

A Mechanism of Creativity¹

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Life on Mars

On July the Fourth, 1997, a Martian admiring the night sky above the ancient floodplain of the Ares Vallis, now a desert, would have seen the Pathfinder space probe parachuting toward the ground in a protective cocoon of inflated air bags. A multimillion-dollar space beach ball, it bounced fifty feet high before dribbling to rest, where the bags deflated. The lander retracted the air bags, unfolded to release a small exploratory roving vehicle, and beamed pictures of rocks back to the Jet Propulsion Laboratory.

An American Earthling, sitting at home, might have seen those rocks on television, interspersed with images of space aliens accompanying news reports about the fiftieth anniversary of 'the Roswell Incident'. According to believers, space aliens had crashed in Roswell, New Mexico, fifty years earlier, and the U.S. Air Force had covered it up. The Air Force, which once dismissed these rumors as absurd, now, on the fiftieth anniversary, admitted that the believers were not actually crazy. They had merely seen desert wreckage of secret high-altitude balloon tests involving capsules and dummies.

As the Mars rover began to analyze the rocks, an anonymous spoof appeared on the web:

Valles Marineris (MPI)—A spokesthing for Mars Air Force denounced as false rumors that an alien space craft crashed in the desert, outside of Ares Vallis on Friday. Appearing at a press conference today, General Rgrmrmy The Lesser stated that 'the object was, in fact, a harmless high-altitude weather balloon, not an alien spacecraft'.

The story broke late Friday night when a major stationed at nearby Ares

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Vallis Air Force Base contacted the Valles Marineris Daily Record with a story about a strange, balloon-shaped object which allegedly came down in the nearby desert, 'bouncing' several times before coming to a stop, 'deflating in a sudden explosion of alien gases'. Minutes later, General Rgrmrmy The Lesser contacted the Daily Record telepathically to contradict the earlier report.

General Rgrmrmy The Lesser stated that hysterical stories of a detachable vehicle roaming across the Martian desert were blatant fiction, provoked by incidents involving swamp gas. But the general public has been slow to accept the Air Force's explanation of recent events, preferring to speculate on the 'other-worldly' nature of the crash debris. Conspiracy theorists have condemned Rgrmrmy's statements as evidence of 'an obvious government cover-up', pointing out that Mars has no swamps.

We are guided to a blended story. The Roswell story itself has no Mars Pathfinder and no landing on Mars, while the Pathfinder story itself has no Martian Air Force, no Martian newspapers, and no sceptical public. These two stories share the scenario of a spacecraft landing in a desert, and they involve balloons. We must borrow parts of each of them to weave a blended story in which the Pathfinder lands on a Mars that has a government, rumors, newspapers, and an Air Force cover-up.

This selective borrowing, or rather, projection, is not merely compositional. Although the Air Force comes from the Roswell story, or more generally from knowledge of the United States, it is not projected blindly into the blend. The Air Force must be Martian, as must the Martians. To create them, we make use of pre-existing blended stories about fictional Martians, who are like us but not like us, who eat unhuman foods, who speak in unhuman languages, who live in subzero (Fahrenheit) temperatures, who communicate through extrasensory channels, who have roles and social organization, and so on.

We also make use of standard news reporting to give, in the blend, a Martian byline (Mars Press International) and a newsy prose style ('A spokething for Mars Air Force denounced as false ...', 'But the general public has been slow to accept ..' ..).

The blend is a joke. It does not seem to be trying to tell us anything new about Pathfinder or about landings by aliens on Earth. In the blend, the Air Force is mistaken, maybe even lying, but those inferences and possibilities do not seem to carry back to the Roswell story itself. Some of the humor derives from accidental connections: both stories have balloons in space. Some people find the image of a spacecraft landing by bouncing inherently funny—a visual joke of the kind one might see in a Bugs Bunny cartoon.

Some of the humor comes from creative selective projection, bringing about, in the blend, telepathic denials, bizarre personal titles, and scare quotes for

strangeness, inaccuracy, and incredulity placed around garden-variety and referentially accurate words. The punchline involves sophisticated leaps in the attribution of invention: at first we credit the inventor of the blend for having equipped it with telepathic Martians, an Air Force, conspiracy theorists, newspaper reporters, and swamp gas, but then, inside the blend, the Martians accuse the General of having invented the swamp gas—which proves, since it contradicts their knowledge (actually, our knowledge, projected to them) about the physical environment of Mars, that he must be lying. We, outside the blend, appreciating the entire network, can find this accusation funny, a clever invention by the network's inventor, but the Martians, living in the blend, cannot.

This blend has a logic. The Martians can't object, as we can, that they don't exist. The language of the news report presupposes that there are Martian spokethings and that at least General Rgrmrmy is telepathic, so these facts are straightforward in the blend. Nonetheless, residents of the blend can object to the presupposition by General Rgrmrmy that there are Martian swamps, even though we, outside the blend, may believe that Martians could have no concept of swamps at all.

This spoof looks exotic, but it is the product of a basic, everyday cognitive operation which we call 'conceptual integration'. The principal statements of our research are Fauconnier & Turner (in press), Fauconnier (1997), and Turner (1996), but many other publications have appeared and many other people have contributed to the research program: Seana Coulson, Margaret Freeman, Douglas Hofstadter, Edwin Hutchins, Nili Mandelblit, Todd Oakley, Martin Ramey, Adrian Robert, Tim Rohrer, Douglas Sun, Tony Veale, Lawrence Zbikowski, and others.

