the native speakers of Italian whom he ran into. To be sure, there were a handful of people who said "Ciao" to him, but these were his closest colleagues whom he knew well. Otherwise, though, the people in the halls tended to say either "Salve" or "Buongiorno" to him. It took him a while to figure out the levels of formality that were linked to these two forms of greeting, but in the end he devised a fairly clear rule of thumb for himself to guide him in his hallway greetings. Basically you say "Ciao" to people with whom you are on a first-name basis; you say "Salve" to people you see from time to time and whom you recognize (or think you recognize); and finally, you say "Buongiorno" to people you're not sure you recognize, and also to people whom you would prefer to keep at arm's length.

Once he had formulated this rule of thumb and had gotten it more or less confirmed by native Italian-speaking confidants (who, in truth, had never really thought about it and who were therefore not all that sure of what they were saying), he tried to put his new insight into practice, which meant that every time he ran into someone in a corridor, he had to make an instant triage: "First-name basis? ⇒ *Ciao*. Know them a little bit? ⇒ *Salve*. Not sure who it is? ⇒ *Buongiorno*." He rapidly discovered that this was a cognitive challenge that was not in the least trivial. Fortunately, in each of these three greeting-categories, there were one or two individuals who served as prototypes, and using these people as starting points, he began to feel his way in the obscure corridors of acquaintanceship. "Hmm… This fellow who's approaching me, I know him roughly as well as I know that tall curly-haired administrator" — and zing! — he whipped out a "Salve". Around several central individuals constituting the nuclei of the three categories, there started to form mental clouds that spread out as time passed. The strategy worked pretty well, and after a few months, *il professore* was handling the challenge fluently as he strode through the corridors of what, at the outset, had been a mysterious maze.

This is a concrete example of how new categories form — in this case, those of *ciao* situations, *salve* situations, and *buongiorno* situations — thanks to the use of analogies at every step of the way. And it also allows us to stress another key point — namely, that behind the scenes of even such a simple-seeming thing as uttering an interjection, there is a complex cognitive process that depends on subtle categories.

Let's take an example in English that has many points in common with the one just described. On certain occasions one says simply "Thanks" to convey one's gratitude to someone; on other occasions, one says "Thank you" or "Thank you very much" or "Thanks a lot"; indeed, there is a whole range of thanking possibilities, including such familiar phrases as "Many thanks", "Thanks ever so much", "Thanks for everything", "Thanks a million", "How can I ever thank you?", "I can't thank you enough", and so on. Obviously there isn't one exact and perfect choice for each thanking occasion, but on the other hand, certain situations will very naturally evoke just one of these expressions, and some of these expressions would be wildly out of place in certain circumstances. In short, although there isn't a one-to-one correspondence between

situations and expressions, a good choice by a native speaker is far from being a random act, far from being a mere toss of dice. When one is a child, one observes thousands of occasions in which adults use one or another of these phrases without thinking about it for a split second, and pretty soon one starts to do just that oneself. Sometimes adults will smile a little, which conveys the sense that one is probably slightly off-target, while other times one can tell, watching others' reactions, that one has hit the bull's-eye. Thus bit by bit, one refines one's feel for the range of applicability of each of these important and frequent phrases. However, one will probably have no memory whatsoever of the many pathways that collectively led one to one's current status of grandmaster in the day-to-day arts of greeting and thanking.

And what holds for these seemingly trivial acts holds as well for the labels that one pins on all aspects of reality, including verbs (as we already illustrated in the case of children), adjectives, adverbs, conjunctions (as we shall shortly see), and so forth.

"Office" or "Study"?

If one pays attention to the words that are spontaneously uttered in the most mundane of conversations, one will run into many surprises that reveal something of the processes underlying these choices (if indeed "choice" is the *mot juste* here, since words generally bubble up so automatically that they do not feel like choices one has made). Here we'll take an example involving Kellie and Dick, two friends who came from Boston to the house of the above-mentioned *professore* a number of years after he had returned to the United States, and who visited for a few days. As it happened, Kellie and Dick both used the term "your office" to designate the standard workplace of their host, while he himself would always call it "my study". After he had put up with this cognitive dissonance for a couple of days, it occurred to him to ask them, "How come the two of you always go around talking about my 'office' when you both know perfectly well that *I* always call it my 'study'?"

This question caught the Bostonians by surprise, but they quickly hit upon an answer to it, and it was almost surely *the* answer. They said, "In our Boston house, the place where we work [they had a small public-relations firm that they ran from their house] is on the third floor — our house's top floor — and we always call it our 'office'. It's the place where we have our computer, printer, and photocopy machine, all our filing cabinets, and all the slides and videos we've made over the course of the three decades we've been doing this. And for you it's the same thing: your work area is on the second floor — the top floor of your house — and it's where you have all the stuff that you rely on for your work: your computer, printer, and photocopy machine, your filing cabinets, your books, and so forth. To us the analogy is blatant, crystal-clear. It just jumps out at us, no need to think at all. So to us, your workplace is your *office*, clear as clear can be. That's the whole story."

After some reflection on the matter, their host answered, "Aha! I think I see what's going on here. When I was a kid in California, my father had what he called his 'study', which was on the second floor — once again the top floor — of our house. It

was the spot where he had lots of papers, books, slide rules, filing cabinets, a mechanical calculator, and so forth. Every day I would see him working there, and it left a vivid impression on me. And also, at the university, on the campus, he had an *office*, where he had many more books, and he often worked down there as well, but the difference between his *study* and his *office* was crystal-clear for me. And today, I too have both a *study* at home and an *office* on the campus here in Indiana. But I would never confuse the two of them. So that's how I see things."

And on this note the exchange between friends closed, but there are important lessons that can be drawn from it. First of all, what's clear is that all parties concerned had depended unconsciously on analogies they had made to very familiar situations. These analogies involved slight "slippages" (third floor instead of second floor; slides and videos instead of books; public-relations work instead of academic work; calculator instead of computer; etc.), but at the same time they respected and preserved a more important essence — namely, both sides of each analogy involved the standard daily workplace, which was separated from the rest of the house and was the storage area for professional material, and so forth. In each case, one sees how the choice of the word to apply to the workplace came from an analogy made to one single familiar situation, rather than what one might have thought *a priori*, which is that assigning an entity to a general category like *office* would depend on the fact that the rich and abstract category *office* had been built up from thousands of different examples encountered over the course of a lifetime. And yet no connection to such a general category took place in this case. Each of the three people, although they all had rich and abstract concepts at their disposal, completely ignored them and instead made a concrete and down-to-earth analogy to a single familiar situation. The numberless prototypical instances of the concept *office*, such as executives' offices, dentists' offices, doctors' offices, lawyers' offices, and so forth, had nothing to do with what went on in Kellie's and Dick's minds. All that mattered was that primordial image of *office* from their own house. This is reminiscent of little Tim's primordial concept of *Mommy*. Even though the concept *mother* has been enormously enriched for Tim as an adult, there's no doubt that his own mother has remained over the decades a potential source for analogies; she never got melted down and lost in the abstract concept of *mother*.

As a postscript to this episode, we might add that the Bostonians, during a visit to their friend's home a year later, occasionally used the term "your attic" when referring to his study. Surprised once again by this word choice, he asked them about it, and they explained that they often used the term "attic" in talking about their office in Boston. For them, in this context, the word "attic" had nothing whatsoever to do with a typical messy and dusty attic in a typical house; quite to the contrary, they were thinking of a room at the opposite end of the messiness spectrum — a very clean space in their house, constantly in use on a daily basis. And thus, once again, we see an extremely down-to-earth analogy linking the new place to just one single familiar place rather than to a generic category in which many places are blurred together.

If Kellie and Dick had discovered a truly prototypical attic in their friend's house, full of cobwebs, ancient checkbooks, huge old wooden trunks shipped from abroad,

discarded amateurish paintings, and such things, the word "attic" would certainly have sprung to mind because each of them has in their memory not only the concept *our own attic* but also the concept *typical attic*, which allows them to envisage a standard attic, if need be. For example, if Kellie were reading a mystery novel and she came across the sentence, "Trembling, the aged aunt slowly groped her way up the steep and narrow stairway towards the attic to look for the golden statuette, but after three quarters of an hour she hadn't yet come down", the chance is next to zero that this description would evoke in Kellie's mind an image of her Boston house's attic.

This example of the host's *study*, designated first by his visitors as "your office" and later as "your attic", shows how we are guided by unconscious analogies towards labels that seem to pinpoint just what we want to say. It illustrates why there is no boundary line — indeed, no distinction — between categorization and the making of analogies.

The Structure of Categories and of Conceptual Space

The anecdote we've just related shows that a concept (such as those designated by the terms "attic", "truck", "to open", "to melt", "to nurse", "come on!", "ciao", and so forth) can have specific and very distinct instances. Indeed, if we ask you to think of a golfer, you *might* conjure up the image of an anonymous middle-aged lady riding, on a Sunday morning, down some anonymous fairway on a golf cart. But it's more likely that you would conjure up the image of a famous golfer such as Tiger Woods swinging a five-iron, or perhaps you would recall a golf pro you once took lessons from. Instances of the category *golfer* abound, and around each of these specific and concrete instances there is a halo that extends far out. For example, around Tiger Woods, one can imagine seeing him not only making (or missing) a long putt on a tricky green, but also teeing off with great power, hitting out of the rough, and getting out of a sand trap, not to mention appearing in various airport ads and on television, and so forth. Moreover, in this cloud surrounding Tiger Woods, any golf aficionado will surely find a number of Woods' famous predecessors, such as Jack Nicklaus, Arnold Palmer, Sam Snead, Ben Hogan, and others. Anyone familiar with golf will evoke such images without any trouble at all. And so, what does the concept of *golfer* amount to?

It might seem, *a priori*, that asking about the nature of the concept *golfer* is a minuscule question in comparison with the huge question, "What is human thought all about?", but the fact is that it is no smaller. In any case, our modest musings about the concept *golfer* are bringing to the fore the obvious fact that concepts are densely stitched together through relationships of similarity and context. The concept of *golfer* is quite closely linked to that of *minigolfer*, and less closely to such concepts as *tennis player*, *runner*, *bicycle racer*, and so forth. Among these connections, some are very close while others are so distant that they barely exist (for example, there will be practically no relation at all between the notions of *golfer* and *sumo wrestler* in anyone's mind, aside from the fact that both are types of athletes).

The concept of *golfer* is also connected (at various conceptual distances) to a multitude of other concepts, such as *golf course*, *hole*, *fairway*, *tee*, *wood*, *iron*, *putt*, *green*, *par*,

birdie, *eagle*, *bogey*, *double-bogey*, *hole-in-one*, *hook*, *slice*, *golf cart*, *caddie*, and *tournament*, and also, of course, to a large number of specific people (or more precisely, to the concepts one has formed that represent these people). Despite the large number of golfers of whom any fan has certainly heard the name and has very likely stored it in memory, it's far more probable that a fan will think of Tiger Woods than of some middling player from the 1960's. Thus the distance from the "center" of the concept *golfer* to the concept *Tiger Woods* is quite small, whereas the distance from the center out to the middling player from decades ago is very great, unless, perhaps, the particular player happens to be one's mother or one's uncle or something along those lines.

And thus we come to the idea of a multidimensional space in which concepts exist, somewhat like separate points; however, around each such point there is a halo that accounts for the vague, blurry, and flexible quality of the concept, and this halo becomes ever more tenuous as one moves further out from the core.

The Endless Chunking of Concepts in a Human Mind

We could not make an analogy between one concept and another if those concepts had no internal structure in our mind. The very essence of an analogy is that it maps some mental structure onto another mental structure. We can only understand how a hand is analogous to a foot if we mentally recall the fingers and the toes, for instance, as well as the way the hand is physically attached to an arm and the foot to a leg. These kinds of facts are part of what "hand" means; they are integral to the concept *hand*, and they make it what it is. But how many such facts are there "inside" the concept *hand*? How detailed are the internal structures of our concepts? This is the question to which we wish to turn for a moment.

Consider a rather complex memory in the mind of a certain professor — say, the sabbatical year she spent in Aix-en-Provence. When she recalls that year, of course she doesn't replay its 300-plus days like a movie; rather, she sees just the tiniest part of it, in its barest outlines. It's as if she were looking down at a mountain range from an airplane, but an extensive cloud layer allowed only a handful of the chain's highest peaks to peek through.

If someone asks her about details of the city of Aix, or about some major event that happened during the year, or about the most interesting people she met there, or about the schools that her children went to, and so on, then any of these aspects will become available upon request, but until that happens, they are all hidden under the "cloud cover". And if she decides to shift her focus to the school that her children attended that year, then still just a handful of the school's most salient aspects will come into view. If her focus shifts still further down onto a particular teacher, then a handful of that person's most salient features come into view — and on it goes. The overarching memory — the sabbatical year in Aix — is never seen in its full glory; rather, just a tiny (but very salient) fraction of it is ever made available. However, pieces of it can be focused in on, and in this way, the large memory can be unpacked into its component pieces, and the same can be done to those pieces, in turn.

