

# Analysis sheds light on how metaphors like 'sheds light' evolved

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**Table 1**  
Examples of metaphorical sense mappings predicted by each model (ordered alphabetically).

Model	Source Domain (rating) → Target Domain (rating)	Sample Words	Attested Period
<i>Animacy</i>	Male person (6.5) → Courage (2.0)	Manly	Old English
<i>Animate → Inanimate</i>	Reptiles (6.4) → Bad (1.9)	Serpent	1350–1400
<i>Concreteness</i>	Reflection (of light) (6.0) → Virtue (1.6)	Clear	1350–1400
<i>Concrete → Abstract</i>	Plants (6.8) → Pride (2.5)	Flourish	1350–1400
<i>Embodiment</i>	Sense & speech organs (6.5) → Rivers & streams (2.6)	Mouth	Old English
<i>Embodied → Disembodied</i>	Strength (5.9) → Politics (2.2)	Stalwart	1850–1900
<i>Externality</i>	Light (6.4) → Thought (1.1)	Reflect	1550–1600
<i>External → Internal</i>	Textiles (6.7) → Belief & opinion (1.0)	Spin	1950–2000
<i>Intersubjectivity</i>	Textiles (5.7) → Difficulty (3.3)	Mesh	1500–1550
<i>Agreeable → Disagreeable</i>	Birth (5.4) → Faith (3.3)	Reborn	1550–1600
<i>Valence</i>	Relative position (4.1) → Excitement (6.4)	Up	1300–1350
<i>Neutral → Valenced</i>	Semi-fluidity (4.3) → Moral evil (1.3)	Slime	1550–1600

*Note.* Each row shows (1) a type of model, (2) examples of metaphorical domain-to-domain mappings consistent with the predicted mapping directions of that model, (3) sample words that have senses within each of the domains, and (4) the first attested time period in which senses exemplifying the domain-to-domain mapping emerged.

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As language develops over time, its limits have forced us to economize. In the evolution of English, the most common way this is accomplished is through imbuing existing words with multiple meanings.

"New word meanings come about when there's a need to express something new," says Barbara Malt, professor of psychology and

director of the Cognitive Science Program at Lehigh University. "For instance, the original meaning of the word 'grasp' only described holding something physically. Later, 'grasp' also came to mean holding something in a metaphorical sense, such as 'grasping an idea.'"

Is this crossing-over from one realm of meaning to another random? Or does it follow a pattern?

In the first study of its kind, Malt and colleagues at the University of California, Berkeley have found that this evolution of word meanings from one "domain" to another (called metaphorical mapping) occurs in a systematic - even, predictable - way.

"We found that a compact set of variables, including externality, embodiment and the degree of emotionality explain the directionality in the majority of about 5,000 metaphorical mappings recorded over the past 1100 years," said Malt.

In other words, over the past millennium, word senses have largely evolved from literal domains to metaphorical domains. Words that originally had only concrete or external meaning have grown to also have meaning in the realms of the abstract and internal. This team of researchers - Malt , as well as Mahesh Srinivasan, a developmental psychologist who studies metaphor and Yang Xu , a computational linguist who uses big data to uncover patterns in language, both at University of California, Berkeley - is the first to show that this progression has followed a compact set of psychological and cognitive principles and that the movement across realms can be predicted.

Their findings will be published in an [article](#) in a forthcoming issue of *Cognitive Psychology* called: "Evolution of word meanings through metaphorical mapping: Systematicity over the past millennium."

Using cognitive psychology, computational and historical linguistics and big data, the trio determined the strongest sources of metaphorical word senses have been in the following domains: textiles; the supernatural; digestive organs; hardness; softness; ruminants (a category of mammal); cultivated plants; wetness; darkness; and, solidity and density.