We leave aside the structural and dynamic properties of blending, the competing optimality constraints on blending, the taxonomy of standard kinds of conceptual integration networks that result from those optimality constraints, and a range of other technical results. They can be pursued by investigating the web page for blending and conceptual integration². We will instead give a brief and intuitive explanation of blending, provide some examples, and illustrate ways in which linguistic constructions prompt us to create conceptual blends.

Ghosts of Predators Past

The Pathfinder blend is merely amusing, but blending often plays a role in the development and expression of scientific knowledge. The front page of the science section of the *New York Times* for Tuesday, 24 December 1996, carried a large photograph of a small American pronghorn chased by pen-and-ink prehistoric cheetahs and long-legged dogs. The American pronghorn is excessively faster than any of its modern predators. Why would evolution select for this costly excessive

² <http://www.wam.umd.edu/~mturn/WWW/blending.html>.

speed when it brings no additional reproductive benefit? The scientists propose that the pronghorn runs as fast as it does because it is being chased by ghosts—the ghosts of predators past As researchers begin to look, such ghosts appear to be ever more in evidence, with studies of other species showing that even when predators have been gone for hundreds of thousands of years, their prey may not have forgotten them.

The ancient American pronghorn, in the historical story, barely outruns nasty predators like cheetahs and long-legged dogs. The modern American pronghorn, in the modern story, easily outruns all its modern predators. In the blend, the modern American pronghorn is being chased by nasty ancient predators, marked as 'ghosts' to signal that they have no reference in the modern pronghorn's world. We are not confused by this felicitous blend: we do not expect to see ghosts chasing a real modern pronghorn; we do not think the modern pronghorn remembers the prehistoric predators. Instead, we know how to connect the blend to the story of the modern pronghorn: great speed was adaptive for the ancestors of the modern pronghorn, who faced nasty predators, and although those predators are now extinct, the instinctive capacity for speed survives.

The network of pronghorn stories is complicated by its use of generic stories for species—a species doesn't actually run, but we can think of the generic representative of the species: the cow chews cud; the pronghorn runs fast; and so on. How we connect the scene of an individual pronghorn to the generic story is an issue I leave aside. There are touches that make the blend seem natural: the existing phrase 'ghost of Christmas past' gives a basis for 'ghosts of predators past'. As Fauconnier & Turner (1994) and Oakley (1996) show, 'ghost' blends are frequent whenever an element from an earlier story has an effect but not an existence in a later story.

Non-Euclidean Geometry

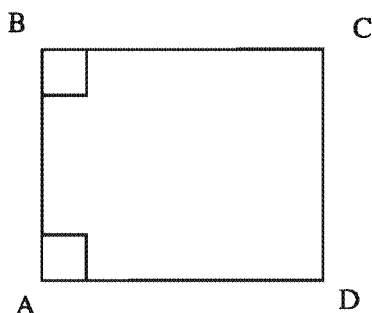
Blends can constitute basic scientific and mathematical knowledge. Consider hyperbolic geometry. As Kline (1984) and Bonola (1955) survey, the laborious birth of non-Euclidean geometry took fifteen hundred years. Euclid had defined parallel lines as straight lines in a plane that, when extended indefinitely in both directions, never meet. He had presented a sequence of proofs independent of the parallel axiom that show that two straight lines are parallel when they form with one of their transversals equal interior alternate angles, or equal corresponding angles, or interior angles on the same side which are supplementary. But proving the converses of these propositions appeared to require the parallel axiom:

If a straight line falling on two straight lines makes the interior angles on the same side less than two right angles, the two straight lines, if produced

indefinitely, meet on that side on which the angles are less than two right angles.

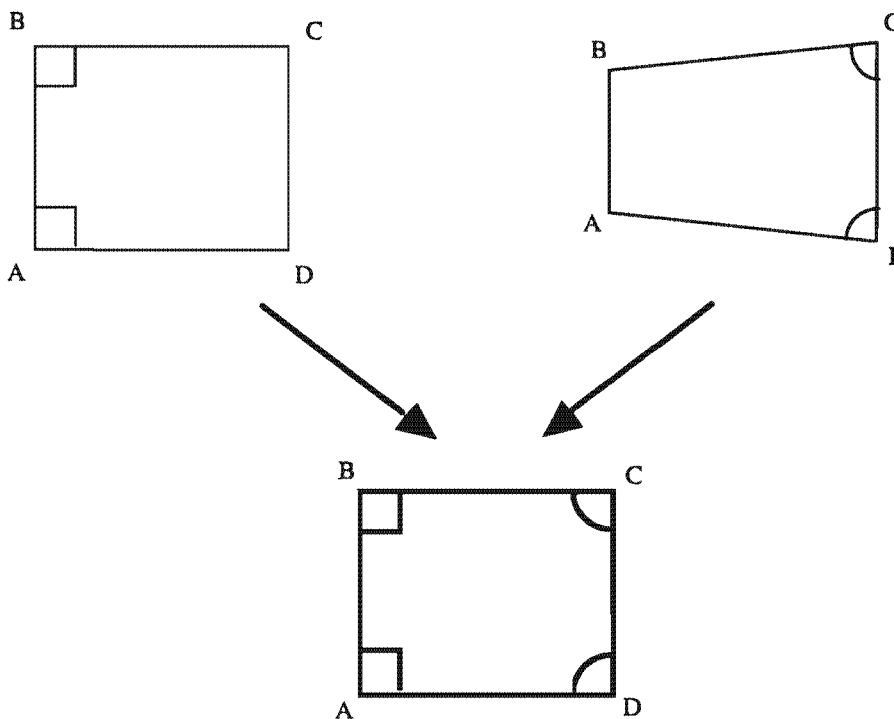
This axiom seemed to many geometers, probably including Euclid, to lack the desirable feature of self-evident truth. Rather than assume it as an axiom, they sought to derive it from the other axioms and from Euclid's first twenty-eight theorems, none of which uses the parallel axiom.