All our concepts, from the grandest to the humblest, have the same quality of being largely hidden from view but partially unpackable on request, and the unpacking process is repeatable, several levels down. One might at first think that concepts named by simple words, in contrast to a vast and complex event like a sabbatical year that one is recalling, don't have much inner structure, but that's not the case.

Consider the concept of *foot*. When you first think about a foot, you don't think of cuticles or sweat glands or hairs on it or the fancy swirls making up its five toeprints; you think about toes and an ankle and a large vague central mass, and perhaps a sole and a heel. If you then wish to, you can mentally focus in on a toe and "see" bones and joints inside it, as well as the toenail on top and the toeprint on the bottom. And then, if you wish, you can mentally focus in on the toenail, and so it goes.

So far, our discussion might suggest that concepts are structured according to the physical parts that make them up, with unpacking always moving towards smaller and smaller pieces. Of course, that wouldn't make sense for concepts of events or other sorts of abstractions, but even when a concept is of something physical, this needn't be the case. We'll now give an example that makes this very clear; it is the contemporary concept of a *hub* for a given airline. We chose this concept because the word "hub" is monosyllabic, just three letters long, and sounds very down-to-earth, at the opposite end of the spectrum from fancy technical concepts like *photon*, *ketone*, *entropy*, *mitochondrion*, *autocatalysis*, or *diffeomorphism*. And yet when one looks "inside" this concept, one finds that it, too, is complex — indeed, it has much in common with technical terms. To be concrete, what comes to your mind if we say, "Denver is a hub for Frontier Airlines"? Most people will picture in their mind a map of the United States, with a set of black lines radiating into (or out of) a dot representing Denver, as is shown below.
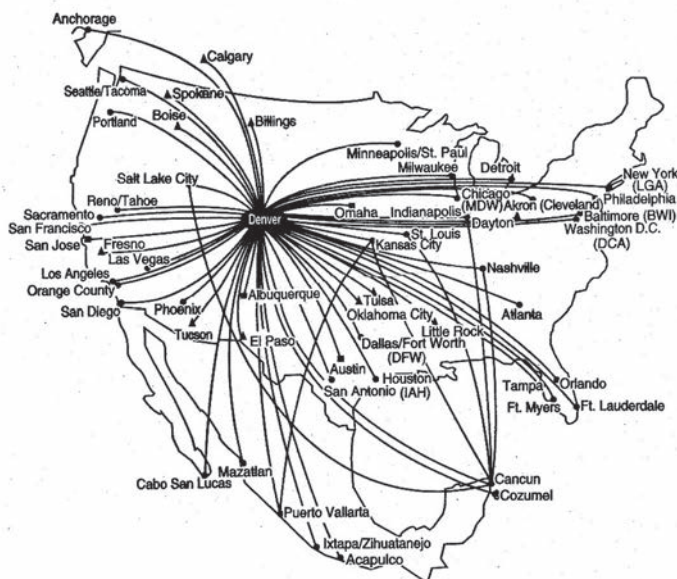
Perhaps they will also think, "Most of Frontier's flights go in and out of Denver", or else "Lots of Frontier planes and gates are found at the Denver airport". This small set of "highest peaks" (*i.e.*, most salient facts) is pretty much all that one needs in most cases where a hub is being talked about. But in fact it leaves out nearly all of what makes up the concept *hub*, and of which most adults in our culture are perfectly aware. The stipulation "in our culture" is crucial, because hundreds of concepts that we take for granted are not part of other cultures or eras. For instance, imagine trying to explain the concept of *hub* to Johann Sebastian Bach, or to Joan of Arc, or to Archimedes, or to Nebuchadnezzar. These were all remarkable individuals in their respective cultures — but how would you go about trying to get across this "simple" concept to any one of them? It would be a rather long story.

To begin with, the word "hub" is the name of a very concrete, visual concept that we learn when we first ride a bicycle and we see the many spokes radiating out of (or into) the wheel's center — its hub. Indeed, it's because of wheels with spokes that airline hubs sport the name "hub", and the concept of *bicycle wheel* is certainly more "primitive" or "elementary" than is that of *airline hub*, not only being learned far earlier in life but also being far simpler to grasp. Let's list some other concepts that are more primitive than *hub* and that are likewise prerequisites to it. There's *airline*, for instance, and *route* and *schedule* and *route map*. And in order to understand the concept of *airline*, you first have to be familiar with the concepts of *airplane* and *company*. And the concept of *route* depends on the concepts of *starting point*, *destination*, *leg*, and *connection*. We won't go on forever, but let's not forget that the *raison d'être* of hubs is economic efficiency — the relentless pressure to cut costs and to reduce the number of different flights — and thus one has to know about the concepts of *trade*, *gain*, *loss*, *profits*, *competition*…

We have only scratched the surface of what goes into the concept *hub*. All of those ingredients are "in there", and they could all, if and when the need arose, be unpacked and revealed. Such unpackings carry one back towards more and more basic, elementary notions — concepts involving motion, vehicles, roundness, acquisition, trading, winning and losing, large and small numbers, and on and on. And note that none of what we have so far spoken of has anything to do with the fact that airports are associated with large cities, or that airports are more than just black dots on maps — indeed, we completely skipped the internal *physical* structure of an airport, with its runways, tarmacs, concourses, gates, jetways, food courts, etc.

The image we've just given of a chain of concepts that depend on other concepts, moving ever downwards in complexity, is reminiscent of the nesting of Russian dolls, and might give the impression that concepts are in fact structured in this boxlike fashion. In truth, however, the phenomenon of concept-building is much subtler and more fluid than that. Concepts are not like nested boxes, with any given concept being rigidly defined in terms of a precise set of previously-acquired concepts, and with concepts always being acquired in a fixed order. Instead, when new concepts are acquired, their arrival often exerts a major impact upon the "more primitive" concepts on which they are based, a bit as if the construction of a house affected the very nature of the bricks with which it was built. Although houses that modify the nature of the

bricks of which they are made do not exactly grow on trees, we are all nonetheless familiar with this basic idea, since, for example, children are dependent upon parents in order to exist, but at the same time their existence radically transforms the lives of their parents.

This is true also for concepts. Thus the concept of *hub* depends, without any doubt, on many others, such as *airport*, but at the same time, the concept of *airport* is itself modified by the concept of *hub*. For instance, familiarity with the *hub* idea inevitably brings out the fact that airports are entities that can help airlines to become more streamlined and thus to save money; this notion is certainly not the most obvious fact about airports. Similarly, recalling that airports tend to be transit areas for travelers somewhat reduces the saliency of airports as final destinations. Even if such effects do not cause radical modifications of the concept *airport*, they are undeniably real and demonstrate that the original concept doesn't remain unaffected by the newer one. One can imagine more radical effects of the *hub* concept on that of *airport*, such as novel kinds of architecture aimed at optimizing the design of airports to function as hubs, or the design of new kinds of airport shopping malls specially designed to serve passengers who are making rapid plane-changes and who have only twenty or thirty minutes. And the existence of hubs can change the seemingly obvious correlation between city size and airport size; that is, with hubs, it becomes perfectly conceivable for a relatively small city (such as Charlotte, North Carolina) to have an airport with an enormous volume of air traffic but very few passengers who actually disembark there. We thus see that although there cannot be a "child" concept of *hub* without the prior "parent" concept of *airport*, the child nonetheless changes the identity of the parent.

There are countless examples of this general sort. It happens particularly often in science, where a new idea depends intrinsically on previous ones, but at the same time it casts the old ones in a fresh new light, and often a deeper light. For example, non-Euclidean geometry not only came historically out of Euclidean geometry, but it also allowed a much deeper understanding of Euclidean geometry to emerge. In physics, much the same could be said for relativistic mechanics and quantum mechanics, both of which are "children" of classical mechanics, and together have yielded a far deeper understanding of it.

The same is true for concepts in everyday life. Thus, the relatively new notions of *surrogate mother*, *adoptive mother*, and *single mother* all come out of the concept of *mother*, as does that of a homosexual couple that adopt a child, and each of these new notions modifies the concept of *mother*, showing how a mother need not give birth to a child, need not raise a child, need not be part of a couple, and may even not be a female. In like manner, the concept of *divorce* depends on that of *marriage*, and yet it also has reverse effects on the nature of *marriage* itself (think, for instance, of the effect of prenuptial contracts, and of the fact that today everyone knows, when going into a marriage, that half of all marriages finish in divorce). The notion of *homosexual marriage* clearly depends on the prior concept of *marriage*, and the intensity of the debate over homosexual marriage is in large part due to the fact that opponents claim that the idea not only extends the concept of *marriage* but in fact does the concept serious harm. The concept

of *death* both depends on and modifies the concept of *life*. The concept of *fast food* both depends on and modifies the concept of *restaurant*. The concept of *credit card* both depends on and modifies the concept of *money*. The concept of *cell phone* depends on and changes that of *phone*. The concept of *traffic accident* depends on and changes that of *car*. The concept of *airplane* depends on and changes that of *distance*. The concept of *recycling* depends on and changes the concept of *garbage*. The concepts of *rape*, *slavery*, *genocide*, *serial killer*, and others not only depend on but change that of *human being*.

Although the repertoire of human concepts is in a sense hierarchical, in that some concepts are prerequisites to other ones, thus implying a rough temporal order in which various concepts generally are acquired, it is nonetheless extremely different in nature from the precise and rigid way that concepts are built up systematically and strictly hierarchically in mathematics or computer science. In the latter contexts, formal definitions are introduced that make each new concept depend explicitly and in an ironclad fashion on a well-defined set of prior concepts. Ordinary concepts have none of this rigidity or precise dependence. True, a person probably needs some familiarity with such concepts as *wheel*, *spoke*, *takeoff*, *landing*, *leg of a trip*, *jetway*, *concourse*, and *transit area*, for instance, before they can acquire the concept of *hub*, but it's by no means clear what precise role such concepts play in any specific person's notion of what a hub is, nor how deeply such concepts have to have been internalized by someone who feels perfectly comfortable with the sentence "Denver is a hub for Frontier Airlines."

Over the course of our lives, we humans build up concept after concept after concept. This process continues incessantly until we die. This is not the case for many animals, whose conceptual repertoires seem fixed from an early age, and in some cases very limited (think of the conceptual inventory of a frog or a cockroach). And each new concept depends on a number (often very large, as we've just seen in the case of *hub*) of previously existent concepts. But each of those old concepts depended, in its turn, on previous and more primitive concepts. The regress all the way back to babyhood is an extremely long one, indeed. And as we stated earlier, this buildup of concepts over time does not in any way establish a strict and rigid hierarchy. The dependencies are blurry and shaded rather than precise, and there is no strict sense of "higher" or "lower" in the hierarchy, since, as we've shown, dependencies can be reciprocal. New concepts transform the concepts that existed prior to them and that enabled them to come into being; in this way, newer concepts are incorporated inside their "parents", as well as the reverse. Moreover, this continual process of conceptual chunking goes hand in hand with a continual process of conceptual refinement.

Classical Concepts

Until quite recently, philosophers believed that the physical world was divided into natural categories — that is, that each and every thing, by its very nature, belonged eternally to an objective category. These philosophers focused primarily on categories such as *bird*, *table*, *planet*, and so on, whose members were visible entities. In part as a result of these conjectures from long ago, there remains a tendency, even among most

contemporary thinkers, to link the notion of *category* with the idea of classifying physical objects, especially objects that we can perceive visually. The idea that situations of someone being *nursed* back to health, for example, or situations of *hoping* for an outcome or of *changing one's mind*, might constitute categories with just as much legitimacy as *table* or *bird* was far from such philosophers' beliefs, let alone the even further-out idea that words such as "and", "but", "so", "nevertheless", "probably" (and so forth) are the names of important categories. If you find it difficult to imagine that a word like "but", which seems so general and perhaps even bland, denotes a category, don't worry; we will come soon enough to this matter, but for the time being we would like to make some observations on the more classical types of categories, since over the millennia certain ideas have become so entrenched in our culture that it is very difficult to overcome them and to start afresh down new pathways. It will thus be helpful for us to make some elementary observations that will paint a picture of concepts that is markedly different from the classical one.