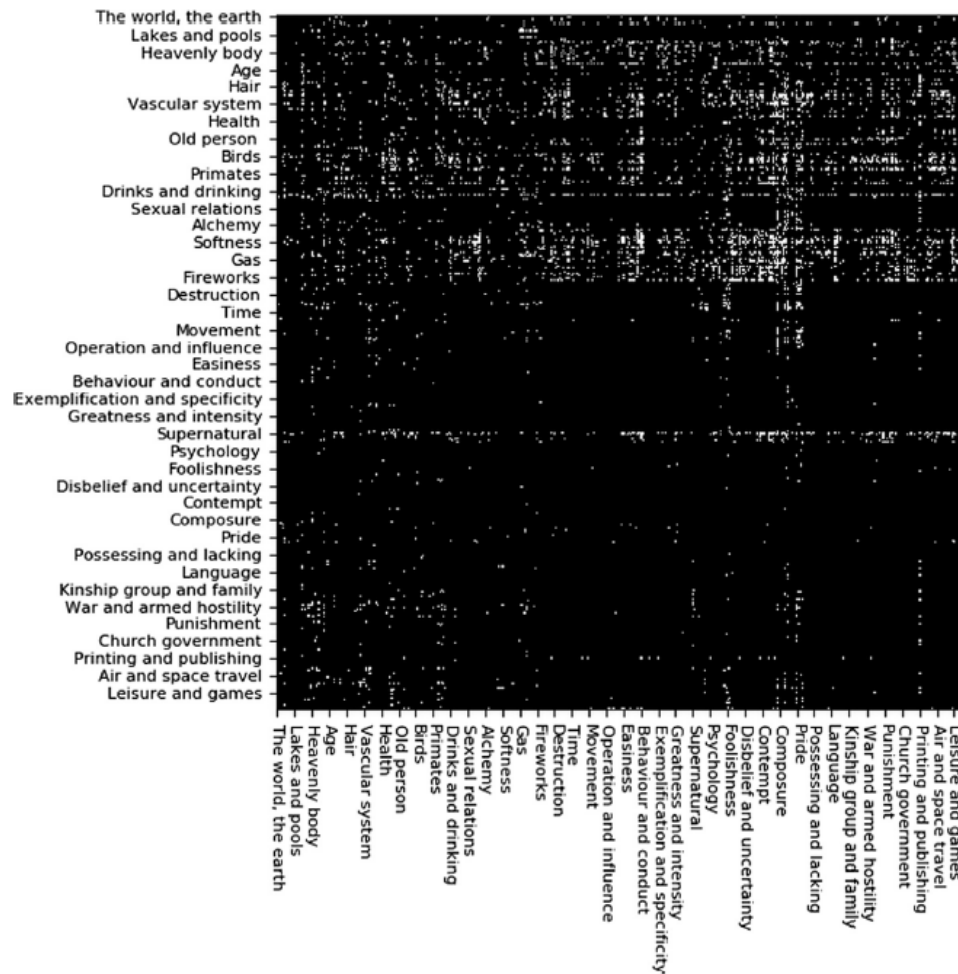


Fig. 3. Visualization of source-target mappings among the 400 domains. Each white dot in the matrix shows a source domain (in the rows) that has been metaphorically mapped to a target domain (in the columns). Due to the large number of domains, we only plot every tenth domain (following the order in the MME database).

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They also discovered that the most negatively or positively-charged emotional realms were the strongest targets (most likely to become metaphors). The most common target domains are: excitement; pride; anger; hatred and hostility; bad; behavior and conduct; money; literature; fear; and, vigorous action and degrees of violence.

"The idea that language moves from describing concrete phenomena to abstract ideas has been around for a few decades," says Malt. "But, nobody has taken that idea and looked at how word meanings have evolved over time - until now."

## **How a word becomes a metaphor**

They began with the premise that the original meaning of a word or set of words is related to that which is most immediate, concrete, physically experienced and emotionally neutral.

"The development of language starts with the need to express something immediate about the world," says Malt, whose work focuses on how word meaning relates to thoughts and how meaning differs across languages. "Our hypothesis was that word meanings, over time, likely moved away from solely expressing immediate and physically-experienced matters toward expressing more complex, abstract and subtle ideas."

