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Abstract

People use lay theories to understand their worlds, including the body and diseases. Conceptual metaphors are similar to lay theories, in their use of a simple domain to understand a more complex one. Unfortunately, some conceptual metaphors about the body prompt inferences about health and illness that ultimately have negative consequences. We explore two such cases. Metaphors relating cancer to a *war with an enemy* imply an incorrect view of the disease that leads to ineffective strategies for prevention. Metaphors relating the body to a *machine* misrepresent its kind as well as its amount of complexity in ways that can lead medical research astray. Awareness of these metaphors and their inferences can help health professionals avoid mistakes.

Keywords: metaphors, metaphoric framing, health, cancer, illness, physiology, judgment, intention

Lay theories of health and illness

How do we understand how our body works? How do we explain what is happening when someone is in pain or is displaying symptoms? How do we infer the best ways to treat disease? We often understand abstract concepts like the body and disease by linking them to domains that are easier to understand (Lakoff & Johnson, 1980). These links are referred to as conceptual metaphors, and they are often seen in the lay metaphors people use to discuss these topics. As we will discuss in this chapter, conceptual metaphors are an important source of lay theories of how the body and disease work. For example, enemy metaphors affect how people think about cancer and cancer prevention, and machine metaphors guide the focus of medical research. Hence, medical professionals should be aware of the metaphors they use and the inferences these metaphors invite.

Conceptual metaphors and lay theories

Because they are not objects that provide direct sensory experience, abstract concepts are inherently difficult to comprehend and represent. What do we think of when we think of justice? What picture pops up in our head when consider morality? Few of us have firm representations of these concepts that automatically activate when we encounter them.

In contrast, most of us have an easier time comprehending and representing concrete concepts, things with which we have direct sensory experience. It is much easier to think of dogs than of justice. A clearer picture pops into mind when we consider apples than morality. Things that we directly encounter are easier to comprehend and have more stable cognitive representations (Barsalou, 1999; Paivio, 1971, 1986).

So then, how do we understand and represent things that we can never directly experience? Conceptual metaphor theory (Lakoff & Johnson, 1980; 1999) suggests that we do so by linking them to easier-to-understand concrete domains. This saves cognitive effort and provides readily available representations of abstract concepts. Rather than struggling to comprehend an abstract concept like time, we instead think about it in terms of a domain we much more experience with, such as physical space (Boroditsky, 2000; Boroditsky & Ramscar, 2002; Hauser, Carter, & Meier, 2009). We can move future events around in time just like we can move a chair around a room – we can reschedule events and *move them forward or backward* a few days. We can

approach future events, while we can leave the past *behind us*. These conceptual metaphors bring a host of easy-to-reach inferences about what time is like and how it is structured that makes thinking about it much easier. They simplify representations of abstract concepts in terms of easier-to-understand, familiar domains.

Conceptual metaphors are ubiquitous. One can spot them in common conversational conventions. We talk about divinity and valence by drawing upon verticality (Meier, Hauser, et al., 2007), moral purity by drawing upon cleanliness (Schnall, Benton, & Harvey, 2008; Lee & Schwarz, 2010), friendliness by drawing upon warmth (Williams & Bargh, 2008; IJzerman & Semin, 2009), and importance by drawing upon heaviness (Jostmann, Lakens, & Schubert, 2009; Chandler, Reinhard, & Schwarz, 2012; Hauser & Schwarz, 2015a; see Landau, Meier, & Keifer, 2010, for more examples). Multiple conceptual metaphors can also be used to comprehend the same domain. As alluded to earlier, we use physical space to think about time (Boroditsky, 2000), but we also think about time as if it is money (Lakoff & Johnson, 1980). Time can be *spent, stolen, wasted, exchanged, loaned*, etc. This conceptual metaphor makes many of the same ways of thinking about money relevant to thinking about time. Not only can abstract concepts utilize multiple conceptual metaphors, but also each metaphor can explain and highlight different attributes of the abstract concept. Relating time to space highlights the dynamic nature of events within time, such as how they can be moved and how we perpetually draw closer to future events, whereas relating time to money highlights the value of time, facilitating decisions such as whether I should spend the morning writing a manuscript or watching television. Different conceptual metaphors often provide different explanations of the same abstract concept.