We might begin by asking what a bird is. According to classical philosophers, whose view went essentially unchallenged in philosophy for centuries, until the studies of philosopher Ludwig Wittgenstein, published in the 1950's, and which also reigned supreme in psychology until the pioneering research of Eleanor Rosch two decades later, the category *bird* should have a precise definition consisting of necessary and sufficient conditions for an entity's membership in the category, such as "possesses two feet", "has skin covered with feathers", "has a beak", "lays eggs". (Obviously one could add further or more refined membership criteria for the category *bird*; these few simply constitute a gesture towards the idea.) The set of membership criteria (the defining properties) is said to be the *intension* of the category, while the set of actual entities that meet the criteria (the *members*) is said to be the *extension* of the category. The notions of intension and extension, borrowed from mathematical logic, are thought of as being just as precise and rigorous as that discipline itself, and the use of these terms reveals the ardent desire to render crystal-clear that which at first seems utterly elusive — namely, the abstract essence of all the highly variegated objects that surround us.

A source of problems, however, is the fact that the words used to express the membership criteria are not any more precise than the concept that one is trying to pin down — in this case, *bird*. What, for instance, is a *foot*? And what does "to possess" mean? What does "covered with" mean? And of course, everyone knows that there are all sorts of birds that don't have two feet (perhaps because of an injury or a genetic defect) or that are not covered with feathers (ducklings and chicks, for example). And turning things around, we human beings have two feet, but if we hold a spray of feathers in our hand, this "possession" does not suffice to turn us into birds. And the famous *plume de ma tante* — my ancient aunt's quill pen, which she loved to use to make beautiful calligraphy — would that count as a feather? And if so, would possession thereof make my bipedal old aunt a bird?

At times one gets the impression that the actual goal of ancient philosophers was not to classify specific entities from the material world, such as individual birds, whose variety is bewildering, but rather to characterize the relationships that hold between

generic, immaterial abstractions, such as the categories *bee*, *bat*, *egg*, *chick*, *ostrich*, *pigeon*, *dragonfly*, *swallow*, *flying fish*, and so forth. If this is one's goal, then the crucial question would be "Which of these *classes* of entities are birds?" It's clear that one has moved far from the specific and concrete, and has replaced it by an intellectual activity where everything is generic and abstract. This rarefied universe of Platonic concepts, since it lacks annoying exceptions like the plucked or the injured bird, not to mention the old aunt who keeps a quill in her drawer, might appear to be as pure, immutable, and objective as the universes of Euclidean geometry or chess, and this could suggest that in this universe there are a vast number of eternal verities lying in wait to be discovered, much like theorems in geometry. But appearances are deceptive. Even if one considers only abstract categories and pays no attention to their annoyingly problematic instances, one still faces enormous obstacles.

Would a chick's lack of plumage make it lose its membership in the category *bird*? That seems unlikely. Or is there a specific instant, for each chick, when it passes over from the category *chick* to that of *bird*? Would that switchover in status take place at the instant when its skin becomes "covered" with feathers? How many feathers does it take for a chick to be "covered" with them? Or what percentage of the skin's area must be covered for it to count as "covered"? And how does one measure the surface area of a chick, if that is needed in order to decide if we are dealing with a bird or not?

The closer one looks, the more such questions one will find, and the more they are going to seem absurd. And we have only scratched the surface of the issues. Consider the generic idea of a bird that has just died. Is it still a bird? And if so, for how long will this entity remain a member of the category *bird*? Will there be a sharp transitional moment at which the category membership no longer obtains? And let's go backwards in time by a few million years. Where is the boundary line between birds and their predecessors (certain flying dinosaurs)? And to push matters in yet another direction, what about questions such as, "Is a plucked chicken still a bird?" The moment one has created the expression "plucked chicken", the question we posed becomes a legitimate question in the hypothetical formal algebra that governs abstract categories. And with this, we have opened a Pandora's box of questions: "Is a robin whose feet have been cut off still a bird?" (since the first noun phrase is the valid name of a category of entities), or "Is a snake onto which one has grafted some feathers and two eagle's feet a bird?", and so on, without any end in sight.

Even without imagining such radical transformations, one can ask whether sandals are *shoes*, whether olives are *fruits*, whether Big Ben is a *clock*, whether a stereo set is a *piece of furniture*, whether a calendar hanging on one's wall is a *book*, whether a wig is an *article of clothing*, and so forth. People turn out to have highly divided opinions on such questions. In an experiment conducted by the psychologist James Hampton, sinks turned out to be just barely included in the category *kitchen utensils*, while sponges were just barely excluded. Since these close calls are the result of averaging over many subjects in a large experiment, one might imagine that if one were to ask individuals instead, one would find clear-cut and fixed boundaries for each person (even if they would vary from individual to individual). However, even that idea, which runs

considerably against the idea of Platonic concepts (which are supposed to be objective, not subjective), turns out to be quite wrong. Many people change their mind if they are asked whether pillows and night-table lamps are articles of furniture and then are asked the same question a few days later. Are these individuals suffering from a pathological state of permanent vacillation, never able to make up their mind about anything? It seems more likely that they are quite ordinary individuals whose categories simply grow blurry toward their edges; if these people were asked about more typical cases, such as whether dogs are *animals*, they would be extremely stable in their judgments about category membership.

Anyone who has taken an interest in the letters of the alphabet will have savored the dazzling richness of a "simple" category like the letter "A", whether capital or small. What geometric shapes belong to the category "A", and what shapes do not? All that one needs to do is take a look at a few handwritten postcards or a collection of typefaces employed in advertising, or for that matter, the figure in the Prologue, in order to see why the boundaries of the twenty-six categories *a*, *b*, *c*, *d*, and so on are impossible to specify exactly. And, to be sure, what holds for the letters of the alphabet holds just as much for other familiar categories, such as *bird*, *bill*, *boss*, *box*, and *brag*.

Summing up, then, the ancient hope of making the categories describing physical objects in the world into precise and rigorous theoretical entities is a vain hope. Such categories are as fleeting and elusive, as blurry and as vague, as clouds. Where are the boundaries of a cloud? How many clouds are there in the sky today? Sometimes, when looking at the sky, one has the impression that such questions have clear and exact answers, and perhaps that's the case on some particular day; however, the next day, the sky will have a radically more complex appearance, and the idea of applying such notions to it as *how many* and *boundary* will simply be a source of smiles.

Concepts Seen in a More Contemporary Fashion

Since the classical view of categories is now generally perceived as a dead end, some contemporary psychologists have tackled the challenge of making the very blurriness and vagueness of categories into a precise science. That is, their goal is to explore those mental nebulas that are our concepts. This has led them to formulating theories of categorization that reject the role of precise membership criteria and instead invoke either the notion of a *prototype* (a generic mental entity found in long-term memory, which summarizes all one's life's experiences with the given category) or else the notion of *the complete set of exemplars* of the given category that one has encountered over one's lifetime. Another influential view involves stored "mental simulators" of experiences one has undergone, which, in response to a fresh stimulus, reactivate certain regions of the brain that were once stimulated by the closest experiences to the current stimulus.

Behind all these efforts lies the appealing idea of non-homogeneous categories — that is, categories having stronger and weaker members — which amounts to distinguishing between more central and less central members. For example, if one times the responses of experimental subjects when they are asked questions of the form

"Is an X a Y?", or if one asks them to write down a list of members of a certain category, or if one gives them a list and asks them to indicate, for each item, its degree of typicality as a member of a specific category, one finds that some very striking trends emerge, and these trends turn out to be stable across all these different ways of testing. Certain members of the category turn out to belong *more* to the given category than others do (recalling how some animals in Orwell's *Animal Farm* were "more equal" than others). For instance, ostriches and penguins turn out to lie close to the outer fringes of the category *bird*, whereas sparrows and pigeons are near its core.

This phenomenon can affect the difficulty one has in understanding a sentence inside a passage that one has been asked to read. Thus, it turns out that the time taken to read and understand a sentence such as "The bird was now just a few yards away" depends on whether, earlier in the passage, there was a reference to an ostrich (an atypical bird) or to a pigeon (a typical bird), in preparatory sentences such as "The ostrich was approaching" or "The pigeon was approaching". The link in memory between *ostrich* and *bird* turns out to be less strong than that between *pigeon* and *bird*, and this tends to impair the understanding of the passage in the first case.

It's important to point out that categorization goes well beyond the intellectual realm of connections among words, which is to say, the names of various categories (such as "sparrow", "ostrich", and "bird"). If, for example, someone were to ask Eleanor "Is a spider an insect?", she might well reply, on the basis of her knowledge from books, "No", and yet if she were to espy a dark blob hanging from the ceiling of her bedroom, it is likely that she would cry out, "Yikes! Get it out of here! I hate insects in my room — they're scary!" If someone were to object to her word choice, Eleanor would say that she knows very well that the "insect" was in fact not an insect but a spider.

Generally speaking, context has a great influence on categorization. The spider in this anecdote was seen as an *insect* in the bedroom, but it would not have been seen as such in the context of a biology test, for instance. And much the same holds in general: a single item in the world belongs to thousands of categories, which can be extremely different from each other, and a good fraction of our mental life consists in placing entities in one category and then in reassigning them to another category. During a basketball game, everyone is aware of the fact that basketballs roll, but it has been experimentally shown that only situations that involve water (such as the loading of a bunch of basketballs on board a ship) evoke the notion that basketballs float.

Context thus changes categorization and can modify how we perceive even the most familiar of items. For example, an object can slip in the blink of an eye from the category *chair* to that of *stool* when a light bulb has just burned out and one needs something to stand on in order to change it. Usually one is unaware of these category shifts because one is mentally immersed in a specific context and such shifts are carried out in a totally unconscious manner. In a given context, just one categorization seems possible to most people. Their lack of awareness of the contextual blinders that they are wearing reinforces the widespread belief in a world in which every object belongs to one and only one Platonic category — its "true" category.

On the other hand, one cannot help but recognize how complex category membership is if one considers the fact that a single entity can easily belong to many diverse categories, such as, for instance:

60-kilogram mass, mirror-symmetric object, living entity, biped, mammal, primate, mosquito attractor, arachnophobe, human being, forty-something, book-lover, nature-lover, non-compromiser, non-speaker of Portuguese, romantic, Iowan, blood-type A+, possessor of excellent long-distance vision, insomniac, idealist, vegetarian, member of the bar, mother, mother hen, beloved daughter, sister, big sister, little sister, best friend, sworn enemy, blonde, woman, pedestrian, car driver, cyclist, feminist, wife, twice-married woman, divorcée, neighbor, Dalmatian owner, intermediate-level salsa dancer, breast-cancer survivor, parent of a third-grader, parents' representative…

To be sure, this is but a small excerpt from a much longer list one could draw up, a list having essentially no end, and whose entries would all be terms that anyone and everyone would, without any trouble, recognize as designating various categories.

When Ann had to be hospitalized on an emergency basis and a transfusion was needed, her membership in the category *blood-type A+* dominated all her other category memberships, but in a restaurant she is above all a *vegetarian*, while at work she is a *lawyer*, at home a *mother*, in a PTA meeting a *parents' representative*, and so forth. It may seem useless to point out such obvious facts, but such simple observations carry one well outside the realm of classical categories.

When I Imitate Tweety, Am I a Bird?

Let's come back to the one-word category *bird*, which still has some lessons to teach us. Consider the following candidates for membership in the category:

- a bat;
- an airplane;
- a bronze seagull;
- an eagle in a photograph;
- the shadow of a vulture in the sky;
- Tweety the (cartoon-inhabiting) canary;
- an entire avian species, such as *eagle* or *robin*;
- a chick inside an egg two hours before it hatches;
- a flying dinosaur (or rather, a dinosaur that once flew);
- a pigeon on the screen in a showing of Hitchcock's film *The Birds*;
- the song of a nightingale recorded and played back fifty years after it died;
- a rubber-band-powered wing-flapping plastic object that swoops about in the air.

If you are like the vast majority of humans, you probably felt a keen desire to say "yes" or "no" to each of the candidates in the list above, as if you were taking an exam

in school and had to demonstrate the precision of your knowledge, and as if, in each of these cases, there really were a *correct* answer to the question. A sparrow — is it a bird? *Yes!* When you spot a black spot moving unpredictably through the air against a light cloudy background, are you seeing a bird? *Of course!* And when one sees the shadow of a vulture on the ground, is one seeing a bird? *Of course not!* When one hears a loud hooting during the night, is one hearing a bird? *Yes!* And if one hears a recorded hooting (perhaps without being aware that it is recorded)? And what about the case where some person imitates hooting extremely well? And if one dreams about an owl, is there a bird involved? And if one reads a comic book featuring Tweety?

