A tangled knot of target domains: Assessing INTELLIGENCE IS BRIGHTNESS and GOODNESS IS BRIGHTNESS in an image rating task

Karen Sullivan, University of Queensland (ksull@uq.edu.au)

Abstract
Recent experimental studies have examined GOODNESS IS BRIGHTNESS and a host of other primary metaphors. However, complex mappings such as INTELLIGENCE IS BRIGHTNESS have been largely ignored, nor has there been any attempt to distinguish their effects from those of primary metaphors such as GOODNESS IS BRIGHTNESS. The current study assesses both the non-primary metaphoric mapping INTELLIGENCE IS BRIGHTNESS and the well-documented primary metaphor GOODNESS IS BRIGHTNESS in a visual priming task. The study finds that a bright background encourages photos of faces to be rated as both more intelligent and well-intentioned, though the background does not significantly affect either attribute alone. This suggests that two metaphors with the same source domain can reinforce each other. The study also underscores the difficulty in assessing a non-primary mapping in isolation from other factors.

Keywords
Primary metaphor, complex mapping, visual priming, source and target domain, conceptual metaphor theory
A tangled knot of target domains:
Assessing INTELLIGENCE IS BRIGHTNESS and GOODNESS IS BRIGHTNESS in an image rating task

1. Primary versus complex metaphors

In recent years, studies have shown that metaphors can affect perception and judgement, suggesting that these metaphors are conceptual rather than purely linguistic. Research has focused on primary metaphors, including GOODNESS IS BRIGHTNESS (Meier et al. 2004; Peña et al. 2009; Frank & Gilovich 1988; cf. Nickels 2007), SIMILARITY IS CLOSENESS (Casasanto 2008), CONTROL IS UP (Schubert 2005; Valenzuela & Soriano 2009), AFFECTION IS WARMTH (Williams & Bargh 2008; Zhong & Leonardelli 2008), IMPORTANCE IS SIZE (Valenzuela & Soriano 2008; Schubert et al. 2009), TIME IS SPACE (Boroditsky 2000; Casasanto et al. 2005), MORALITY IS CLEANLINESS (Zhong & Liljenquist 2006), and HAPPY IS UP (Meier & Robinson 2004).

All these metaphors are “primary” in that they are based on the association of co-occurring experiences, such as AFFECTION and WARMTH, a correlation that leads to the establishment of the metaphor AFFECTION IS WARMTH (Johnson 1997; Grady 1997; Grady & Johnson 1998; Sullivan 2007, 2013). Other metaphors are complex, in that they are based on a combination of primary metaphors and structural correspondences rather than direct experiential correlations. For example, the relation between THEORIES and BUILDINGS (as in the foundation of an argument) is not experientially based, because theories and buildings do not tend to co-occur in the world (Grady 1997).

Both primary and complex metaphors are theorized to be conceptual as well as linguistic. For example, the metaphor AFFECTION IS WARMTH is apparent in linguistic expressions such as warm greeting or icy stare. However, conceptual theories of metaphor presume that the structure AFFECTION IS WARMTH is primarily cognitive, and only secondarily surfaces in language (Lakoff & Johnson 1980). The psycholinguistic studies listed above offer evidence that the conceptual theories are correct. If the temperature of a cup of coffee can affect feelings of AFFECTION, even in the absence of any language related to WARMTH, then the association between AFFECTION and WARMTH is necessarily conceptual and not merely linguistic (Williams & Bargh 2008).
The available psycholinguistic evidence for complex metaphors is much less compelling. Only a few complex metaphors have been examined experimentally, such as ANGER IS HEATED FLUID IN A CONTAINER (Gibbs & O’Brien 1990; Gibbs et al. 1997; Valenzuela & Soriano 2007). This metaphor is complex, in that angry behaviour and boiling containers do not literally co-occur in the world. However, studies of complex metaphors such as these present the metaphors linguistically, as metaphoric sentences or phrases. As such, they do not test whether the complex metaphors are active in cognition outside of language.

The current experiment employs visual stimuli to examine INTELLIGENCE IS BRIGHTNESS, a non-primary correspondence which underlies expressions such as bright thinker and dim student. In the world, intelligent people do not literally emit light, so the mapping between INTELLIGENCE and BRIGHTNESS is not experientially based. Instead, the mapping is realized by a systematic series of extensions from BRIGHTNESS to INTELLIGENCE (illuminate, shed light on, dim, bright, brilliant) built around the primary metaphor KNOWING IS SEEING. INTELLIGENCE IS BRIGHTNESS can form the basis of novel linguistic expressions (intellectual supernova, a guttering candle of an intellect). Finally, though the metaphor is far from linguistically universal, INTELLIGENCE IS BRIGHTNESS occurs in a range of languages including Spanish (una persona brillante ‘a brilliant person’; tiene pocas luces ‘S/he doesn’t have many lights’ meaning ‘S/he is stupid’). In sum, INTELLIGENCE IS BRIGHTNESS is theorized to exist on the basis of the same type of linguistic evidence as other complex mappings and complex metaphors, making it an acceptable test case for this large class of metaphors and mappings.