Malt and her colleagues wanted to test whether the direction of word sense evolution could be predicted. For example, could one predict that certain domains of meaning—such as "light"—were likely to be sources and that other realms of meaning—such as "thought"—were likely to be metaphors?

To do this, they studied approximately 5,000 recorded metaphorical mappings derived from the Metaphor Map of English (MME) database which identifies changes in word meanings over more than a millennium. The words in the database are classified by the source domain (the original meaning) and the target domain (the metaphorical meaning).

The team established a set of six variables to describe the domains. The variables—based on previous research into the nature of word meanings—were: Concrete ? Abstract; Embodied ? Disembodied; External ? Internal; Animate ? Inanimate; Less valenced ? More valenced (a measure of emotionality from neutral to highly charged); and, More Intersubjective ? Less intersubjective (the degree to which people experience something the same way).

**Table 2**  
Strongest source and target domains across history.

Strongest sources	Strongest targets
Textiles	Excitement
Supernatural	Pride
Digestive organs	Anger
Hardness	Hatred and hostility
Softness	Bad
Ruminants	Behaviour and conduct
Cultivated plants	Money
Wetness	Literature
Darkness	Fear
Solidity and density	Vigorous action and degrees of violence

In the first large-scale study of its kind, researchers from Lehigh University and University of California, Berkeley analyzed 5,000 English-language metaphorical mapping records over the last 1100 years and found the evolution of word meaning to be highly systematic--following predictable patterns. The research will be published in an upcoming issue of *Cognitive Psychology*. Credit: Yang Xu, Barbara C. Malt, Mahesh Srinivasan

To establish an objective rating system, they recruited human participants to rate word domains (such as "light" or "thought") based on the six variables. Data were collected from 1,439 online survey participants who self-reported as native English-speakers. The participants rated 400 domains for concreteness vs. abstractness, animacy vs. inanimacy, etc.

The team ran a variety of analyses on the data and found it could predict directions in historical mappings above chance. In particular, externality (accuracy = 73.9%) and concreteness (73.5%) were most accurate. In fact, they found that externality and concreteness were roughly equivalent to one another and play a dominant role in predicting the directionality of historical metaphorical extension. These were followed by intersubjectivity (60.7%), valence (59.6%), embodiment (56.7%), and animacy (52.6%).

Their results indicate that historical metaphorical mappings follow systematic and predictable directions, such that between a pair of domains, the domain that is rated higher on these variables is more likely to be the source, and the remaining [domain](#) is more likely to be the target.

## **Surprising systematicity in word meaning evolution**

In other words, yes - one can predict that the external category of "light" is likely to be a source of word meaning and that the more internal category of "thought" is likely to become a metaphor. Thus, over time, a word like "reflect" - which originally had only concrete [meaning](#) as way to describe what light does—evolved to also describe internal experience related to thought: "self-reflection."

Malt and her colleagues report that, in many respects, their findings are surprising.

"Not everyone would have forecast that we would find this level of systematicity and predictability," adds. "One could certainly see how the evolution of word sense could have come about more randomly, given ever-changing cultural conditions."

In the paper, the authors state that cultural conditions and communicative needs have indeed shaped metaphorical extension in many cases: "For instance, mouse would never have been extended to a computer accessory if the invention of the computer had not come about, nor would file or folder have been extended from objects held in the hand to virtual ones without specific cultural developments."

However, they conclude: "Our data demonstrate that, in spite of the effects of complex and dynamic cultural conditions, there is an underlying regularity to the direction of metaphorical sense extension driven by measurable communicative and cognitive principles."

**More information:** Yang Xu et al, Evolution of word meanings through metaphorical mapping: Systematicity over the past millennium, *Cognitive Psychology* (2017). [DOI: 10.1016/j.cogpsych.2017.05.005](https://doi.org/10.1016/j.cogpsych.2017.05.005)

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