No one ever taught us the boundaries of categories. Our spontaneous sense for their boundaries is an outcome of what we often call "common sense", and no one teaches that in any school. There are no courses on category membership, and even if there were, there would be endless arguments among the students as well as between teachers and students, not to mention the passionate debates that would take place among the teachers themselves. Indeed, expertise doesn't help at all. Here we borrow an anecdote from the psychologist Gregory Murphy, who quoted from a keynote speech once delivered by a world-renowned metallurgist at a conference of world experts in that field: "I'll tell you something. You really don't know what a metal is. And there is a big group of people that don't know what a metal is. Do you know what we call them? *Metallurgists!*"

The recent vehement debates among astronomers over whether Pluto should or should not be deemed a planet (which, as of this writing, it no longer officially is) were due to the blurriness of the concept of *planet*, even in the minds of this planet's greatest specialists, which made the question extremely thorny. For similar reasons, although there is considerable agreement among experts today that it is not correct to refer to our "five senses", since proprioception, thermoception, and nociception (among others) would be left out of such a roll call, there remains a major blur about what our senses really are. Since the experts can't even agree on how many senses we have, let alone on what they all are, they often talk about "our five main senses". And in a similar vein, a standard definition of *life* is still missing, even if biologists, hoping to pin it down for once and for all, are constantly juggling the details of taxonomies that laypersons would have presumed had long ago been cast in concrete. The classification of living organisms has come a long way since Linnæus, and today, many classic terms that he employed in his classification, such as "reptile", "fish", and "algæ", remain present in school texts, but no longer appear in modern phylogenetic classifications. All this goes to show that the blur of categories is not due to some kind of lack of expertise, but is part and parcel of the act of categorization.

How Many Languages do You Speak?

Although psychologists have done a good job in making it clear that no category has precise boundaries, our everyday language and thought are still permeated with residual traces of the classic vision in which category boundaries are as sharp as those of

nations (which, to be sure, are often not all that clear, but we'll leave that matter aside). Our intense human desire to avoid ambiguity, to pinpoint the true and to discard the false, to separate the wheat from the chaff, tends to make us seek and believe in very sharp answers to questions that have none.

For instance, people who enjoy studying foreign languages are frequently asked the question, "How many languages do you speak?" Despite how perfectly natural this question might seem, it is based on the tacit idea that the languages of the world fall into two precise bins: languages that person X *does* speak, and languages that X does *not* speak, as if this were a black-and-white matter. But in fact, for each language one has studied, one speaks it to a different degree, depending on many factors, such as when one first studied it, the context in which one studied it, how long it has been since one spoke it, and so forth. When pressed, the questioner may retreat, saying, "All I meant was, 'How many languages can you have an everyday conversation in?'"

But once again, even if this new question sounds reasonable at first, it's just as blurry. For example, it presumes that the category *everyday conversation* is sharp and well-defined. But it might mean a conversation of two minutes about the cost of postage stamps with someone standing next to one in a line in the post office. Or it might mean a half-hour conversation about one's children and family, or about the World Series, or about the sad state of the world economy, with a stranger sitting next to one in an airplane. Then again, it might mean a three-hour conversation ranging over twenty different random topics with seven other people, all native speakers, seated around the table at a lively dinner party. Most people say they speak a language when they have surpassed a far lower threshold than that, but in any case, the threshold for "speaking a language" is not well-defined.

And indeed, the category *language* is itself very blurry. How many languages are spoken in a polyglot land such as India, China, or Italy? In each case, there are many languages and dialects; moreover, what is the precise distinction between a *dialect* and a *language*? The following humorous observation is often attributed to the linguist Max Weinreich: "A language is a dialect with an army", and there is much truth to it, but it still begs the question; after all, what exactly constitutes an army?

In short, the question "How many languages do you speak?" is not a simple question, and has no simple answer — no more so than do the questions "How many sports do you play?", "How many movies do you love?", "How many soups do you know how to make?", "How many big cities have you lived in?", "How many friends do you have?", or "How many things have you done today?"

The Endless Quest for Creative Metaphors

Psychological studies have shown that a mental category, rather than having well-defined and context-independent boundaries, is more like a vast cosmopolitan area such as Paris, which first sees the light of day as a tiny, almost solid, central core (and which, as time passes, will eventually be baptized the "old town", and which shortly after its birth might well have had walls defining its boundary). The "old town" is the

original core from a historical standpoint, but the core can move over time and today it may contain modern buildings and roads. After all, both metropolises and categories evolve; it's part of their natural developmental process. Both metropolises and categories exhibit a structure that is the result of repeated acts of extension, and in the case of categories, each new extension is due to some perceived analogy. At every moment in the life of a major metropolis or a "mature" category, there is a crucial, central zone that includes, surrounds, and dominates over the original core, and this zone is considered the town's (or category's) essence. Further out, one finds an urban ring that is not as dense or as historically important, and then there comes a vast suburban ring, which extends far out from the center while growing gradually less and less densely populated, and which has no precise outermost boundary. Nonetheless, one has a pretty clear sense for when one has gone beyond the edge of the metropolitan area, since fields filled with wheat and cattle are evidently no longer part of a city.

In our analogy, the suburban sprawl corresponds to the most recent, fresh, novel, creative usages of the word, which still strike us as metaphorical. And yet over time, these usages, if they resonate with native speakers, will become so widespread and bland that after a while no one will hear them as metaphors any longer. This is essentially what happened to yesterday's suburbs, which today strike us as essential parts of the city, so much so that we have great difficulty imagining how the city ever could have been otherwise.

Seldom if ever reflecting on the literal meaning of what we are saying, we casually speak of such things as:

> the *legs* of a table; the *spine* of a book; a *head* of lettuce; the *tongue* spoken by the islanders; the kisses we *give*; the *window* of opportunity for doing something; the *field* one studies; a *marginal* idea; salaries that *fall* within a certain *bracket*; the *moons* of Jupiter; the *voices* in a fugue; a product of *high* quality; someone's inner *fire*; the familial *cocoon*; a heat *wave*; the *bond* of love; a couple that *splits up*; a relationship that is *foundering*; an athlete who is *worn out*; a team that is *beaten*; a *roaring* wind; a light bulb that is *burned out*; anger that *flares up*; a *handful* of acquaintances; a *circle* of friends; the *friends* of Italian cuisine; someone who *moves* in *high circles*; the *tail* of an airplane; the *burners* on an electric stove; a *ton* of good ideas; the *punch line* of a joke; the *tumbling* reputation of a singer; an idea that one *drops*; a name that one *drops*; the *high point* of a melody; the *crest* of a *fabulous* career; a *slimy* politician; a popular *bodice buster*; a *fleabag* of a hotel; a *rotten* government; a *budding* romance; a wine's exquisite *bouquet*; a belly *button*; a worry *wart*; a traffic *jam*; *laundered* money; an idea that's difficult to *grasp*; the subtle *touch* of a novelist; a *box canyon* in which one is *stuck*; the *block* one lives on; one's *neck* of the woods; a *stream* of insults; the *bed* of a river; the *arrow* of time; an *umbrella* policy; a *haunting* melody; a *skeleton* key…

and of course we could go on forever. The halo of a word gradually moves outwards or, rather, the blurry boundaries of the concept named by a word gradually engulf what were once metaphorical swamps and forests and turn them into apartment buildings, parks, and shopping malls.

Linguist George Lakoff and philosopher Mark Johnson have shown that there are certain systematic tendencies that guide the construction of a number of metaphors in everyday language. Their studies, along with related studies by other researchers, have helped to demonstrate that metaphors, far from being just an elegant rhetorical flourish exploited solely by poets and orators, are the coin of the realm in much of ordinary discourse. For example, time is often characterized linguistically in terms of physical space (*in* three weeks; *at* four o'clock; a *distant* era; the *near* future; *from* now on; a tradition that *goes back* to the seventeenth century), and conversely, space is often represented in terms of time (the first street *after* the traffic light; the road changes name *when* it crosses the river; a star twelve *light-years* distant). Likewise, life is often spoken of in terms of motion or a trip (the *path* of her success; a *sinuous* career; the *dead end* in which they're trapped), with everyday events as places one passes through (I'm *going* to see them tomorrow; I'll *come back* to that point), and happiness and unhappiness are often represented by the concepts of high and low (*raising* someone's morale; to be in *seventh heaven*; to *plunge* into despair; to be very *down*). Abstract notions are often conveyed through comparisons to familiar human activities (her experiment *gave birth* to a new theory; the facts *speak for themselves*; fate *played dirty tricks* on me; life was *cruel* to her; a religion *dictates* certain behaviors; his fatigue *caught up* with him). Complex situations are often cast in terms of a metaphorical fight with a metaphorical adversary (the recession is our *enemy*; our economy has been *weakened* by inflation; corruption must be *fought*; outsourcing *kills* growth; we are *victims* of the stock-market crash; we have *declared war* on the economic crisis; we have *won a battle* against unemployment, etc.). Systematic families of metaphors such as these abound in human languages and they explain, at least in part, the great richness inherent in even our most casual and informal speech.

On the other hand, thousands of words are used metaphorically without belonging to any systematic family of metaphors. Here is a small set of examples:

> they're all *fruitcakes*; you're *nuts*; it's *Greek* to me; while wearing her parental *hat*; he *punted* on the term paper; what a *mousy* person; *watertight* reasoning; today was another *roller-coaster* for the stock market; he *snowed* the committee; my engine is *coughing*; an old *salt*; a *spineless* senator; the company *folded*; a *bubbly* personality; they *creamed* the other team; let the wine *breathe*; to *dress* the salad; a rule of *thumb*; I was such a *chicken*; a *cool* idea; nerves of *steel*; pass the *acid* test; in *round* figures; she's so *square*; you're getting *warmer*; *yellow* journalism; what a *drag*; he just didn't *dig*; *cloverleaf* exchange; *hairpin* turn; make a *hit*; no *soap*; she's really *wired* today; he *swallowed* her story; the old man finally *croaked*; she *drove* me crazy; *carpet* bombing; an *umbrella* clause; a *blanket* excuse; we just *nosed* them out; a *straw* vote; a *blue* mood; we always *horse* around; his *gravelly* voice; they *railroaded* us…

and on and on.

Calling someone "butterfingers", for instance, does not belong to any large, overarching system of metaphors, but the image is very easy to relate to, since butter is slick and slippery, and thus, one imagines, a person whose fingers were covered with butter (or even were *made* of butter) would be completely unable to catch a ball or hold

onto anything at all. Therefore, someone who often drops balls that are thrown to them can be easily found in the (metaphorical) halo of the concept of *buttery fingers*. In summary, we often come up with a label for a complex situation by finding a more familiar concrete situation to which it is analogically linked, and then borrowing the standard name of the concrete situation. Such a strategy allows us to create a useful verbal label for a new category of situations.

The act of "metaphorization", whether it is broad and systematic, like the set of metaphors portraying life as a voyage, or narrow and one-of-a-kind, like "butterfingers" and the other phrases cited in the display above, is a crucial aspect of the way in which we naturally extend our categories. The human mind is forever seeking novelty, and it would never be satisfied with a limited and fixed set of metaphors. One might say that human nature is characterized by a constant, intense drive to go beyond all conventional metaphors, which are often labeled "dead metaphors", since when a metaphor is used enough, one no longer hears the original imagery behind it and it loses all its sparkle. Categories are extended successively via metaphors that at first are used over and over again in a vivid, evocative fashion, but then, like dough that first needs to settle before rising, they gradually congeal and become inert, and this very fact sparks a quest for a new extension. Each time a metaphor loses its punch, we push the boundaries further out with new metaphors, always with the goal of understanding more directly and intensely what surrounds us, of adjusting to change, and of adding piquancy and novelty to the way we see familiar things.

Concerning the Literal and the Metaphorical

It might seem tempting to establish precise boundaries for each category, just as we do for cities, and to declare that anything that is found outside of those boundaries is not a member, end of story. In order to retain some flexibility, however, one could grant the title of "honorary member" to certain non-members, as long as they were found within a certain distance of the category's *official* boundaries; in such specially sanctioned cases, one would put the category's name in quotes to indicate that this would be an *official* metaphorical usage. In such a world, then, if someone said, "Ella has a large circle of friends", it could mean only one thing — namely, that Ella's friends were neatly arranged in a big closed curve having a fixed radius; to indicate otherwise, one would have to say, "Ella has a large 'circle' of friends", and in order that one's listeners would realize that the term was not being used literally, one would have to wag one's fingers in a quote-marky fashion or else say, "so to speak" or "quote unquote" or "metaphorically speaking" or something of the sort.

In a world where this linguistic convention held sway, Galileo would not have seen the moons of Jupiter but the "Moons", quote unquote, of Jupiter. And no one would ever come home to the cocoon of their family (since the expression would make no sense, unless the family had acquired one prized cocoon, but even then it would be far too small for a human to fit into) but *so to speak* to the cocoon of their family, or to the *metaphorical* cocoon of their family. One would no longer *give* kisses, but one could

metaphorically give a kiss to someone or *so to speak* give a kiss to someone. One would never be *under pressure*, but quote-unquote under pressure, and as for the so-called pressure, it too would have to be in quotes, unless one were a diver thirty meters below the surface of the sea. And so on and so forth, without end.