As explained in earlier chapters, lay theories are explanations that people use to understand and predict the world. Whether it is a lay theory of intelligence as fixed or malleable (Dweck, 1999), self-control as a depleteable resource (Job earlier chapter, XXX), or mind wandering as controllable or uncontrollable (Zedelius earlier chapter, XXX), lay theories provide simplified accounts of complex phenomena. People draw upon these lay theories to understand their own thought processes and the social world, which then guides decisions about their behavior.

Conceptual metaphors share much in common with lay theories. Both provide simplified explanations which people use to inform their reasoning and behavior. In that

way, both are adaptive by helping people easily represent ambiguous situations. However, both can be maladaptive; certain lay theories of intelligence and self-control can have negative effects for how we respond to situations (Dweck, 1999; Job earlier chapter, XXX), and as will be shown, conceptual metaphors for cancer have negative effects on how we think about the disease (Hauser & Schwarz, 2015b).

We propose that conceptual metaphors can function similarly to lay theories. Most lay theories state that a domain has an all-important attribute. Intelligence is fixed or malleable (Dweck, 1999) or mind-wandering is uncontrollable or controllable (Zedelius, XXX). Conceptual metaphors operate similarly by highlighting important attributes of the abstract concept that fit with the concrete domain (Lakoff & Johnson, 1980; 1999). "Time is money" metaphors imply that time is valuable, and as we discuss later, "cancer is an enemy" metaphors imply that limitation is unimportant (Hauser & Schwarz, 2015b). Many lay theories even seem to draw upon conceptual metaphors. Lay theories of self-control (Job earlier chapter, XXX) often hinge upon the conceptual metaphor that self-control is a limited resource, like the natural oil in the earth or the gasoline in your car. Indeed, conceptual metaphors and lay theories function similarly in that they both carry implications about a social domain's important attributes.

Of course, this is not to say that conceptual metaphors and lay theories are fundamentally indistinguishable from each other. Each arises through different processes, and the research traditions surrounding each rarely intersect. However, we will treat them as interchangeable for the purpose of this chapter. When it comes to how people think about health and disease, conceptual metaphors and lay theories operate similarly. They each suggest a crucial attribute about a phenomenon that can guide reasoning and behavior.

Conceptual metaphors of health and disease

Bellicose metaphors and cancer

America is *waging a war* on cancer. Many patients are *fighting* and *battling* the disease. Cancerous cells *attack* our bodies, and we try to *destroy* them with treatment. President Obama claims that "now is the time to commit ourselves to *waging a war* against cancer *as aggressive as the war that cancer wages against us*" (emphasis added; Lennon, 2009).

As shown here, public discourse commonly relates cancer to a hostile enemy invader that we must attack and defeat (Sontag, 1978). It is the most popular conceptual metaphor employed by science journalists (Camus, 2009) and cancer patients in online forums (Semino, Demjen, Demmen, Koller, Payne, Hardie, & Rayson, 2015). In everyday American discourse, two of the top ten verbs used to describe cancer call upon this metaphor (*fight* cancer and *battle* cancer; Davies, 2008, cited in Hauser & Schwarz, 2015b).

However, these bellicose metaphors were not always dominant. They surfaced only in the 1930s, when Mary Lasker joined the American Cancer Society and used the metaphor to lobby for research funding. Her efforts were ultimately successful, as the National Cancer Act of 1971 was passed, marking the beginning of the government's "War on Cancer" (Mukherjee, 2010). Thus, war metaphors began as a way to drum up support for cancer research, and they have been effective.

Somewhere along the way, however, these metaphors transformed how people think about cancer in general. Many metaphors center on how the public should act towards cancer, such as sayings like "We need to *fight* and *beat* cancer." Other sayings portray cancer biology and treatment in bellicose terms, positing that cancerous cells *attack* the body and that our cancer treatments are the *bullets* and *ammunition* that we use to *destroy* cancer. Others link cancer treatment to the metaphor, like books the detail the foods that *fight* cancer or the cancer *fighting* diet (Beliveau & Gingras, 2006). These bellicose expressions are interesting examples of how metaphors may become overextended. While they had positive effects on support for cancer research, they have now come to explain other aspects of cancer, such as its biology, treatment, and prevention, with potential negative effects (Aktipis, Maley, & Neuberg, 2010).