Gerolamo Saccheri (1667-1733) made the crucial attempt, as Bonola reports. Saccheri focused on a quadrilateral ABCD where angle DAB and angle ABC are right angles, and where line segments AD and BC are equal:



Without using the parallel axiom, it is easy to prove that angles BCD and CDA must be equal. Saccheri did this. If we assume the parallel axiom, BCD and CDA must be right angles. Therefore, if we deny that BCD and CDA are right angles, we thereby deny the parallel axiom. Saccheri did just this, in the hope of deriving a contradiction from the denial, which would prove the parallel axiom by *reductio ad absurdum*.

But if BCD and CDA are not right, they are still equal, and so they must be either obtuse or acute. Saccheri sought to show that, in either case, a contradiction follows. He assumed that they are acute; that is, he performed the following conceptual integration:



Both inputs are routine Euclidean figures. Both have a quadrilateral $ABCD$, equal line segments AD and BC , equal angles DAB and ABC , and equal angles BCD and CDA . The blend takes this structure from both inputs. But the first input has right internal angles DAB and ABC , and the second input has acute internal angles BCD and CDA . The blend takes the right angles from the first input and the acute angles from the second. The blend is impossible in Euclidean geometry, but Saccheri never really found a contradiction for this blend. He carefully drew many conclusions about this blend that he regarded as repugnant elaborations of the blend's inherent falsity but that today count as foundational theorems of hyperbolic geometry.

It is important to see that all of Saccheri's elaboration of the blend followed everyday procedures of Euclidean geometry. The input spaces are Euclidean and familiar; the elaboration procedures are Euclidean and familiar. The only thing new in the process is the selective, two-sided projection to create the blend. Saccheri's line of reasoning, far from being exotic, is the uniform strategy of all *reductio* arguments in logic and mathematics: a system of inferential principles that is taken to be consistent is applied to a structure that may not be consistent. Saccheri imagined

that he was conducting what could only be a *reductio ad absurdum* argument, and he hoped that the inevitable contradiction would be forthcoming. Those who came after him reinterpreted the same proofs not as *reductio* arguments but as steps in the development of a new and consistent branch of geometry.

It happens that there are many equivalent ways to produce a blend that delivers hyperbolic geometry. All that is needed is a blend that requires the interior angles of a triangle to sum to fewer than 180 degrees.

Saccheri is not credited with the invention of non-Euclidean geometry. As Kline (1972:869) summarizes and simplifies the history,

[i]f non-Euclidean geometry means the technical development of the consequences of a system of axioms containing an alternative to Euclid's parallel axiom then most credit must be accorded to Saccheri and even he benefited by the work of many men who tried to find a more acceptable substitute axiom for Euclid's.

Credit is given instead to Gauss, Bolyai, and Lobatchevsky for recognizing (but not proving) that hyperbolic non-Euclidean geometry is mathematically consistent, and to Gauss for recognizing that physical space might be non-Euclidean.

Blending and Metaphor

If metaphor is the understanding of something in one conceptual domain, like business competition, by conceptual projection from something in a different conceptual domain, like boxing, then none of the blends we have seen so far is essentially metaphoric. The hyperbolic geometry network lies within the domain of geometry and the two inputs are not related by metaphor. The pronghorn network lies within the domain of North American pronghorns, and the modern pronghorn is the evolutionary, not the metaphoric, counterpart of the historical pronghorn. The Pathfinder spoof lies within the domain of spacecraft landing on a planet. Its input stories have literal counterparts: planets, spacecraft, landings, and balloons.

Yet metaphoric projections also typically involve blending in ways that have gone unnoticed. Here is an example that forces us to notice the blending. As I write, the Dow Jones Industrial Average has rocketed past 8000, but just a few months ago, it stood at 6500 as investors had become cautious, even bearish. Reuters news service reported:

U.S. stocks ended sharply lower on Wednesday after an attempt to extend a one-day rally was quashed. Market players said investors were unwilling to return to the market amid fears that rising interest rates would lead to further

losses in the days ahead. 'Everybody has their horns pulled in', said Arnie Owen, director of equities at Kaufman Brothers.

'Everybody has their horns pulled in' exploits a conventional metaphor in which a market charging up is a bull and aggressive investors with confidence in the market are also bulls. In the target story of investment, there is a linear scale of confidence in the market, linked as causal to a linear scale of investment. In the source story of bulls, a bull is a bull is a bull and the length of a bull's horns is fixed. But in the blend, length of horn is degree of confidence and investment, and so, in the blend, a bull/investor can increase or decrease the size of its horns.