Unfortunately, such a solution would give rise to more problems than it would solve. Firstly, those "precise boundaries of categories" — even of the most common categories — are nonexistent, as we've shown. And secondly, even were we to imagine that categories could be precisely defined, the problem of identifying their so-called "honorary members" would not be solved. Earlier we suggested that some entity located outside the border of a concept would be granted this title provided it were "sufficiently near" the boundary line — but what is the nature of this conceptual distance that would allow us to measure proximity precisely? What kind of yardstick would we use to measure distances? And would there be precise outer limits for the use of quote marks, beyond which even "quote unquote" would not apply? And would all of this be taught to children in courses on categorization and quotation-mark usage?

We could of course imagine introducing second-order quotation marks, which would be used to name entities found in a ring yet further out from the concept's core than the first-order quote-mark ring. One's fingers would soon become indispensable aids to one's mouth in communicating these subtle distinctions. Among the most frequent words and phrases would be "so-called", "in quotes", "so to speak", "metaphorically", and others. In addition, there would be a whole system for expressing the number of quotation marks needed — second-order, third-order, and so on — in other words, oral or manual "roadsigns" telling the distance to the center of the "city". It's "pretty" clear that this "'straitjacket'" would soon "give" "'"royal"'" "'headaches'" to anyone who "wore" it, metaphorically "speaking".

The Categorization/Analogy Continuum

The idea of courses to teach people how to categorize and how to use quotation marks to indicate metaphorical uses of terms seems ridiculous, and for good reason. It's like imagining that in elementary school we should teach children how to walk, eat, and breathe. The reason we don't do that is that our bodies were fashioned by evolution to do such things, and it makes no sense to teach a body what it was designed by nature to do. The same can be said about our brains, which evolved as powerful machines for categorization as well as for quotation-mark deployment. But there is no sharp boundary between pure categorization and quotation-mark deployment, for all the reasons just given. A category has an ancient core, some commercial zones, some residential zones, an outer ring, and then suburbs that slowly and imperceptibly shade off into countryside. It's tempting to say that perceiving something as a member of the "old town" or "downtown" is an act of "pure" categorization, while seeing something as belonging to the outer ring or the suburbs involves a certain amount of quotation-mark deployment — but a bit of thought shows that one passes smoothly and continuously from a concept's core to its fringes, and there are no clean and clear

demarcation lines anywhere. All these concentric layers making up a category in its full glory are the result of a spectrum of analogies of different types, collectively made by millions of people over a period ranging from dozens to thousands of years. These analogies form a seamless continuum; they range from the simplest and easiest to make, giving rise to the concept's core (so simple and natural that they are not even seen as analogies by an untrained observer), to more interesting and lively ones, giving rise to the suburbs, and finishing up with extremely far-fetched and unconvincing analogies, giving rise to the remote countryside (that is, objects or situations that hardly anyone would consider as belonging to the category in any sense).

Verbs as Names of Categories

More than once in this chapter we have stated that what holds for nouns, such as "desk", "elephant", "tree", "car", "part", "idea", and "depth", holds just as much for other parts of speech. We already broached this topic in our discussion of some of the charming verb choices such as "nurse the truck" and "patch people's teeth", made by children whose categories *to nurse* and *to patch* didn't coincide totally with those of adults. We'll now go into this idea in greater detail.

It's not so hard to move from nouns to verbs, firstly because many verbs are tightly associated with certain nouns, and vice versa. To start with an obvious example, anyone who can recognize *rain* falling on the ground can also recognize that *it is raining*. The same holds for the category associated with the noun "snow" and the category associated with the verb "to snow"; ditto for "hail" and "to hail". We move effortlessly back and forth between noun and verb, because the words are identical. But even in cases where there is no phonetic resemblance between noun and verb, there are countless cases where the evocation of a particular verb goes hand in hand with the evocation of a particular noun. When you see a dog and hear it make a sudden loud noise, you are simultaneously perceiving a member of the category *dog* and a member of the category of situations where *something is barking*. In much the same manner, given that mouths eat, drink, and speak, we all perceive, many times per day, members of the categories of situations where *something is eating*, *something is drinking*, and *something is speaking*. In the same vein, the sun *rises* and *shines*, eyes *look* and *see*, birds *fly* and *chirp*, cyclists *ride* and *pedal*, leaves *tremble* and *fall*, and so forth.

Our insistence on the idea that verbs, no less than nouns, are the labels of categories might seem to be merely a fine point of philosophy without any consequence. However, we are insisting on it because the same perceptual mechanisms that allow us to recognize pumpkins, pastries, plows, and pigs also allow us to recognize situations where some marketing, menacing, meowing, or mutating is going on. Once one has had enough experience with situations where menacing is going on, one is able to recognize members of this category, to label them as such, to talk about them with one's friends, to report them to the appropriate authorities, to describe them if called on as a witness in a court, and so forth. One even learns to recognize, from long observation of how people drive their cars, situations where someone is driving in a menacing fashion,

occasionally through hearing just a certain telltale squealing of tires. The fact that the verb "to menace" automatically bubbles up to our conscious mind in such situations is in no way different from the fact that a certain noun bubbles up when we look at a canary, a doorknob, or a pair of pants. These evocations of words are the result of categorization. In the case of verbs just as much as that of nouns, the effortless bubbling-up of a word occurs as a result of a vast number of prior experiences with members of the category in question.

If at first glance the collection of all the members of the category *to nurse* seems vaguer and less "real", somehow, than the collection of all members of the category *bridge*, that's simply a prejudice and an illusion. The bridges of the world are not given to us without effort and without blur. Even if all the existing bridges could oblige us by simultaneously lighting up in response to a button-push, there would still be all the bridges from ancient Roman times, ancient Chinese dynasties, and so forth, which have long since disappeared, not to mention all the bridges that are yet to be constructed during this century and all centuries yet to come. And of course, we haven't even touched on the fictitious bridges seen in paintings and films and described in novels. And what about the miniature bridges built by children out of wooden blocks? Or tree trunks fallen over creeks? Or "jetways" (those tunnels on wheels that link an airplane with a gate)? And then there are bridges (or do they count as such? — that's the question) built by ants, for ants, and made out of ants! And what about a toothpick casually placed between two plates, affording a shortcut for a wandering ant? What to say about bridges inside one's mouth, bridges built between distant cultures, bridges between distant ideas? A moment's thought shows that the category *bridge* is highly elusive. At this point, one might even wonder if situations that deserve the slightly abstract verbs "to nurse", "to menace", and "come on!" aren't rather straightforward in comparison with situations that deserve the visual noun "bridge".

Much Ado about *Much*

Let's move on now to such an everyday word so mundane that most people would never think of it as the name of a category or concept. Namely, we'll focus on the word "much". What is the nature of situations that cause this word to spring to one's lips? What do they all have in common? In short, what is this *much* category? Let's take a close look at some examples of this abstraction.

> That's much too little for him. That's a bit too much for me. Much less than that, please. Much the same as the last time. Don't go to too much trouble. How much will that be? Much obliged. I'd always wanted it so much. It's not much, but it's home. I'm very much in agreement with you. Much though I wish I could… Much of the time it doesn't work. Your hint very much helped me. Just as much legitimacy as her rival had. Moths are much like butterflies. As much as I'd like to believe you… So much so that we ran into trouble. She got much the better of him. It didn't do us much good. Her florid writing style is just too much!

What is the shared essence of *much* situations? A *much* situation involves an opposition (usually unconscious) to an imaginary *some* or *somewhat* situation; in other words, a *much* situation involves a mental comparison in which a particular mental knob is "turned up" relative to a milder, more common situation. For example, "I wanted it so much" can only be understood by means of a fleeting comparison with a hypothetical scenario in which the speaker's desire is less intense. In short, the word "much" is evoked in the mind of English speakers when they want to describe an unexpectedly large quantity or large degree of something, whether it's concrete ("too much peanut butter", "not very much air") or not concrete ("much to my displeasure", "much more prestige than it deserves"). As for listeners, when they hear the word used, they understand this intention on the part of the speaker, and consequently, in their heads they turn up a small mental knob in order to reflect the speaker's apparent desire to intensify some part of speech, or even to intensify a phrase or clause.

A *much* situation is thus a situation that resides partly in the objective, outside world and partly in the subjective, inner world of one's expectations about the nature of the outer world. In order to recognize a *much* situation as such, you have to be concentrating not only on something in the world "out there" (such as the amount of soup you're being dished up by someone), or on some internal situation (like being hungry or sleepy), but also on your own expectations in such a situation, or on a typical person's expectations. The exclamation "Hey, they sure didn't give me much soup!" means that, in comparison with one's expectations of the amount of soup typically served in restaurants, this serving is on the low end of the spectrum.

If a speaker didn't feel that some milder contrasting scenario needed to be hinted at (at least subliminally), the word "much" wouldn't pop to mind. "Too much peanut butter", when spoken in a given situation, is aimed at evoking in listeners a hypothetical contrasting situation where the *right* amount of peanut butter was used. It's in this contrast that the phrase's meaning resides. Likewise, "Thank you very much!" is aimed at evoking in a listener, in a subtle fashion, the idea that the speaker *could* have voiced a less ebullient sentiment; it is therefore heard as a desire to convey gratitude more intensely than some other people might do in the same situation, or more intensely than the same speaker might do in a different situation or in a different mood.

We have seen that *much* situations concern the disparity between the external world and an ideal inner world filled to the brim with expectations and norms. Just as one can hope (though always vainly) to pin down what the essence of the category *bird* is, so here we've tried, with the aid of extremely blurry words, at least to hint at what the essence of the category *much* is.

Grammatical Patterns as Defining Mental Categories

As the above list of examples shows, when one is talking, there are certain ready-made syntactic slots into which the word "much" fits very neatly and there fulfills its function. In fact, these syntactic slots themselves constitute another facet of the nature of the word "much". As we grow up and go to school, we encounter the word "much"

many thousands of times, and if certain spots where that word sits among other words strike us, on first hearing, as a bit surprising, after a while they become more familiar, then turn into a habit, and in the end they wind up being a reflex that is completely unconsciously integrated into us. Ways of placing the word "much" that at the outset seemed odd and unnatural gradually become so familiar that in the end one no longer sees what could at first have seemed puzzling or confusing about them.

Why do we say "I much appreciate all you've done for me" but not "I appreciate much all you've done for me?" Why do we say "I don't go out much" and sometimes "I don't much go out" but never "I much don't go out"? Why "I'm much in agreement with her" but not "I'm much out of contact with her"? Why "much the same" but not "much the different" or "much the other"? Why "I'm much obliged" but not "I'm much grateful"? Why "much though I'd like to join you" but not "very much though I'd like to join you" or "much although I'd like to join you"? Why is "Many thanks" as common as daisies while "Much thanks" is as rare as orchids? Or is it? A quick Google search revealed a ratio of 200 to 1 in favor of "Many thanks to my friends" as compared to "Much thanks to my friends" — but the fact that the latter exists at all suggests that things might be changing. Here we find ourselves face to face with the blurry and moving contours of the category *appropriate syntactic slots for the word "much"*. Who knows what the just-mentioned ratio will be in five years, ten years, or fifty? Native speakers seldom ask themselves these kinds of questions about word usages, because the patterns are deep parts of their very fiber.

What all this means is that the category *much* — that is, roughly speaking, the full range of situations that evoke the word "much" and a feeling of "muchness" — is a category that possesses not only a *cognitive/emotional* side (while speaking, we feel a need or a desire to emphasize something, to draw a contrast between how things are in fact and how they might have been or may become), but also a *syntactic* side (we sense, as we are building a sentence even while uttering it, various telltale slots where the word could jump right into the sentence with no problem).

A reader might react to this observation by claiming that all we've said is that the word "much" has two facets, one being the concept behind it, and the other being the grammatical roles that the word can play in English, and thus that our claim is merely that "much" has both a semantic and a syntactic side (much as does any word), and that semantics and syntax are independent human mental faculties. Such a stance implies that the mental processes that underlie people's choice of *what* to say and their choice of *how* to say it are autonomous and have nothing in common. But making such a distinction is highly debatable. Could it not be that the mechanisms with which we perceive *grammatical* situations in the world of discourse are cut from the same cloth as those with which we perceive *physical* situations in the world around us?