The chief difficulty in examining INTELLIGENCE IS BRIGHTNESS is distinguishing its effects from those of the well-documented metaphor GOODNESS IS BRIGHTNESS (Meier et al. 2004; Peña et al. 2009), since INTELLIGENCE is generally considered a GOOD quality. For this reason, the current study assessed the effects of BRIGHTNESS on both INTELLIGENCE and GOODNESS. To evaluate the impact of BRIGHTNESS on INTELLIGENCE independently of GOODNESS, the experiment introduced each set of stimuli with a story. Each story involved a group of protagonists who exhibited combinations of intelligence/stupidity with good/bad intentions. The story was then followed by a series of faces against either light or dark backgrounds, and participants were asked to rate the probability that each face corresponds to one of the protagonists of the preceding story. These ratings were interpreted as judgements of the faces’
goodness and intelligence. For example, a high rating for an image as a protagonist of the story with intelligent/good characters was interpreted as a judgement that the depicted person is both intelligent and good.

The effects of the two metaphors were predicted to influence results more or less independently. That is, GOODNESS IS BRIGHTNESS would cause the bright-background images to be rated more highly in the two “good” stories than in the two “evil” conditions, and INTELLIGENCE IS BRIGHTNESS would cause the bright images to be rated more highly in the “intelligent” conditions than in the “stupid” conditions.

2. Method

Participants. Participants were 77 undergraduate students at a large Australian state university, enrolled in an introductory phonology course. Participants included 11 males and 66 females, 58 native speakers of English and 19 with high English proficiency.

Materials. Four experimental conditions examined all combinations of “smart” vs. “stupid,” and “good” vs. “evil,” to distinguish and compare the effects of the visual stimuli involving BRIGHTNESS on INTELLIGENCE and GOODNESS. An introductory written component (a brief story) evoked these combinations of attributes for each of four conditions. One story involved smart and good-intentioned protagonists, one had stupid but good-intentioned protagonists, one had smart but evil protagonists, and one had stupid and evil protagonists (see Appendix 1). These stories were intended to provide an exhaustive combination of two points on the scales of each of the qualities being tested, INTELLIGENCE and GOODNESS.

The images involved 32 male Caucasian faces displayed in colour against either a light grey or a dark grey background. To minimize the effects of visual compensation for the background – i.e., faces on a light background appearing darker – and to maximize the effect of the background itself, faces were presented small, filling about 5% of the screen. The faces themselves were neither lightened nor darkened in any condition. In each background, the lightest or darkest area was around the face, to suggest that the person was the
source of the light or dimness. All participants were debriefed after the experiment, and no participant noticed that the faces had appeared against two different backgrounds.

The experiment was conducted in E-Prime 2 on Macintosh computers with Dell LCD monitors. Ratings were indicated by pressing the numerical keys at the top of the keyboard.

**Procedure.** The experiment involved two tasks, a story rating task and an image rating task. In the story rating task, participants read one of the four stories and pressed the space bar when done reading. They then rated the “intelligence” and “good intentions” of the story protagonists on a scale from 1 to 7, to test whether they understood the story in the intended way.

Following each story rating task, the experiment progressed to the image rating task. In this task, participants viewed a series of faces, each with either a lightened or darkened background. Each face remained on screen until participants rated the probability that the face corresponded to one of the protagonists of the preceding story. Responses were not allowed during the first 500 ms of the image’s appearance, to ensure that participants saw the image before rating it. Ratings of probability ranged from 1 (not at all likely) to 7 (very likely). Once a key 1–7 was pressed, the screen became a neutral grey for 500 ms, followed by the appearance of the next face. Ratings were interpreted as a measure of the faces’ perceived intelligence and good intentions. That is, participants who rated a face highly for the “smart/good” story were deemed to consider that person both intelligent and good.

**Design.** Each participant saw all four stories in a random order. In the image rating task of each story condition, participants rated eight faces randomly selected from the set of 32. Four of these faces had light backgrounds, and four had dark backgrounds, with the order of appearance of the backgrounds randomized. In the overall experiment, each participant saw either the light or dark background version of each of the 32 faces, with no participant seeing the same face twice.