Consider the standard view that metaphor and analogy make their contribution by projecting structure from the source to the target or by finding shared structure. The metaphor of 'horns pulled in' does not fit this view. It does not project the nature of horns from the source onto the target or find structure they share. Instead, it works by creating a blend. The horns in the blend have a variable nature incompatible with the horns in the source. Certainly this is an example of metaphor, and the metaphor is certainly unidirectional—we understand investors by projection from bulls and bears, not bulls and bears by projection from investors—but the central inferential mechanism is neither projection from source to target nor detection of structure they share.

There can be multiple inputs to a blend and an input can be covert. For example, it is possible that the 'horns pulled in' blend has, for some readers, a covert input of 'animal retracting its claws'. In lucky cases, there is linguistic or conceptual evidence indicating the covert input, but not here. It would be useful to have psychological tests for detecting covert inputs.

The 'horns pulled in' blend is noticeable, but for the most part, blending is itself a covert operation that escapes notice. Consider 'that's a two-edged sword', used conventionally of arguments or strategies that are risky since they simultaneously help and hurt the user. In the domain of literal swords, two-edged swords are superb weapons, better for stabbing since both edges cut and better for slashing since both edges slash. Their superior performance explains their development and deployment despite the relative difficulty of manufacturing and maintaining them. But a two-edged sword in the blend is quite different: one edge of the sword/argument exclusively helps the user and the other edge exclusively hurts the user. It is not impossible for a literal warrior to be hurt by his own literal blade, the way it is impossible for literal bulls to retract their literal horns, but it is atypical, and even in the atypical scenario, it doesn't happen that one of the edges always hurts the user while the other always helps. If it did, the two-edged sword would be discarded for the one-edged model. This atypical scenario, recruited to the source under pressure from the target, still projects only selectively to the blend. The central

inference of the metaphor still does not arise by projecting the structure of the atypical scenario to the target or finding structure they both share.

Chinese Flags In A Capitalist Breeze

Metaphor often involves multiple blending:

HONG KONG, Tuesday, July 1—As dawn rises for the first time over red Chinese flags officially fluttering here in a capitalist breeze, the most fascinating question is not how China will change Hong Kong but how Hong Kong will change China. (Nicholas D. Kristof, 'Year of the Trojan Horse', *New York Times*, front page, 1997).

A flag is a metonymic symbol—e.g., fifty stars for fifty states. Understanding a nation metaphorically as a physical object (e.g. 'Austria was crushed during the negotiations') does not delude us into believing that the physical flag is actually the nation it represents, but blending may be at work in this metaphor. There are, now anyway, many American citizens with no political opinion about the burning of cloth, no visceral reaction to the expression 'I despise America', and a firm belief in protected free speech who nonetheless become so distressed at the image of someone burning an American flag that they want to make the act illegal. They refer to the act not as 'burning an American flag' but as 'burning *the* American flag'. In such a case, the flag may count as more than mere metonymic representation. In the blend, an attack on the flag is an attack on the nation. We are not trapped inside blends, but emotional reactions generated there can, like inferences generated there, leave their mark on reality.

The ceremony of raising a flag adds another metaphoric connection to this blend—*higher versus lower* maps to *governing versus governed*. In the blend, the raised flag is simultaneously a physical object, a flag, a higher physical object, a political entity, and a government. What it is raised above is simultaneously a geographical or architectural entity, a lower object, and a governed political or institutional entity.

The blend is useful in giving a concrete and realistic representation of government. We learn in grade school the fiction that the blend had legal causality: planting a flag on 'discovered' land made it the territory of the 'mother nation'. The raising-the-flag blend, with its evident psychological and emotional power, was exploited during Britain's handover of Hong Kong to the People's Republic of China. The 'handover' was portrayed to the world in a riveting and memorable scene in which the British flag was lowered and then the Chinese flag was raised.

'Raising the flag' is a standard blend in which power relations are given entirely by the fact that the flag is above. In this blend, there is no significance in

which way the flag blows or even whether it blows at all. But in the *New York Times* flag blend, new structure has emerged: China, a nation, a government, a physical object, specifically a flag, is now affected by physical force, a breeze, capitalism, Hong Kong, the governed political entity. This new blend uses the standard metaphoric connection between physical forces and causation to give an odd inference: the higher, governing element is controlled by what it governs; China, the flag, is controlled by Hong Kong capitalism, the breeze. This irony is the point of the article. It is further elaborated in many interesting ways—if China had not taken over Hong Kong, had not raised its flag over Hong Kong, then Hong Kong, the breeze, would have had no opportunity to influence China, the flag.

There is a second interesting reversal in the *New York Times* blend. In a different standard flag blend, there is indeed significance in which way the flag blows and whether the flag blows at all. In this blend, the flag is not merely a physical object but also an animate agent: flag and nation are personified, or at least given some features of animacy. This blend underlies descriptions of the U.S. flag as 'proudly snapping in the breeze' and of the 'once-proud Soviet flag' now 'drooping'. In this blend, internal psychology of the flag/person/nation causes the movement/behavior of the flag. Appearance is the index of psychology. But in the *New York Times* blend, the movement/behavior of the flag/nation is caused not by China but by something else—Hong Kong, the breeze, capitalism.

Examples like these suggest that basic metaphors should be reanalyzed to determine whether they depend upon hidden conceptual blending. We have argued elsewhere that basic metaphoric connections—such as the metaphoric connection between anger and heat, or between failure and death—give rise to conventional blends like 'Steam was coming out his ears' and 'You are digging your own grave'. In fact, even the most famous of all basic metaphors, the 'conduit metaphor of communication', analyzed by Michael Reddy in 1979, requires conventional blending. In this basic metaphor, a sender (speaker) places an object (meaning) into a container (expression) and sends it (expresses it) to a receiver (hearer) who opens the container (processes the expression) to take out the object (understand the meaning). This metaphor underlies expressions like, 'I am trying to put my thoughts into words' and 'I am not getting much meaning out of this poem'.