As a child, one learns to "navigate" (quote unquote!) in the abstract world of grammar just as one learns to navigate in the world of concrete objects and actions. A child starts to use the word "much" in the simplest syntactic contexts at first, such as "too much", "not much", "much more", and so on. These initial cases constitute the core of the category; as such, they are analogous to little Tim's Mommy as the core of

his category *mommy*, and to the Moon as the core of Galileo's category *moon*. The child might possibly explore risky avenues such as "a lot much", "many much", "much red", "much here", "much now", "much night", and so forth, but such trial balloons will be popped, sooner or later, by society's cool reaction, and will be given up.

As the years go by, our child will hear, read, understand, and integrate increasingly sophisticated usages, such as "much traffic", "I much prefer the other one", "much to my surprise". These could be likened to the other children's mothers in the mind of little Tim, and to the moons of Jupiter in the mind of Galileo. Each time a new usage is heard (such as "much to my surprise"), that specific case will contribute to a blurry mental cloud of potential usages that are *analogous* to it ("much to her horror", "much to his shame", "much to our disappointment", "much to my parents' delight", etc.) Thus the child will be led to taking further risks by making little explorations at the fringes of these expanding categories — risks such as "much to my knowledge", "much to her happiness", "much to his unfamiliarity", "much to their comfort" — and to the extent that these tentative forays resonate or fall flat with other speakers, they will be reinforced or discouraged.

Children refine their sense for the category of *much* situations (both its semantic and its syntactic aspect) in much the same way as they refine their sense for any other category. And they do all of this on their own, because schools do not teach any such thing and do not need to; children simply become, without any particular effort (let alone a great deal of conscious effort), *much*-ness experts. They will randomly run into the word in poems, in song lyrics, in ancient texts, in slang phrases, and in marginal usages like "it's of a muchness", "thanks muchly", "it cost me much bucks", "too much people here", and without realizing that they are doing so, they themselves will indulge in just this kind of pushing of the linguistic envelope. Bit by bit, this will add up to a personal sense for the limits of the category — the category of *appropriate usages and syntactic slots for the word "much"*. For each person, this mental category will stretch out in its own idiosyncratic fashion, but no matter who it is, it will consist of a core surrounded by a "halo". Just as in each person's mind there are prototypical chairs and also quotation-marked "chairs" that flirt with the very edges of the category, so there are prototypical usages of "much" and also edge-flirting usages of the same word.

Words that Name Phenomena in Discourse

A profound aspect of growing up human involves developing an exquisite real-time sensitivity to the many types of expectations that our words set up in the minds of our listeners. In so doing, we acquire a rich set of categories that have to do with these abstract phenomena. Oddly enough, though, some of the most important of these categories are labeled by words that seem boring and bland — "and", "but", "so", "while", and numerous others. Such words may at first strike us as unimportant and even trivial, but that is a most misleading impression. These words denote deep and subtle concepts, and as we shall see, those concepts are grounded in analogies, much as are all other concepts.

Let's look at some examples involving the word "and". No one would be at all surprised if a friend, upon returning from a trip to France, enthused, "I like Paris and I like Parisians." On the other hand, we would certainly be confused if our friend first declared, "I like Paris" and then stated, after a short pause, "I like Parisians." This would give the impression of two ideas that were unrelated to each other, which of course is not the case. Our friend could make it a bit more logical-seeming by adding "also" at the end of the sentence; doing so would acknowledge the fact that listeners want to hear an explicit, sense-making link between the two utterances. Indeed, that's precisely one of the key roles of the word "and" — to set up a natural link between two statements. Thus if our friend declared, "I like Paris and I just bought a pair of pliers", we would be caught off guard by the lack of coherence. A central purpose of the word "and" is to convey to listeners a clear sense of the logical flow that, in the speaker's mind, links one thought to the next one uttered.

The flow of discourse is just as real to human beings as the pathway of a fleeing zebra is real to a pursuing lion. They are both varieties of motion in certain kinds of space; it's just that the space of hunting is physical and the space of discourse is mental. Lions live mostly in the physical world, and although we humans live there too, we also live in the world of language, and a large part of our category system revolves around phenomena that take place in that intangible but no less real world. We perceive and categorize situations that arise in discourse space, and we do so just as swiftly and just as naturally as the pursuing lion, on the savanna, chooses its direction of motion in a split second in chasing its prey.

We all acquire the word "and" and the concept behind it just as we do for other words and concepts — through analogical broadening. Can anyone recall the very first occurrence of the word "and" that they ever heard? Of course not. But as with all other words acquired during early childhood, it was never defined explicitly; rather, its meaning was picked up from context ("Mommy and Daddy", possibly). At first it linked people, we might well suppose. Then it linked people and objects ("Sally and her toy"). Then it linked sequences in time ("I went out and looked"). Then it served to represent causal links ("It fell and broke"). Then it linked combinations of abstract qualities ("hot and cold water"), as well as of relationships ("before and after my haircut") and other abstract attributes ("a hot and healthy meal"). And then many more came, in an avalanche.

Like any category, the category of *and* situations expands gradually and smoothly in each human mind — indeed, so smoothly that after the fact the resulting urban sprawl seems, albeit illusorily, monolithic and uniform, as if it had been constructed all at once, as if there were but one single elementary idea there, which had never needed any generalizing at all. There are no conscious traces left of the many concentric layers of outward expansion of *and*, just as there are no conscious traces left of how we acquired categories that give the impression of being considerably more complex, such as *mother*, *stop*, and *much*. And so this innocent little conjunction, which very few people would think of as standing for a *category*, fits right in with the story of words and concepts that we are here relating.

Contrasting "And" with "But"

Now let us deepen and broaden our discussion by looking at some examples involving the conjunction "but". A totally logic-based view would claim that "and" and "but" mean exactly the same thing except for emotional shadings. However, that's a pretty parochial view of the matter. Let's take a closer look. Were our just-returned friend to say to us, "I like Paris but I like Parisians", we would surely wonder, "What does *that* mean? It makes no sense!" The reason is that hearing the word "but" leads us to expect a *swerve* or a *zigzag* in discourse space, but there was no such sudden switch in direction. Stating that one likes Paris and also Parisians does not challenge common sense, does not violate reasonable expectations, and thus it does not in any way, shape, or form constitute a swerve or zigzag in discourse space. Our hypothetical friend's hypothetical sentence faked us out by *announcing* a swerve but not carrying it out. There is a puzzling inconsistency between the conjunction and the two phrases that it links. Indeed, if such a sentence were to show up in an email message, you might well guess that it was a typo and that your friend had intended to write, "I like Paris but I don't like Parisians." Now that would indeed constitute a zigzag in discourse space.

For effective communication, speakers have to pay close attention to the nature of the flow in the sequence of ideas that they are conveying — in other words, they have to carry out real-time self-monitoring. When motion in the space of discourse continues smoothly along a pathway that has already been established, then the word "and" (or some other cousin word or phrase, such as "moreover", "indeed", "in addition", "on top of that", or "to boot", to list just a few possibilities) is warranted. We'll call situations of this sort "*and* situations". When one recognizes that one is in an *and* situation, one can say "and" and be done with it. By contrast, when motion in the space of discourse makes a sudden, unexpected swerve, then the word "but" (or some other concessive word or phrase, such as "whereas", "however", "actually", "in fact", "although", or "nevertheless", "even so", "still", "yet", "in spite of that" to list just a few possibilities) is warranted. Analogously, these are *but* situations, and of course, when one recognizes that one is in a *but* situation, one can say "but" and be done with it.

What Makes One Say "But" Rather than "And"?

Occasionally one hears sentences like "I don't know what country the florist comes from, but she seems very nice." Why the "but" here? What kind of a zigzag in discourse space is this? Well, first consider how it would sound with "and" instead: "I don't know what country the florist comes from, *and* she seems very nice." It simply sounds like a *non sequitur*. One wonders what these two thoughts are doing in the same sentence. On the other hand, with "but", there is a definite logical flow, although it's a bit subtle to pin down. The feeling being expressed is something like this: "*Despite* my near-total lack of knowledge about her, I would say that she seems affable." "Despite" is a concessive that is a close cousin to "but". The point is that the first part of the sentence is about a hole in one's knowledge, and the second part is about a small but

significant counterexample to that tendency. Thus the first part of the sentence suggests a pattern and the second part states an exception to the pattern. Whenever we are about to tell someone a "piece of news" and just before doing so we realize that in some way or other it goes against expectations likely to be set up by what we had just told them moments earlier, we have detected the telltale signs of a *but* situation. The two-clause sentence about the florist has exactly that property, and that's why putting "but" between its clauses makes sense and sounds right to our ears, whereas putting "and" there would make it sound very strange.

Likewise, if someone says "He has big ears, but he's really a nice guy", it doesn't mean (despite the way it sounds on the surface) that the speaker has a stereotype of large-eared people as being unpleasant. Rather, it means something more like, "Although this person is on the negative side of the norm in a certain physical way, he is on the positive side of the norm in terms of his behavior." Once again, we see that the conjunction "but" signals a swerve in discourse space — the person in question is on one side of *one* norm and yet (despite that fact) is on the other side of *another* norm.

The category of swerves that the word "but" denotes is just as real as the category of swerves made by vehicles on roads, though it is more intangible, and the use of the word "but" comes about because as people speak, they are always paying some amount of attention to their trajectory in discourse space and are categorizing its more familiar aspects in real time, just as they are always paying some amount of attention to the scene before their eyes (and the sequence of sounds coming into their ears, etc.) and are categorizing its more familiar aspects in real time.

Sometimes a speaker becomes aware of the real-time linguistic self-monitoring going on as a background process in their brain, and this can affect the flow of speech. It can result in one verbal label being canceled and swiftly replaced by another label. One example is when someone says, "Oh, look at that horse — uhh, I mean *donkey*". The following story involves such a relabeling, but the self-correction involves an event in the speaker's linguistic output stream rather than an object in the environment.

Frank and Anthony, lifelong friends, hadn't seen each other in a long time and were pleasantly catching up on the news of each other's families. Frank wanted to tell Anthony about his daughter, who had been hit by a mysterious illness and, to everyone's relief, recovered from it after a couple of years. One of his sentences went like this: "She got to be an excellent skier during her stay in Montana, and one day on the slopes she just couldn't keep her balance — or rather, *but* one day on the slopes she just couldn't keep her balance…"

As he launched into his sentence, Frank thought he was in an *and* situation, and then suddenly — or rather, "*but* suddenly" — when he started to flesh out the second clause, he clearly heard the abrupt swerve in what he was telling Anthony (it would strongly violate anyone's expectations that a highly accomplished skier will, without any warning, start to fall a lot), and so he quickly spun in his tracks and, changing conjunctions in mid-stream, jumped from "and" to "but", as he realized that from a listener's point of view, the story he was relating involved a kind of zigzag — thus a member of the category of *but* situations rather than of the category of *and* situations.

Further Refinements in Discourse Space

Making the distinction between *and* situations and *but* situations is not a high art, but it is a most useful skill to pick up, and that dichotomy is perfectly adequate in many situations. However, there are numerous subcategories inside the broad categories that we've labeled "*and* situations" and "*but* situations", and people, first as children and later as adults, gradually pick up the finer nuances that will help them to recognize these subcategories and thereby to choose, in real time, the sophisticated connecting word or phrase that best describes the situation in discourse space.

Sticking to just the categories *and* and *but* while making no finer distinctions is rather like making the useful but coarse distinction between the categories of *car* and *truck*, but not venturing into finer details. The *car/truck* distinction is good enough for many purposes. People who are fascinated by motor vehicles, though, are eager for much more detail, and they'll often use a much narrower category than is designated by the generic word "car". In the same way, fluent speakers depend on making finer distinctions than just the coarse "and"/"but" dichotomy. However, just as recognizing whether a vehicle is a Honda or a Hyundai, a coupe or a sedan, automatic or manual, fuel-efficient or gas-guzzling, sporty or family-style, and so forth, takes considerable experience, so deciding whether one finds oneself in a *nonetheless* situation in discourse space, a *however* situation, an *and yet* situation, a *still* situation, an *on the other hand* situation (and so forth) is a subtle skill, since it requires having constructed these subcategories and having a decent mastery of them.

We have no need to delve into the subtleties that underlie such choices. Just as it is not our aim to explain how people distinguish among *studies*, *studios*, *offices*, *dens*, *ateliers*, *cubicles*, and *workplaces*, or among their friends who are *agitated*, *antsy*, *anxious*, *apprehensive*, *concerned*, *disquieted*, *distressed*, *disturbed*, *fidgety*, *frantic*, *frazzled*, *frenetic*, *frenzied*, *jittery*, *nervous*, *perturbed*, *preoccupied*, *troubled*, *uneasy*, *upset*, or *worried*, or between situations calling for "Thanks a million", "Thank you ever so much", "Many thanks", and other expressions of gratitude, so it is not our aim to explain the nature of the nuances that lead a person to choose to say "however" rather than "but" or "nonetheless" or "actually" or "and yet" or "that having been said" or "despite all that". We are concerned not with pinpointing the forces that push for choosing one or the other of these linguistic labels, but simply with the fact that each of these different phrases is the name of a subtly different mental category — a highly characteristic, oft-recurring type of pattern in discourse space to which one can draw analogies.