Simple exposure to this pervasive metaphoric language may negatively affect how people think about cancer. Encountering a metaphorically-framed concept induces people to conceptualize the concept in terms of the metaphor (Lakoff & Johnson, 1980; Landau, Sullivan, & Greenberg, 2009; Gibbs, 2014; Ottati, Renstrom, & Price, 2014; Thibodeau & Boroditsky, 2011). This highlights attributes of the concept that fit with the source domain and de-emphasizes attributes that are not relevant to the source domain. For instance, reading that crime is a *beast* that *attacks* a city leads people to propose more punitive solutions to a crime wave while reading that crime is a *virus* that *infects* a

city leads people to propose more reformative solutions (Thibodeau & Boroditsky, 2011). Thus, exposure to bellicose metaphoric framings of cancer leads people to think of cancer as an enemy, prompting them to map their knowledge of enemies (such as how they arise, how to deal with them, etc.) onto how they think about cancer. Dealing with enemies tends to encourage active, masculine behaviors aimed at attacking and defeating the enemy. In contrast, limitation and restraint are de-emphasized as ways to deal with enemies. One does not often see limitation and restraint nominated as effective ways to attack enemies (see pilot collocation study in Hauser & Schwarz, 2015b for more information). So, exposure to bellicose metaphors de-emphasizes limitation and restraint as effective ways to deal with cancer.

This metaphoric representation of cancer is only beneficial if it closely maps onto the actual effective ways to deal with cancer. Unfortunately, it does not. Many effective cancer prevention behaviors involve limiting behaviors that are known to increase the risk of cancer, such as smoking, sunbathing, and eating foods associated with cancer. Processed foods, red meats, high fat foods, and high calorie foods increase the risk of cancer, and limiting their intake decreases the risk (World Cancer Research Fund & the American Institute for Cancer Research, 2007; Kushi et al., 2012). Viewing cancer as war against an invader may decrease motivation for these effective prevention behaviors. Because it does not make sense to limit yourself in order to fight enemies, then it might not make sense to limit yourself in order to fight cancer. These bellicose framings may convey information about prevention that is ultimately harmful for public health.

Does simply reading bellicose metaphors affect how people think about cancer? To test this possibility, we (Hauser & Schwarz, 2015b, study 1) recruited sixty-four participants for an online survey about cancer. We gave them information to read about cancer that was manipulated to either use surface metaphoric utterances relating cancer to a *hostile enemy* that needs to be *fought* or not (randomly assigned). For example, for our enemy metaphors group, participants read that “Cancer is a broad group of disease characterized by the *hostile* growth and *invasive* spread of abnormal cells,” whereas for our control group, the italicized words were eliminated.

Then participants were asked what cancer prevention behaviors they could think of. This question was also metaphorically framed. For participants in the enemy

metaphors group, the question ended by asking “what things would you do to fight against developing cancer” while for the control group, the question ended by asking “what things would you do to reduce your risk of developing cancer.” Participants listed behaviors on separate lines and coders rated whether those behaviors involved limiting a behavior known to increase the risk of cancer or increasing a behavior known to decrease the risk of cancer.

As expected, enemy metaphors lessened how often people thought about limiting risk-increasing behaviors. Participants in the control condition listed, on average, two risky behaviors to limit. However, participants who read that cancer was *hostile* and *invasive* listed, on average, only one and a half risky behaviors to limit, a significant 25% reduction. As hypothesized, reading bellicose metaphors forces people to bring attributes of enemies to bear on their representation of cancer. Because it does not make sense to limit yourself in order to fight enemies, limiting yourself does not come to mind as a way to fight cancer. These metaphors portraying cancer as a battle decrease cognitive access to effective prevention behaviors.