But we can also use the conduit metaphor in saying, 'Most of the meaning this poststructural critic finds in *Paradise Lost* simply isn't there'. In the source domain of physical objects and containers, 'finding' something presupposes its existence in the location where it is found, so it must be impossible to find a physical object in a container if it isn't in the container. But in the blend, the object/meaning depends for its existence upon the mental work of the receiver, so it can be there for the critic but not for the poet.

Visual blends

Before we turn to language, it is best to emphasize that blending is not restricted to language. Blending is, for example, common in visual representation, from Renaissance and early modern paintings of the Annunciation to contemporary newspaper cartoons. An issue of *The New York Times*, *The Economist*, *The Washington Post*, *Figaro*, or any American news magazine will usually include many visual blends, or rather, visual representations that evoke conceptual blends.

Consider an advertisement for a Zip disk, a data storage device in a squarish, flat housing. The circular hole in the middle of the casing reveals a metal circle used in turning the disk mechanically. The ad shows the Zip disk standing up, its central circle transformed into a camera lens. A small flash bulb and a shutter release button have been added, and a photographic print is rolling out of its lower section as if the Zip disk were a Polaroid camera delivering a print. The ad asks us to think of a Zip disk as a digital photo album—the storage disk is camera-like not in taking the picture but in delivering the picture, and is album-like in serving as a repository of the image. The image can go back into this disk-camera-album and come back out as many times as you like.

Visual representations that prompt for blends often exploit accidental connections ingeniously. The divided Apple Computer Corporation is depicted as a quartered apple, with printed circuits for flat interior surfaces and computer chips for seeds. An illustration on the cover of *The Economist* for a story about the dangers of genetic explanations of behavior depicts an abstract human being controlled like a puppet by threads/chains that are double helixes. A Samsung all-in-one office machine is depicted as a Swiss Army knife with its blades out: the helical corkscrew is the helical phone cord, and so on. A news story, 'Can Pepsi Become the Coke of Snacks: Using Fritos, Not Fizz to Conquer the World' shows distinctive snack foods pouring out of a Pepsi can. We are meant to construct a conceptual blend in which the Pepsi can is the Pepsi Corporation and the distinctive snack foods are produced by corporations owned by Pepsi.

An ad for the J.P. Morgan Company shows a man striding purposefully up the stairs. He is going to plummet, since the middle stairs are missing. But an enormous key—J.P. Morgan Company—is being pushed by three employees into place, its round head down and its blade in line with the stairs, so that its perfectly regular notches will serve as the missing stairs, arriving in place just as the man requires them to sustain his *ad astra* ascent into wealth. The caption for this visual blend exploits its unobvious nature—'Morgan means more than the obvious solution'. In small print, 'The obvious solution may not always be the one that takes you furthest'. Visual blends like these are common, once you look for them.

Conceptual Integration and Linguistic Constructions

Conceptual integration typically works below the horizon of observation. It is a general cognitive operation with many functions and wide application. It is routine, cognitively cheap, and not restricted to exceptional examples. It occurs dynamically in the moment of thinking, acting, and speaking, for local purposes, but its products can become entrenched. Often, it builds on those entrenched products to yield hyperblends. It interacts with other cognitive operations, such as analogy, metaphor, mental modeling, categorization, and framing.

Research on blending includes research on language. We have often argued (see, e.g. Turner 1991:206), that expressions do not mean, but are prompts, usually minimal, to construct meanings by working with mental processes we already know. The meaning of an expression is never 'right there in the words'. Understanding an expression is never understanding 'just what the words say'; the words themselves say nothing independent of the richly detailed knowledge and powerful cognitive processes we bring to bear.

Many expressions prompt for blending. To make this point, we have often cited the example of a modern philosopher saying in seminar, 'I claim that reason is a self-developing capacity. Kant disagrees with me on this point. He says it's innate, but I answer that that's begging the question, to which he counters, in *Critique of Pure Reason*, that only innate ideas have power'. In the blend, Kant and the philosopher are holding a debate. Words like 'agree', 'disagree', 'retort', 'answer', 'respond', 'counter', 'yes', 'no', 'yes and no', and so on can be used to pick out elements in the blend, and we know the relation of that 'debate' blend to the input story of Kant and to the input story of the modern philosopher.

'McJobs' asks us to think of a blend that constitutes an extended category of entry-level, low-paying, stultifying, impersonal, insecure jobs that offer little opportunity for advancement. Adjective-noun compounds like 'artificial life' and 'military democracy' have the same purpose. Noun-noun compounds like 'house boat', 'computer virus', 'bond ghoul', and 'same-sex marriage' also suggest obvious blends.

The Ditransitive Construction

It may be less obvious that clausal constructions can also prompt for blending. Consider the Ditransitive Construction in English, analyzed by Adele Goldberg (1995). A prototypical example is 'Bill gave Mary a gift', with prototypical syntax

NounPhrase1—Verb—NounPhrase2—NounPhrase3.