**3. Results**

Given the number of factors involved in the study (including the type of story, the ratings of the story protagonists, the ratings of the images and the background of the images), results were evaluated with analyses of variance
(ANOVAs). An ANOVA tests whether the means of several groups are all equal, and therefore resembles a t-test conducted across more than two groups. To assess whether responses from non-native English speakers should be included in the study results, an ANOVA with the factors story (smart/good, stupid/good, smart/evil or stupid/evil), first language (English or another language), and background (light or dark) was conducted. A main effect of language was found, $F(1, 76) = 8.96, p = .00$, meaning that the average ratings of native and non-native speakers differed overall. However, this factor did not interact with story type or background, meaning that the difference in language background was merely an overall result and not one that varied with the factors of interest in the study. Therefore, data from both native and non-native speakers of English were included in the study.

Overall, the stories were interpreted as intended. In the story rating task, mean evaluations of the protagonists’ “intelligence” and “good intentions” for the smart/good story were 6.54 for intelligence and 6.07 for good intentions, both high ratings on the 7-point scale. For the smart/evil story, ratings were 5.68 for intelligence and 1.54 for good intentions, a high and a low rating, respectively. The stupid/good story received 2.88 for intelligence and 5.96 for good intentions, low and high ratings respectively. For the stupid/evil story, ratings were 2.22 for intelligence and 1.91 for good intentions, both low ratings. These were large effects. For example, the difference in the 6.54 intelligence rating for the smart/good story and the 2.22 intelligence rating for the stupid/evil story was substantial, $d = 3.99$. An ANOVA with the factors story type (smart/good, stupid/good, smart/evil or stupid/evil) and rating of the protagonists’ “good intentions” (on a scale of 1—7), with subject as a random factor, showed a significant interaction between story type and “good intentions”, $F(1, 76) = 285.51, p = .00$. A second ANOVA, identical except considering the factor of protagonist’s “intelligence” instead of “good intentions”, was equally significant, $F(1, 76) = 253.71, p = .00$.

Though all stories were interpreted as intended, some were more effective than others at communicating the relevant characteristics. For example, the stupid/good protagonist was rated a mean 2.88 for intelligence, which is higher than the intelligence rating of the stupid/evil protagonist, 1.91, $F(1, 76) = 10.66, p = .00, d = .51$. This was the case even though both stories were considered to involve “stupid” protagonists. Similarly, the smart/good protagonist was rated a mean 6.54 for intelligence, higher than the 5.68 intelligence rating of the
smart/evil protagonist, $F(1, 76) = 30.84, p = .00, d = .724$, even though both protagonists were intended to be “smart”.

In the image rating task, the light and dark background images received different mean ratings depending on the story the participants had just read. For the smart/good protagonist, the images with bright backgrounds received a mean rating of 4.01 and the dark images received a mean of 3.79. Ratings for the smart/evil condition did not vary much depending on background, with a mean rating of 4.35 for the bright and 4.42 for the dark backgrounds. Stupid/good varied even less, with mean 3.64 for the bright backgrounds and 3.67 for the dark ones. Finally, the stupid/evil story ratings depended considerably on background, with mean 3.91 for the bright and 4.10 for the dark backgrounds. None of these effects was particularly large: for the smart/good condition, which had the largest effect of background, the effect size of the difference based on background was small, $d = .19$. The stupid/evil condition had the next-largest effect, $d = .11$.

The numerical ratings of faces from 1 to 7 were analysed using ANOVAs with the factors intelligence (the two “smart” stories versus the two “stupid” stories), goodness (the two “good” stories versus the two “evil” stories) and background (light or dark). In the by-subjects analyses, subject was treated as a random factor; in the by-items analyses, item (the original photo of a face) was treated as a random factor. The interaction between background and goodness (good/evil) approached significance in both the subjects analysis, $F_1(1, 76) = 3.37, p = .07$ and the items analysis, $F_2(1, 31) = 3.32, p = .08$. The interaction between background and intelligence (smart/stupid) was not significant, $F_1(1, 76) = 1.52, p = .22$, $F_2(1, 31) = 1.73, p = .20$.

Based on the observation that the smart/good story and the stupid/evil story showed the greatest differences in mean rating of faces with light and dark backgrounds (4.01 and 3.79 for smart/good, and 3.91 and 4.10 for stupid/evil), it was decided to compare these two stories independently of the two stories that mixed a positive and a negative quality (smart/evil and stupid/good). When only the stories combining two positive traits (the smart/good story) and two negative traits (the stupid/evil story) were considered, then the interaction between the factors story (smart/good or stupid/evil) and background reached
significance in both the subjects analysis, $F_1(1, 76) = 4.13, p = .05$ and the items analysis, $F_2(1, 31) = 4.83, p = .04$.