Do these bellicose metaphors only affect how people think about cancer, or do they also affect what people intend to do? We addressed this question in a second study (Hauser & Schwarz, 2015b, study 2) on three hundred people who took an online survey on health messages. Participants were randomly assigned to read one of three similar messages about colorectal cancer, modeled upon information disseminated by the American Cancer Society (*Cancer Facts & Figures*, American Cancer Society, 2012). The control message used few metaphors and discussed colorectal cancer and its risk statistics. The enemy metaphor message added only six words to the control message, and those words framed cancer as a *hostile enemy*. Finally, the imbalance metaphor message added only five words to the control message, and those words metaphorically framed cancer as *imbalance*.

After reading one of those three messages (randomly assigned), participants rated how much they intended to limit behaviors known to increase their risk of colorectal cancer (limit eating red meats, limit eating high fat foods, etc). Similar to study 1, bellicose metaphors lessened people’s intention to limit risky behaviors. Participants who read a message saying that cancer was *hostile* had less intention to limit risk-increasing behaviors compared to participants who read the control message and

participants who read the imbalance metaphor message. Thus, the effect is not a metaphoric-framing effect in general, but rather it is specific to talking about cancer as if it is a *hostile enemy* that needs to be *fought*. Exposure to bellicose metaphors not only undermines how often limitation comes to mind, but it also undermines people's intentions to limit risk-increasing behaviors.

These studies point to the power that conceptual metaphors have on people's beliefs of how cancer works, and a metaphoric fit mechanism seems to drive the effects. Statements that draw upon the same metaphors are processed more fluently than statements that draw upon metaphors from different domains. When the attributes of a concept clash with someone's metaphoric representation, processing is hindered (Thibodeau & Durgin, 2008, 2011). Therefore, an enemy representation of cancer only advocates ways to deal with cancer that have the same attributes as ways to fight an enemy. Because limitation by default does not seem like an effective way to fight an enemy, an enemy representation undermines accessibility of it and intentions for it.

A third study (Hauser & Schwarz, 2015b, study 3) provided further evidence of this process, demonstrating that the negative effect of bellicose metaphors is eliminated when limitation strategies are framed in a way that fits with fighting enemies. When risk-increasing behaviors were framed as "weakening the body's ability to fight cancer," then the negative effect of the enemy metaphor message was eliminated. Thus, limitation is not often thought of as a way to fight enemies, but if one frames it as such, then it motivates people to lessen behaviors that are said to "weaken one's ability to fight."

Bellicose metaphors for cancer serve as an interesting example of how metaphors can go awry. They began as a way to motivate funding for cancer research, and they were quite successful at that (Mukherjee, 2010). However, the metaphors were extended into how people think about cancer biology, treatment, and prevention where they imply that many effective prevention behaviors for cancer are ineffective. Simple exposure to these metaphors undermines the extent that people think of several prevention behaviors and undermines whether people intend to do them. Everyday language has the power to shape people's beliefs of how cancer works and affect what people intend to do about it.

Machine metaphors and the body

The metaphor of the body as a machine looms large in the study of human biology and modern medicine (for reviews, see Osherson & Amarasingham, 1981; Nesse, 2016). It originated in the renaissance but became dominant during the industrial revolution of the 18th century, when empirical observation and mechanistic causal principles displaced vitalism (Westfall, 1977). Discoveries from medical dissection allowed philosophers such as Rene Descartes to draw parallels between the body and mechanical contrivances (Cottingham, Stoothoff, & Murdoch, 1984). Blood vessels appeared to operate similarly to hydraulic tubes. Muscles and bones functioned similarly to pulleys and levers. The body was explained in reductionist terms, with each body part serving a specific function and interacting with one another to form a functioning machine (Miller, 1978)

Medical discourse still relies on this metaphor today (Ochsner, 2010; Mumford, 1964), and it is seen often in how people talk about their ailments. Many diseases or ailments are described as due to broken or malfunctioning parts of the body. People often say they have *bad* shoulders or *bad* knees to describe chronic pain. Type I diabetes is said to stem from a *malfunctioning* pancreas, and cancerous tumors are even sometimes explained as resulting from *malfunctioning* cells which are *stuck* in "divide" *mode*.