By itself, the verb 'give' evokes an abstract conceptual schema in which a causal agent, by some means, successfully causes the transfer of an object to a

recipient. Call this schema 'D' for 'ditransitive schema'. By itself, the verb 'pour' does not evoke D ('The water poured out of the drain pipe'), yet when 'pour' is used in the ditransitive syntax ('Bill poured Mary some wine'), the construction evokes schema D: Bill causes the transfer of a glass of wine to Mary.

For the complexities of the ditransitive construction and its relation to other constructions (e.g. 'I baked Joe a cake' versus 'I baked a cake for Joe'), we refer the reader to Goldberg (1995). Our purpose here is to use the English ditransitive construction as an illustration of the way in which a clausal construction can prompt for blending, especially including two-sided blending.

The ditransitive construction prompts for a blend B that has two inputs, D and ID is the abstract but highly-integrated ditransitive schema. I is a set of unintegrated elements to which the words refer. The blend B is *two-sided*, by which we mean that B takes some of its organizing schema-level structure from each of its inputs, D and I. Although Goldberg (1995) does not use the model of conceptual integration, various two-sided blends are implicit in her analysis. The following is a restatement of her claims in the vocabulary of the network model, with some slight changes.

If D and I have organizing schemas that match closely, their blend takes its organizing schema from both D and I. This is the case for verbs that inherently signify acts of giving an object (give, pass, hand, serve, feed ...), verbs of instantaneous causation of ballistic motion (throw, toss, slap, kick, poke, fling, shoot ...), and verbs of continuous causation in a deictically specified direction (bring, take ...).

But if the verb is a verb of refusal (refuse, deny) as in 'The boss denied Bill a raise', then the blend B takes the potential recipient and the potential patient from D but the causing of the not receiving from I, with the result that D is counterfactual with respect to B.

If the verb is a verb of giving with associated satisfaction conditions (guarantee, promise, owe ...), then the blend takes from I kinds of causal structure for reception that are not in D.

If the verb involves a scene of creation (bake, make, build, cook, sew, knit ...) or a verb of obtaining (get, grab, win, earn ...), then B takes from D intention to cause the recipient to receive the patient, and invites us to take success as well, but does not require it. If you 'feed Joe a cake', he almost certainly receives it, but not so if you merely 'bake Joe a cake' (and even less so if you 'bake a cake for Joe').

If the verb is a verb of permission (permit, allow...), then B takes enablement from I rather than successful causation from D.

If the verb is a verb of future transfer (leave, bequeath, allocate, reserve, grant ...), then the blend takes future transfer from I rather than successful causation of present reception from D.

These blends fall into conceptual classes, each class with its own two-sided organizing schema, and each with its associated classes of verbs. These two-sided conceptual blends, and the use of the ditransitive construction to evoke them, can become conventional, so that the ditransitive can be associated not only with the prototypical schema D but also with these various abstract two-sided blends.

In fact, this only scratches the surface of the conventional conceptual integration that can be prompted for by the English ditransitive construction. There are various metaphoric blends that have D as one input. Although Goldberg does not use the model of conceptual integration, there is a taxonomy of metaphoric blends implicit in her analysis, as follows:

(1) D is conventionally blended with an abstract schema for *causing an effect for an entity*. This produces a metaphoric blend in which the effect is an object and causing the effect for the entity is causing the object to come to the entity. This conventional blend inherits the ditransitive syntax from D, so one can say 'The medicine brought him relief' and 'She gave me a headache'.

(2) D is conventionally blended with a schema for *communication*. This produces a metaphoric blend, analyzed by Reddy (1979), in which meaning is an object and communicating it to someone is giving it to a recipient. This conventional blend inherits the ditransitive syntax from D, so one can say 'She told Jo a fairy tale'.

(3) There is a conventional blend of *motion of an object toward a recipient with perceiving*. In the blend, perceiving is reception of the 'perception' by the recipient. This metaphoric blend is exploited as a basis for producing a more detailed metaphoric blend, with D as one input and *causing someone to perceive* as the other. In this more detailed blend, a perception is an object and causing someone to perceive it is transferring it to him. This blend inherits the ditransitive syntax from D, so one can say, 'He showed Bob the view'.

(4) D is conventionally blended with *directing an action at another person*. In this metaphoric blend, the action is an object and directing it at another person is transferring it to her as recipient. This blend inherits the ditransitive syntax from D, so one can say 'She threw him a parting glance'.

(5) There is a conventional metaphoric blend of *constructing an object out of parts and developing an argument*. In this blend, facts and assumptions used in arguing are parts used in constructing. This blend is exploited as a basis for a more detailed blend, of D and *granting facts and assumptions to an arguer*. In this more detailed blend, granting a fact or assumption to the arguer is transferring it to her as recipient. This blend inherits the ditransitive syntax from D, so one can say, 'I'll give you that assumption'.

There is an interesting final case. Goldberg observes correctly that in expressions like 'Slay me a dragon', one of the input spaces has an agent performing an action for the benefit of someone else, and the first postverbal noun refers to the

beneficiary while the second postverbal noun refers not to what the recipient receives but rather to what the causal agent acts upon. We offer the following explanation, which we think follows the spirit of Goldberg's analysis closely even though it uses the model of blending and a mildly different array of input schemas.