We might point out here that where English has two most basic conjunctions ("and" and "but"), Russian has three — "и" ("and"), "но" ("but"), and "а" (whose meaning floats somewhere between "and" and "but"). This means that Russian speakers and English speakers have slightly different category systems concerning very basic, extremely frequent phenomena that take place in discourse space. Picking up the subtleties of when to use "а" instead of "и" or "но" takes a long time. It's much the same story as for any set of categories that overlap. We don't want to give a linguistics lesson, so we'll stop here, but the bottom line is that words that to most people seem

infinitely far from the most venerable and clichéd examples of categories (such as *chair*, *bird*, and *fruit*) are nonetheless the names of categories, and they are so for the very same reasons, and the categories they name act very much the same.

Ever More Intangible

It might seem logical for a chapter on words to move from the most frequent ones to rarer ones, but we will go against expectations here. We want to finish up by talking about some of the most frequent words of all, which, like "and" and "but", are almost never thought of as being the names of categories. Consider words like "very", "one", and "too", for instance. What category does "very" name? Of course we can't literally point to members of the *very* category the way we can point to members of the category *dog*, say. Still, let's try for a moment. Usain Bolt is a very fast runner. Cairo is a very big city. Neutrinos, they are very small. That's very *you*. There; that's enough to give the feeling. Much like *much*, *very* is a category having to do with norms built up over a lifetime of prior experience. Where Rome is a big city, Cairo is a *very* big city.

We learn to use the word "very" just as we learn to use the word "much" — by hearing examples of its usage and feeling our way around in the world of sentence construction. Does the fact that the crux of the notion *very* has to do with the formation of sentences disqualify it from being a concept? No, not at all. The concept *very* is just as genuine a concept as is *dog*. The concept *very* is all about relative magnitudes, expectations, importances, intensities. All of that is deeply conceptual.

And while we're at it, let's not forget that Albert Einstein was one very smart dude. Yes, no doubt about it, Einstein was *one* smart dude, as opposed to being *several* smart dudes; but why was he not just *a* smart dude? The word "one" can convey more information, it seems, than just the number of items that somebody is talking about. In this case, saying "one smart dude" emphasizes the extreme rarity of a genius of Einstein's caliber; it is a subtle way of squeezing extra information into the sentence via a very unexpected channel. However, the choice of the word "one", as opposed to the word "a", also conveys information about the persona of the speaker (earnest, candid) as well as about the tenor of the conversation (informal, casual). Moreover, using the word "dude" strongly resonates with using the word "one", and vice versa — indeed, when used together, these two words paint a vivid portrait not only of Albert Einstein but of a certain brand of English speakers who are prone to use this kind of phrase.

To put it more explicitly, probably most native speakers of American English have developed a category in their minds that could be labeled "the kind of person who goes around saying 'one smart dude'". However, the category is not as narrow as this label suggests. To be sure, it would be instantly evoked if one were to hear the above remark about Albert Einstein's intelligence, but its evocation doesn't depend on having heard the specific words "smart" and "dude"; it would also be evoked by remarks like "Doris Day was one cute cookie" or "That's one bright lamp!" We thus see that even bland little words like the numeral "one" intoned in a certain fashion, which might seem very close to content-free, can evoke rich and subtle categories in our minds.

Having just considered "one", let's move along to "too". Of course that word has two quite separate meanings — namely, "also" and "overly much" — so let's focus on just the latter. What are some quintessential members of the *too* category? Well, perhaps the idea that eating a whole fudge cake would be too much. Or the idea that teaching general relativity to elementary-school kids would be too early. We'll let readers invent their own *too* situations. The point is that doing this little exercise will make it vivid for you that there are analogies linking each *too* situation to other *too* situations, and thus to the abstract concept of *too*-ness.

When we considered the concept *much*, we pointed out that part of its richness is how it is used in sentences. Indeed, the realm of discourse is one of the richest domains we humans come into contact with. Just as there are concepts aplenty in the worlds of linear algebra, molecular biology, tennis-playing, and poetry, so there are concepts galore in the worlds of discourse, language, grammar, and so forth, but we seldom think about them. Thus a high-school student might pen a poem in flawless amphibrachic hexameter without ever suspecting that there is a standard name for such a meter. Likewise, we native speakers of English are all past masters in the use of words such as "the" and "a" without ever analyzing how they work. But the Polish linguist Henryk Kałuża wrote a whole book — *The Articles in English* — to teach non-native speakers "the ins and outs" (one of his examples of "the") of our language's definite and indefinite articles. As it turns out, Kałuża's book is all about the *meanings* of these rich words, but nonetheless, some people resist the idea that "the" and "a" have meanings, arguing that they are not "content words" but just grammatical devices. It seems that since these words do not designate tangible objects, some people think they are devoid of meaning (not unlike people who insisted for centuries that zero isn't a number). It seems strange, however, to suggest that the difference between "the president" and "a president" has nothing to do with *meaning*. There is a great deal of content conveyed by the distinction between "the sun's third planet" and "a sun's third planet", between "I married the man in the photo" and "I married a man in a photo", between "the survivor died" and "a survivor died".

Trying to pin down how words like "the" and "a" are used in English is not our purpose here — no more than trying to specify the type of circumstances likely to evoke the word "office" as opposed to the word "study". What we are emphasizing is that this subtle knowledge is picked up over many years thanks to one analogical extension after another, usually carried out without the slightest awareness of the act.

And thus we have moved our discussion from fairly low-frequency words, like "hub", "attic", and "moon", to the very top of pile — the most frequent word in all of English — the definite article "the". In so doing, we have also moved from very visual, concrete phenomena to phenomena that are largely intangible and mental. But what's crucial is that in making this move, we have never left the world of categories. Just as "hub" denotes a category (or perhaps a couple of different categories — the centers of bike wheels as opposed to certain major airports), so "the" denotes a category (or perhaps a few distinct ones, as the world-class "the"-expert Henryk Kałuża would be quick to point out).

Carving Up the World Using a Language's Free Gifts

Any language has an immense repository of labels of categories that people over millennia have found useful, and as we grow up and then pass through adulthood, each of us absorbs, mostly by osmosis, a decent fraction of that repository, though far from all of it. The many thousands of categories that we are handed for free and that we welcome, seemingly effortlessly, into our minds tend to strike us, once we have internalized them, as self-evident givens about the world we live in. The way we carve the world up with words and phrases seems to us *the right way* to view the universe — and yet it is a cliché that each language slices up the world in its own idiosyncratic manner, so that the set of categories handed to speakers of English does not coincide with the set handed to speakers of French, or to those of any other language. In short, "the right way" to see the world depends on where and how one grew up.

A striking example is provided by English and Indonesian. The English words "brother" and "sister" seem to us anglophones to cover the notion of *siblinghood* excellently, as well as to break that concept apart at its obvious natural seams. However, the Indonesian words "kakak" and "adik" also cover the notion of *siblinghood* excellently, but they break it into two subconcepts along an entirely different axis from that of sex: that of age. Thus "kakak" means "elder sibling" while "adik" means "younger sibling". To speakers of Indonesian, this seems the *natural* way to slice up the world; they don't feel a need to be able to say "sister" using just one word any more than anglophones feel a need to be able to say "older sibling" using just one word. It doesn't cross their minds that something is *missing* from their language. Of course Indonesian speakers can say "female kakak or adik", and that effectively means "sister", just as we English speakers can say "older brother or sister", and that effectively means "kakak". Each language can express through a *phrase* what the other language expresses through a *word*. And the French language does an admirably diplomatic job with these concepts, managing to slice the world up in both ways. The male/female dichotomy tends to be the more frequently used one in French ("frère" vs. "sœur"), but the older/younger one exists just as well ("aîné" vs. "cadet"), and thus all possibilities are available. As this shows, slicing the world up at its "natural" joints is not quite so natural as one might think.

Different ways of cutting up the world are far from being exceptional picture-postcard rarities. In order to unearth good examples of the phenomenon, one certainly doesn't need to resort to pairs of languages that are spoken halfway around the world from each other. We can find plenty of them right under our nose, simply by poking about a bit in the languages that are closest to our native tongue, even limiting our search to words and concepts that are unquestionably central.

Thus, nothing seems more obvious to us anglophones than what *time* is. We know *what time it is* right now, we know *how much time* it will take to drive to the airport, and *how many times* we've done so before. These three ideas strike us as being very clearly all about just one central, monolithic, and hugely important concept: the concept known as "time" (in fact, the most frequent noun in the English language). And yet, most

strangely, there are languages that don't see those three ideas as being about the same concept at all! If you're a francophone, you know what *heure* it is right now, you know how much *temps* it will take to drive to the airport, and how many *fois* you've done so before. They aren't the same word or even related words, and the three concepts labeled by the words "heure", "temps", and "fois" seem quite distant from each other for French speakers. As if this weren't bad enough, the French word "temps" doesn't denote only a certain subvariety of English's concept of *time* — in addition, a good fraction of the time, it means "weather". Thus speakers of French, in their whimsical fashion, somehow manage to confuse the weather and the time! On the other hand, we speakers of English manage to mix up the hour of the day with the number of occasions on which something has happened! Which mistake is sillier?

The English and French languages certainly don't agree on how the world should be broken up into categories, even for the nouns of the highest frequency that exist, let alone for categories labeled by verbs, adverbs, prepositions, and so forth. For example, those incorrigible French speakers, they irrationally distinguish between two kinds of "in" — namely, "dans" and "en". What could make less sense than that? Whereas we clear-sighted English speakers, we distinguish (most rationally, of course) between two kinds of "de" — namely, "of" and "from". What could make more sense than this?

These kinds of discrepancies are totally typical of how different languages carve the world up differently from each other, and between any given pair of languages there are myriads of such discrepancies. How, then, do people ever communicate at all across language boundaries?

Spaces Filled Up with Concepts

To help answer this question, we would like to offer a simple visual metaphor for thinking about the words of a language (and more generally about lexical expressions) and the concepts that they represent. We begin by suggesting that you imagine a two-dimensional space or a three-dimensional one, as you prefer; next, we are going to start filling that space up, in our imagination, with small patches of color, using a different color for each different language that we are interested in — say green for French, red for English, blue for German, purple for Chinese, and so forth. It is tempting to think of these concept-blobs as something like rocks or jelly beans — odd little shapes having very well-defined edges or boundaries. The truth is far from that, however. While each blob is intensely colored in its center (deep red, deep green, whatever), as one approaches its "boundaries" (which in truth don't exist), it grows lighter in shade — think of pink or chartreuse — and then it simply fades out, passing through lighter and lighter pastel shades as it does so. This image of blobs with hazy contours of course echoes our metaphor likening concepts to very dense cities that gradually turn into suburbs and then fade into countryside.

We will call the space itself, before the insertion of any colored blobs (somewhat like a house without furniture), a "conceptual space" (there are many such, which explains the indefinite article). At the very center of each conceptual space are found the most

common kinds of concepts — those for very common tangible objects, intangible ideas, phenomena, properties, and so forth — the concepts whose instances are encountered all the time by people who belong to a particular culture (or subculture) and era, and which those people must be able to categorize quickly and effortlessly in order to survive, or simply to live.

The core items in a typical conceptual space include, quite obviously, the concepts for various entities such as the main parts of the human body; general classes of common animals, such as *bird*, *fish*, *insect*, and a few farm animals; general classes of plants, such as *tree*, *bush*, and *flower*; things to eat and drink; common feelings, such as being *cold* or *hot* or *hungry* or *thirsty* or *sleepy* or *happy* or *sad*; common actions, such as *walking* and *sleeping* and *eating* and *giving* and *taking* and *liking* and *disliking*; common properties, such as *big* and *small*, *near* and *far*, *kind* and *cruel*, *edible* and *inedible*; common relationships, such as *belonging to*, being *inside* or *outside*, being *above* or *below*, being *before* or *after*; common degrees, such as *not at all*, *not much*, *slightly*, *medium*, *very much*, *totally* — and so forth. Every language has words for such notions, because all humans require these concepts in order to live. This list merely scratches the surface of the core of a typical conceptual space, of course, but it gives the general idea. In any case, these concepts, all residing at or very close to the dead center of a typical conceptual space, are quasi-universals that most humans deal with constantly, and they are thus bases that are well covered, and necessarily so, by every language.

The idea of conceptual spaces will help to make more tangible and concrete some ideas about the words and expressions of a given language and the concepts used by its speakers. One of the most important ideas that it helps one to think about is how different languages cover, or fail to cover, certain concepts. Between the conceptual spaces of distant cultures there will be large discrepancies. But what about cultures that are bound together by geography, history, traditions, and so forth? In such cases, the conceptual spaces will be very close to each other.