This conceptual metaphor guides people's beliefs, forcing them to bring attributes of machinery to bear upon how the body works (Lakoff & Johnson, 1980; 1999). It implies that, like machines, the body is comprised of discrete parts, and each part has a specific purpose. These parts interact with one another in order to produce our health, as well as our thoughts and behavior. Disease and ailments are caused by malfunctioning, broken, or worn out parts (Osherson & Amarasingham, 1981). However, many aspects of how the body works do not fit with lay beliefs provided by machinery metaphors (Nesse & Williams, 1994). To that end, these metaphors oversimplify how the body works (Nesse, 2016).

For instance, machine metaphors suggest that the parts of the body are discrete, with clear boundaries between where one part begins and another part ends. Some boundaries are discrete, such as the tissue that surrounds the kidney. However, the many other boundaries are much more blurry, such as the blurry lines between many

different emotions (Larson & McGraw, 2011) and different aspects of the immune system.

The different parts of a machine also often serve one or a few specific purposes, so these metaphors also suggest that each body part has only a few specific purposes. Again, this is an oversimplification. For instance, the stress system exists not only to mediate arousal in dangerous situations, it also adjusts the body to cope in any situation when activity is necessary (Nesse, Bhatnagar, & Ellis, 2016). Also, some of its actions are not direct but instead function to limit damage that would otherwise be imposed by other aspects of the stress system (Munck, Guyre, & Holbrook, 1984). Even the eyebrows serve multiple functions, including nonverbal signaling and keeping sweat from the eyes.

Machines are designed by engineers who conceived of specific parts with specific functions. They also build in redundancies (i.e., backup systems) in case one part fails. In contrast, natural selection shapes systems with multiple intimately interacting parts that allow the whole system to continue functioning even if one aspect fails. Instead of specific backup systems, bodies have networks of systems. This has clinical implications. For instance, fever is useful to counter infection, but using drugs to block it is often safe because fever is part of a network of other defenses, including immune responses, cough, etc. Thus, demonstrating that drugs that block fever are safe does not imply that fever is an unnecessary epiphenomenon.

The main shortcoming of the machinery conceptual metaphor arises from evolution. Machines are designed, meaning that parts and processes that were no longer efficient or useful would be removed and replaced with new ones. Humans, on the other hand, are evolved. Natural selection is limited to tinkering in ways that leave bodies with many vulnerabilities, such as the opening of the windpipe into the pharynx where it can be obstructed by food, and the extraordinarily roundabout path taken by the laryngeal nerve down into the thorax before it ascends to the vocal cords. Similarly, the spine evolved to serve four-legged creatures. Standing upright must have given hugely-adaptive advantages given the manifold of problems it encourages, including back pain, hemorrhoids, hernias, varicose veins, and knee and ankle pain. Natural selection works to reduce such problems, but only on a scale of millions of years, and subject to severe constraints such as the inability to start a new design from scratch. Much modern human

disease results from the marvelous environments we have created to meet our every need. For instance, our appetite regulation mechanisms were shaped in environments where fat, salt, and sugar were in short supply, so the obesity epidemic is now overwhelming (Pilj, 2011).

The machine metaphor encourages reductionism and an exclusive focus on the body's mechanisms, resulting in extraordinary over-investments in research at the cellular level, and underinvestment in studies of environmental factors. For instance, the vast bulk of research on multiple sclerosis focuses upon brain mechanisms, but rates are an order of magnitude higher in modern environments (Correale & Farez, 2007). Explaining these differences in prevalence should be a major priority. Human populations that routinely have high burdens of worms have very low rates of multiple sclerosis (Correale & Farez, 2007), but the exact nature of the relationship remains unclear even as most research continues to focus on biochemical and immunological mechanisms.

The machine metaphor has also encouraged a model of the brain that has not lived up to empirical observation. For decades, researchers believed that the brain operated similarly to a machine; each part of the brain executes a specific function. Many also believed that specific areas of the brain would map on to specific concepts, with some parts “activating” during thought of a single concept (see discussion of localization in Kosslyn & Anderson, 1992). For instance, the amygdala has been thought to be devoted to fear learning (LeDoux, 2003); however, its functions turn out to be far more diverse, being involved in social learning, self-control, aggression, and reward learning (Balleine & Killcross, 2006). Research proposed a brain location for processing faces (the fusiform face area; Kanwisher, McDermott, & Chun, 1997), but the same area also is activated when car experts look at pictures of cars and when bird watchers look at pictures of birds (Gauthier, Skudlarski, Gore, & Anderson, 2000). While the machine metaphor encouraged models of a localized brain, it appears that brain regions serve multiple functions and are often neither necessary nor sufficient for any one specific function.