D inheres in a more detailed but highly conventional schema D'. In D', someone brings a benefit to someone by transferring an object to him. For example, 'Bill gave me a dollar' is typically understood as meaning not only that a dollar was transferred but that a benefit (e.g., the ability to purchase) was conferred by means of the transfer. 'Mary poured Bob a glass of wine' is typically understood as meaning not only that a glass of wine was poured with the intention of transfer but also that a benefit (e.g., wherewithal for pleasure or nourishment) was intended to be conferred by means of pouring and (intended) giving. Of course D is not always an instance of D': 'My child handed me his banana peel' is probably D but not D', because there is no intended conferral of benefit. Nonetheless, the ditransitive syntax is attached not only to D but also to D', and, depending on vocabulary and context, it is usually a good strategy to try to interpret ditransitive syntax as evoking D'. In the ditransitive construction, the second postverbal noun always refers to the patient (metaphoric or not) of the causal agent's action, whether or not that patient is also the transferred object (metaphoric or not).

What happens in 'Slay me a dragon', 'Carry me two messages' (said by the Queen to her messenger), and 'Slide me a bass trombone' (sung by James Taylor to the band) is a two-sided, selective projection to the blend, with D' as one input, as follows. From D', the blend takes a causal agent performing an action on an object (metaphoric or not) and the intended consequent conferral of a benefit on someone, but the blend does *not* take the reception of an object. The blend inherits the ditransitive syntax associated with D', and, as always in the ditransitive, the patient of the causal action (*a dragon, two messages, a base trombone*) is assigned to the second postverbal noun.

The XYZ Construction

The XYZ construction is specialized to evoke blending. 'Money is the root of all evil' and 'Brevity is the soul of wit' are examples of this construction, first noticed by Aristotle, in the following passage:

'As old age (D) is to life (C), so is evening (B) to day (A). One will accordingly describe evening (B) as the 'old age of the day' (D + A)—or by the Empedoclean equivalent; and old age (D) as the 'evening' or 'sunset of life' (B + C). —*Poetics*, 1457B.

Consider 'Vanity is the quicksand of reason'. The XYZ syntax prompts for a conceptual mapping scheme involving conceptual integration³. The scheme is complicated: X (*vanity*) and Z (*reason*) are to be grouped into a single mental array; Y (*quicksand*) is to be placed inside a different mental array; some unspecified cross-domain mapping is to be found in which Y (*quicksand*) is the counterpart of X (*vanity*); an unmentioned W (e.g., *traveler*) is to be found in the Y (*quicksand*) domain such that W (*traveler*) can be the counterpart of Z (*reason*); X and Y are to be integrated (*vanity-quicksand*); W and Z are to be integrated (*reason-traveler*); the X-Z (*vanity-reason*) relation is to be integrated with the Y-W (*quicksand-traveler*) relation. A great deal—what the relevant conceptual domains are, their internal organization, what W and the other unmentioned counterparts might be, the nature of the relevant relations, and so on—must be constructed by the understander without further formal prompting.

The products of XYZ mappings are diverse:

Adams Morgan is the Greenwich Village of Washington, D.C.

He's the Babe Ruth of Hungarian kayaking.

Sex is the ancilla of art.

Sex is the poor man's opera.

Children are the riches of poor men.

The wages of sin is death.

The harlot's cry, from street to street, / Will be Old England's winding sheet
(Blake).

In 'Vanity is the quicksand of reason', the two mental arrays connected by the mapping (the *quicksand* space and the *reason* space) are radically unlike: one involves geographical travel while the other involves internal personal psychology. In contrast, 'Adams Morgan is the Greenwich Village of Washington, D.C.', has two mental arrays that share a specific conceptual frame: *city and its neighborhoods*. In 'Paul Erdos is the Euler of our century', the mental arrays connected by the mapping share not only a frame (*mathematician*) but many details not standard for that frame: both Euler and Erdos were exceptionally prolific; both lived a long time; both worked in a number of fields; each was eminent but never quite attained the status of a mathematician like Gauss and Newton; and so on. 'Erdos is the Euler of our century' feels quite different from 'Vanity is the quicksand of reason', but they

³ For the original work on the XYZ construction, see Mark Turner, *Reading Minds*, chapter nine, 'The Poetry of Connections, III'; and Gilles Fauconnier and Mark Turner, 1994, 'Conceptual Projection and Middle Spaces'.

involve the identical syntactic form paired with the identical pattern of conceptual mapping.

Satan, Sin, and Death

Literary works frequently prompt for highly intricate blending. Milton's portrayal of Satan as father in the second book of *Paradise Lost*, analyzed in Turner (1987), is an extended display of two-sided blending.

The commonplace notion of Satan is already a blend for which a conceptual domain has been elaborated. Satan is a blend of individual human being—thinking, talking, desiring, intending, and so on—and theological ontology. In the theological space, there are eternal features (e.g. evil) as well as non-human powers and limitations. Satan is anthropomorphic, but he has theological features and unhuman conditions. The blended domain for Satan is quite elaborated—Satan has like-minded colleagues in the form of a cohort of devils; Satan and the devils form an intricate hierarchical organization of social groups; and so on. This blended domain is entrenched both conceptually and linguistically. Consequently, although the blend is in some ways two-sided, expressions like 'The devil made me do it' or 'Get thee behind me, Satan'—or even expressions based on further blending, such as the reference to a child as a 'little devil'—do not feel especially figurative.

Milton extends this blend in ways that seem strikingly figurative and allegorical. Milton's theological space includes evil, disobedience, sin, death, and their relations, as well as the psychology of the prototypical sinner confronted with spiritual death. Milton's kinship space includes progeneration and kinship relations, especially the role *father*. He adds to the kinship space a pre-existing blend, of the birth of Athena from the brow of Zeus.