In what follows, we will focus mostly on contemporary Western cultures, simply because we ourselves feel more competent in that context, and we assume that many of our readers (at least those who are reading this book in one of its two original languages) would also feel more comfortable that way. However, our general points have nothing to do with the specific concepts that we will discuss.

Looking at Two or More Languages within a Conceptual Space

How is a conceptual space filled up with sets of blobs of different colors? For instance, how do the repertoires of concepts possessed by French and English speakers who share essentially the same culture compare?

According to our visual metaphor, regions near the very center of a conceptual space are densely filled in, no matter what language we are speaking about. If, as suggested above, French is represented by green, then there is a green blob near the middle of conceptual space that covers the area occupied by the concept *hand*. And if English is represented by red, then fairly much the same area is covered by a red blob

of similar size and shape to the green (French) blob. Each different language will cover that same area of a conceptual space fairly well, so there will be blobs of many different colors right there, all closely overlapping with one other.

Some of the different-colored blobs representing different languages' coverages of a given extremely frequent concept will tend to have pretty much the same shape, but in the case of other blobs there will be discrepancies, some minor and some major. We've already seen a pretty major one, involving *time* corresponding to *heure*, *temps*, and *fois*, and *temps* corresponding to both *time* and *weather*. To provide another case, the red blob representing the extremely frequent concept expressed by the word "big" in English aligns quite well with the green blob for the French word "grand", but by no means perfectly so, since some of the meanings expressed by our "big" are usurped by French's "gros" (for instance, things that are large in thickness or width, as opposed to those that are large in height), and conversely, our word "great" usurps some of the meanings expressed by French's "grand" (those that mean "highly accomplished, world-famous, and deeply influential").

Some even more severe misalignments involve extremely frequent prepositions such as "in" (which in fact is covered in French not just by "dans" and "en", but by many other prepositions, depending on the context), and by similarly frequent and enormously protean verbs such as "to get" (which sometimes is best rendered by "obtenir", other times by "prendre", other times by "chercher", other times by "recevoir", other times by "comprendre", other times by "devenir", other times by "procurer", and on and on). Of course, the story is symmetric; that is, each of the just-mentioned high-frequency French prepositions and verbs is likewise covered by all sorts of different English verbs, depending on the context. There's no clean one-to-one alignment between blobs of different colors, although there's a great deal of overlap.

On the other hand (and quite luckily!), for a very large number of truly important concepts — say, *finger*, *water*, *flower*, *smile*, *weight*, *jump*, *drop*, *think*, *sad*, *cloudy*, *tired*, *without*, *above*, *despite*, *never*, *here*, *slowly*, *and*, *but*, and *because*, to give just a few examples — there is generally quite good agreement between French and English, and, for that matter, among all the languages that we are familiar with.

Thus, the center of this conceptual space is inhabited by red and green blobs that often coincide quite well, and when they don't coincide, then there are all sorts of overlapping blobs, each with its own curious shape. Luckily, though, despite the fact that the green blobs covering a certain concept and the red blobs covering the same concept are often shaped rather differently, the central zone of the overlapping space is extremely densely covered both by red blobs and by green blobs (and also, if we want to throw in other languages, blue blobs and purple blobs, and so forth).

Furthermore, there aren't going to be any gaping holes in the linguistic coverage of concepts residing near the dead center of the conceptual space of some other culture (such as the Nepali or the Navajo culture); there won't be blank zones where a human language totally lacks a lexical item labeling a concept that is universally part of the human condition. Any language spoken by more than a tiny, isolated group will easily be able to talk about, for instance, sleeping poorly, or seeing a friend after a long time,

or breaking a stick, or throwing a stone, or walking uphill, or feeling sweaty, or being very tired, or losing one's hair, though each one will have a unique way of doing so.

Rings or Shells in Conceptual Space

Let us now imagine moving outwards from the core towards slightly less frequently encountered concepts, such as, for instance *thanks*, *barn*, *fog*, *purple*, *sincere*, *garden*, *sand*, *star*, *embarrassing*, *roof*, and *although*. If these concepts are of comparable importance to one another within the culture, then their distance from the center will be about the same, and we can say that they constitute a ring (or a shell, if you are envisioning a three-dimensional space). These concepts are still important in the conceptual space — and so, once again, we expect that this region of conceptual space, though not belonging to the most central core, will still be quite densely filled with blobs of every color. On the other hand, let's zoom outwards a considerable distance further from the core of our conceptual space, to a different shell where we will encounter (let us say) the concepts *frowning*, *cantering*, *fingernail-biting*, *tap-dancing*, *welcome home*, *income tax*, *punch line*, *corny joke*, *sappy movie*, *vegetarian*, *backstroke*, *chief executive officer*, *wishful thinking*, *sexual discrimination*, *summit meeting*, and *adverb* (just to give a tiny sampling of the hypothetical shell). This latest outward leap has clearly carried us into more rarefied territory, and so we would not expect all the cultures of the world (and of all different historical epochs) to share all the concepts in this shell, nor would we expect all the earth's languages to have words or phrases to denote all the concepts in this shell.

What is Monolithic is in the Eye of the Beholder

Let's take any shell of this conceptual space. Since languages differ enormously, we can easily find a red blob that no single green blob covers precisely. However, a small *set* of green blobs will collectively do a pretty good job of covering all the territory of the red blob (although they will inevitably also cover areas outside the red blob). And of course, what's sauce for the goose is sauce for the gander, meaning that we can easily find green blobs that no single red blob covers precisely.

To make things concrete, let's take an example. English speakers fluently and effortlessly use the word "pattern" to describe regularities, exact or approximate, that they perceive in the world. However, if they wish to talk about such phenomena in French, they will soon learn, to their frustration, that there is no French word that exactly covers this very clear zone of conceptual space. And thus, depending on details of what they mean, they will have to choose among French words such as "motif ", "régularité", "structure", "système" , "style", "tendance", "habitude", "configuration", "disposition", "périodicité", "dessin", "modèle", "schéma", and perhaps others.

At the outset, this lacuna in the French lexicon strikes English speakers as a rude violation of common sense, since the concept of *pattern* strikes them as being self-evident and objective, and therefore something that should be universal to all languages. It seems obvious that there "should" be just one word for all those notions that the

English word unites; after all, it feels like just *one thing* rather than many. But in French and in fact in most other languages, there simply isn't such a word. Nonetheless, other languages manage to cover the zone of conceptual space labeled "pattern" in English pretty completely, although somewhat less efficiently, by using a bunch of smaller blobs each of which corresponds to a limited facet of the notion, or else a set of large blobs that intersect partly with the English one.

For the sake of fairness, we should point out that French, too, has words of quite high frequency that have no counterpart in English — for instance, the adverb "normalement", which certainly looks like it means what we anglophones mean when we say "normally" (and sometimes it indeed does), but which a large part of the time means something rather different. Here are a few examples that show typical uses of the word, and that give a sense for the wide variety of translations it needs in order to be rendered accurately in English:

> Normalement, Danny doit être arrivé à la maison maintenant.
> > *Hopefully*, Danny's back home by now.

> Normalement, on va courir à 7 heures ce soir, non ?
> > *Unless we change our plans*, we'll be taking our run at 7 this evening, right?

> Normalement, nous devions passer deux semaines en Bretagne.
> > *If there hadn't been a hitch*, we would have spent two weeks in Brittany.

French speakers will be just as puzzled by English's lack of a single word for the obvious, monolithic-seeming concept expressed by the word "normalement" as English speakers are puzzled by French's lack of a single word for the obvious, monolithic-seeming concept that is embodied in the word "pattern". What is monolithic is in the eye of the beholder.

In cases such as these, where one language has a single word that covers a set of situations that another language needs a variety of different terms to describe, we are dealing with linguistic richness and poverty. Thus in the case of "pattern", English is richer than French, and in the case of "normalement", French is richer than English. More generally, we can say language A is locally richer than language B if language A has a word (or phrase) denoting a *unified* concept — that is, a concept that native speakers feel hangs together tightly, and that seems to have no natural internal cleavages — and if language B *lacks* any single word covering that same zone of conceptual space. We can thus speak of a local "hole" or "lacuna" in language B's coverage of conceptual space, even though language B manages to cover the zone by resorting to a *set* of words.

On the other hand, when a certain area of conceptual space is finely broken up by a given language, and when speakers of both languages agree that this fine break-up is warranted, then a language that doesn't offer its speakers such a fine break-up has to be considered poorer. Take the English word "time", for instance. To native speakers of English, whereas the word "pattern" feels unitary and monolithic, the word "time" does

not have that monolithic feel; native speakers readily and easily see (at least if it's brought to their attention) that there are several very different meanings of "time" (for instance, those corresponding to the French words "heure", "temps", and "fois"). Thus in this case, it's the French language that is richer and the English language that is poorer, for the English lexicon doesn't break that large zone of conceptual space into smaller separate zones, as the French language does. An example where French is weaker is the word "beaucoup", which corresponds to both "much" and "many" in English. For us anglophones, it's obvious that these are separate concepts, one having to do with a large quantity of a substance, the other having to do with a large number of similar items. The French word that blurs this distinction thus seems rather crude. Thus in this case, the English language appears to be richer, and French poorer.

In summary, when language A has a word that strikes its speakers as representing a natural and monolithic concept, and language B has no corresponding word, then language B is poorer and language A is richer, because speakers of language B are forced to cobble different words together in order to cover the zone of conceptual space that language A covers with just one word. Conversely, when language B has a set of words that cut up a zone of conceptual space that is covered by just one word in language A, and when the distinctions offered by language B seem natural to speakers of both languages, then it's language B that is richer and language A that is poorer.

The Need to Stop Subdividing Categories at Some Point

When one studies various languages, one discovers that many concepts that one had at first naïvely taken as monolithic, because of one's native language, are in fact broken up into subconcepts, and often with excellent reason, by other languages. And if one studies enough languages, one often discovers numerous different ways of subdividing one and the same concept. Seeing a concept being broken up into all sorts of subconcepts that one hadn't previously dreamt of suggests that it would in theory be possible to continue carving the world up into tinier and tinier blobs, thus making an ever finer mesh of very small, extremely refined concepts, without any end.

But no language in fact does this, because all languages come from the key human need to have categories that apply at once to a vast number of superficially extremely different and yet deeply extremely similar situations. Such categories help us to survive and to have comfortable lives. To be sure, some language could, in principle, have separate words for red books and green books, or for books printed on butterfly wings, or for orange books of under 99 pages, or for puce-colored books about subtropical botany that contain between 221 and 228 pages (but not 225) and are in (Brazilian) Portuguese and are typeset in 13-point Bodoni — but it's obvious that there comes a point of diminishing returns, and it's nowhere near the absurdly fine distinctions just hinted at. There's no reason for any culture to construct any of these categories, let alone to reify it via a word in its language, although the miracle of language — of every language on earth — is the charming fact that any of those odd and far-fetched categories *could* in theory be invented by someone, if they were needed or desired.

We should also point out that category refinement doesn't always move in the direction of an ever-finer mesh. Sometimes refining one's mental lexicon of categories means broadening through abstraction, in the sense of learning to perceive common threads in situations where people who lack the concept would simply see unrelated phenomena (for example, the commonality linking human mothers with animal mothers, den mothers, and mother companies, or the commonality linking female animals with female plants, or the commonality linking hubs of wheels with airports that are hubs, and so forth). The emergence of this type of *broader* category is also extremely useful for the development of a people or a culture.

There is thus a tension between the desire to make finer distinctions that cover very few cases and the desire to make broader categories that cover many more cases. Earlier, we saw that children's perception of the world is quite coarse-grained relative to the perception of adults (this is why some young children uninhibitedly speak of "patching teeth", "eating water", "undressing bananas", and so forth), and we saw that as children grow older, they acquire more and more refinements in their conceptual systems. This is a universal tendency, but at some point, adults stop refining their lexicon when it comes to ordinary objects, actions, relationships, and situations. Each language and culture has found its natural grain size for such entities, and in a kind of unspoken collective wisdom, it ceases to go beyond that, although of course experts are continually refining their technical vocabularies, and each society, as it makes new discoveries and inventions, collectively creates new concepts and new words for them.

Everyone in every culture is constantly refining their conceptual repertoire by acquiring ever more compound words, idiomatic phrases, proverbs, and new catch phrases that enter the language through books, movies, and advertisements; in addition, everyone is also constantly building up a rich repertoire of concepts that have no verbal labels. In the next two chapters, we will turn our attention to these two key ways in which our conceptual storehouse continues growing as long as we live.

≈ ≈ ≈