The idea that the body is a machine has led to many improvements in medicine, such as a departure from animism. However, it fosters beliefs about the body that oversimplify ideas of how it works and how disease works. Because humans are

evolved, they are fundamentally different from well-designed machines (Nesse & Williams, 1994; Nesse, 2016). These beliefs about the body guide medical research in potentially problematic ways that can potentially be prevented by recognizing that the organic complexity of the body is fundamentally different from the designed complexity of machines (Nesse, Ganten, Gregory, & Omenn, 2012).

Awareness of metaphors in practice

Conceptual metaphors provide beliefs about complex issues and concepts (Lakoff & Johnson, 1980). They are useful, but their costs can be considerable. Enemy metaphors for cancer suggest that prevention strategies based on limitation are unimportant (Hauser & Schwarz, 2015b). Machine metaphors for the body suggest the body's mechanisms are like those designed by an engineer, when in fact they are characterized by fundamentally different organic complexity (Osherson & Amarasingham, 1981; Nesse & Williams, 1994; Nesse, 2012, 2016). These beliefs guide how people behave. Enemy metaphors spur research investment and active efforts to conquer cancer; however, they also have negative effects on cancer prevention. Machine metaphors have been essential to escape vitalism and motivate research to delve more deeply into reductionist detail; however, they misrepresent the organic complexity of the body in fundamental ways.

Human minds rely on metaphors, so there is no escaping them. However, medical professionals and organizations should be more cognizant of the metaphors they use. Increasing our recognition of their applications in medicine and disease may help to maximize their benefits and minimize their costs (Hauser & Schwarz, in press). In particular, even though these metaphors may be intended as simple linguistic flourishes, casual use of metaphors by medical professionals can result in widespread misimpressions about diseases.

More attention to the use of metaphors in medicine also provides opportunities to offer superior metaphors. For instance, the long-standing belief that bacteria are bad invaders is being replaced quickly by recognition that they are beneficial partners in an ecosystem that is required for our guts, and our bodies more generally, to function normally (McFarland, 2006). Also, while negative emotions continue to be viewed as abnormal, recognizing that they are states shaped by natural selection because of their

benefits offers opportunities to study them with greater sophistication in ways that hopefully will reduce the burdens of anxiety disorders and depression.

Preferably, medical professionals, educators, and even popular media should try to avoid metaphors that promote harmful inferences and use only ones that promote helpful or more accurate inferences about the body. It is not safe to assume that metaphors that worked in one domain will also work in another. This was the issue with enemy metaphors for cancer; these metaphors worked well for securing funding for cancer research (Murkherjee, 2010), but when applied to the biology of cancer genesis and how to prevent and treat cancer, they promoted harmful inferences about cancer prevention (Hauser & Schwarz, 2015b).

Given the pervasiveness of metaphor in shaping how we think about the body and disease, and its implications, positive and negative, for medical research and treatment, intensive research on the role of metaphor in medicine is needed. Research should focus on the inferences that people draw from metaphorical language in order to assure that metaphorical language does not undermine public health or research efforts. Research can elucidate the metaphors that promote healthy behaviors or ones that closely map onto important or accurate features of a domain. Shedding light on the optimal (and suboptimal) metaphors for the body may provide a rich agenda for future collaborations between scholars in medicine, psychology, and communication in the coming years (Hauser & Schwarz, in press).

Conclusion

Conceptual metaphors provide lay theories of how the body and how disease work. However, they can ultimately oversimplify these abstract, complex domains. Beliefs that cancer is an enemy make certain prevention behaviors seem less effective. Theories that the body is a machine spur oversimplified beliefs about how the body works. Thus, professionals should be more aware of the metaphors they use, and research should investigate the ideas that these metaphors imply.

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Zedelius. mind wandering as controllable or uncontrollable (Zedelius earlier chapter, XXX)