In Milton's blend, Satan conceives of the concept of sin; a fully grown woman, Sin, leaps from his brow. Satan is attracted to sin/Sin: he has sex with her. Although he does not know it at the time, his involvement with sin/Sin has a consequence, namely death—in the blend, Death is the male offspring of Satan's incestuous involvement with Sin. Death rapes his mother, causing her to give birth to a small litter of allegorical monsters.

After Satan has been sent to Hell and has decided to try to escape, he meets two characters at the gates of Hell who have been stationed there to keep him in. They are Sin and Death. He does not recognize them.

The mental spaces that contribute to this blended story—the kinship space and the theological space—correspond in some ways but not others. Milton draws from both of them, selectively, to create a two-sided blend. For example, he takes exclusively from the kinship space Sin's intercession between Death and Satan—father and son—when they are on the brink of terrible combat.

He takes exclusively from the theological space many central features, as follows. In the theological space, the cast of mind that goes with thrilling sin ignores the fact that mortality and spiritual death are sin's consequences and is appalled to acknowledge them. Hence, in the blend, Sin is surprised to have conceived Death, and she finds her son odious. Next, in the theological space, mortality and spiritual death overshadow the appeal of sin and are stronger than sin; acknowledging death devalues sin; willful, sinful desires are powerless to stop this devaluation. Hence, in the blend, Sin is powerless to stop her horrible rape by Death. In the theological space, the fact of spiritual death brings ceaseless remorse and anguish to the sinful mind, and the torments of hell bring eternal punishment. Hence, in the blend, the rape of Sin by Death produce monstrous offspring whose birth, life, actions, and relationship to their mother are impossible for the domain of human kinship:

These yelling Monsters that with ceaseless cry
Surround me, as thou saw'st, hourly conceiv'd
And hourly born, with sorrow infinite
To me, for when they list, into the womb
That bred them they return, and howl and gnaw
My Bowels, thir repast; then bursting forth
Afresh with conscious terrors vex me round,
That rest or intermission none I find.

Milton creates unobvious correspondences between the kinship space and the theological space. For example, he blends the unusual scenario of disliking a child with feeling horror at the fact of death. He blends the unusual scenario of a son raping a mother with the effect of death on sin.

Perhaps most ingeniously, he blends the unusual medical frame of traumatic vaginal birth that physically deforms the mother, making her less attractive, with the way sin becomes less attractive once death is acknowledged as its outcome:

At last this odious offspring whom thou seest
Thine own begotten, breaking violent way
Tore through my entrails, that with fear and pain
Distorted, all my nether shape thus grew
Transform'd.

Although Milton's portrayal of Satan as a father is two-sided, it preserves considerable structure associated with *father* and *birth*. Consider first the paternity of Death. The 'father' has human form and speaks human language, is excited by feminine beauty, and has anthropomorphic sex with an anthropomorphic female in a

prototypical human scene. There is a birth through a vaginal canal. The son inherits attributes of both father and mother. Father and adolescent son have a conflict over authority. And so on. Now consider the paternity of Sin. The father again has human form and speaks human language. There is an offspring in human form, who emerges from a container-like body part and who develops into a sexual being.

Other examples, taken from *Death is the Mother of Beauty*, show a different projection from the space of *father* and *birth*. 'Satan, liar and father of lies' does not take the anthropomorphic offspring. 'The acorn is the father of the oak' takes neither anthropomorphic form nor anthropomorphic progeneration for either father or child. 'Thy wish was father to that thought' (Shakespeare) does not take physical distinction for either father or child. Similar two-sidedness appears in 'Fear, father of cruelty' (Ezra Pound), 'Pain is the father of complaint' (Sidney), 'Love's extremity is the father of foul jealousy' (Spenser), and 'Pale desire, father of Curiosity', (Blake).

Consider as a final example the XYZ expression 'The child is the father of the man' (Wordsworth). The two inputs—father-and-child versus child-growing-to-man—come from the same conceptual domain, human life. But the example feels figurative, for the following reasons. First, the cross-space connections are highly resisted because they run counter to usual categories: *Immature child* in the first input has as its counterpart *father* in the second input, and *grown man* in the first input has as its counterpart *immature child* in the second input. Second, the blend must integrate frame-level structure from both inputs in a particularly surprising way. The chronological *child* in the blend takes from the input of father-and-child the relative influence (and even causal role) of the father, but it takes from the input of child-to-grown-man the relative *youth* of the child. The chronological *man* in the blend takes from the input of child-to-man the maturity of the man, but it takes from the input of father-and-child the dependency of the child.

The oddness of its counterpart connections and the extensive two-sidedness of its blend help make Wordsworth's line feel figurative. But the syntax and mapping scheme of 'The child is the father of the man' are the same as the syntax and the mapping scheme of 'John is the father of Mary'. Both prompt for a conceptual mapping scheme involving conceptual blending.

The Scope of Blending

The cognitive study of language, which seeks an approach to language fitting the empirical facts, goes beyond both a philological interest in the history of words and a formal interest in the patterns of grammar to a cognitive scientific interest in basic mental operations that underlie language and that are indispensable to human understanding. Conceptual blending is a basic mental operation. It plays a role in grammar, semantics, discourse, meaning, visual representation, mathematics, jokes,

cartoons, and poetry. It is indispensable to the poetics of literature because it is fundamental to the poetics of mind.

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