4. Discussion

As predicted, faces with dark backgrounds were rated highest for the story with the stupid and evil protagonist; images with bright backgrounds were rated highest for the intelligent and good protagonist; and the other two cases fell in between. However, these differences were significant only in the comparison between the smart/good and the stupid/evil story.

There are two reasons that the smart/good and stupid/evil stories differed significantly from each other but not from the other stories. First, the effect of background was of the greatest magnitude in these two stories, and was in an opposite direction for each of the two stories. That is, brighter backgrounds led to higher ratings for the smart/good story but lower ratings for the stupid/evil story. Second, the smart/good and stupid/evil stories were most effective at conveying the intended characteristics. As noted above, the smart/good story portrayed intelligence better than the smart/evil story, as demonstrated by the significantly higher rating of the protagonists’ “intelligence”; and the stupid/evil story was a better portrayal of stupidity than the stupid/good story. The effectiveness of these stories may have contributed to the difference in the significance of their ratings, as opposed to the two other stories, which were less successful in achieving the desired ratings for intelligence and goodness.

The experiment may have been limited overall by the faces chosen as stimuli. The images had expressionless faces, closed mouths, identical grey shirts, and no make-up, glasses or accessories. The individuals depicted were not speaking or expressing themselves. It is possible that people’s intelligence, or perhaps even their benevolence, can be evaluated only when they communicate. Images of speaking individuals might lead to stronger results. Alternatively, non-human images might be preferable. As Nickels (2007) observes, light and darkness have complex social associations, which may be difficult to disambiguate or control for when images of humans are involved. Many social factors come into play as soon as a human image is introduced, and the factors that are the focus of a given experiment may compete with stronger, unrelated associations.
Though the study did not obtain significant separate results for INTELLIGENCE IS BRIGHTNESS and GOODNESS IS BRIGHTNESS, the observation that these metaphors interacted to produce the study results is itself a novel finding. If INTELLIGENCE IS BRIGHTNESS is indeed a metaphor distinct from GOODNESS IS BRIGHTNESS, the interaction of these metaphors implies that metaphors can reinforce each other if they have the same, or compatible, source domain(s). A person that is both INTELLIGENT and GOOD is more likely to be metaphorically BRIGHT than one having only one of these two qualities. Rather than interfering with each other or creating a “mixed metaphor”, additional connections to a source domain appear to strengthen the activation of that domain. Further study of the interaction of metaphors with the same source domain may prove fruitful both for its own findings, and for the advantages this would lend to the investigation of metaphors that need to be distinguished from others, such as INTELLIGENCE IS BRIGHTNESS.

5. Conclusion

The current study suggests that the complex mapping INTELLIGENCE IS BRIGHTNESS is relevant in interpreting visual stimuli, but only when it does not conflict with another metaphor, such as GOODNESS IS BRIGHTNESS. Why might INTELLIGENCE IS BRIGHTNESS be more entangled with other metaphors than, for example, a primary metaphor such as SIMILARITY IS CLOSENESS (Casasanto 2008)? As noted above, the lack of results for the stupid/good and smart/evil stories may be attributed to a number of factors, including the use of human images and the content of the stories themselves. However, the results may also be related to the complexity of the metaphor INTELLIGENCE IS BRIGHTNESS and its dependence on the primary metaphor KNOWING IS SEEING in combination with non-primary associations. Complex metaphors, founded on cultural and linguistic experience rather than arising directly from embodiment, may have a more complicated cognitive status than primary metaphors. Further study of INTELLIGENCE IS BRIGHTNESS, and ultimately of other complex mappings and metaphors, is needed to disentangle INTELLIGENCE IS BRIGHTNESS from primary GOODNESS IS BRIGHTNESS, and to explore why and how these metaphors interact in the first place.

The current study suggests certain complications that future studies of complex metaphors might encounter, such as the challenges of distinguishing the effects of a primary from those of a complex metaphor, and the difficulty of creating
appropriate visual stimuli to assess a complex metaphor. Complex metaphors such as THEORIES ARE BUILDINGS are predicted to be more complicated to assess than, say, SIMILARITY IS CLOSENESS. It is easier to present visual stimuli that are CLOSE together or FAR apart, and test the effect on judgements of SIMILARITY, than to present BUILDINGS and judge the effect on reasoning about THEORIES. Studies of complex metaphors and mappings are therefore predicted to involve more complications and considerations than research on primary metaphors. Nevertheless, such studies are necessary to evaluate the conceptual status of complex metaphors. The current study identifies some of the obstacles that such studies may face, but also suggests, in the findings that it does offer, that such studies may eventually prove fruitful.

6. References


Williams, Lawrence/Bargh, John (2008): “Temperature to temperament: Warm objects alter personality impressions”. Unpublished manuscript, Yale University, New Haven, CT.

Appendix 1: Full text of stories preceding each condition

**Story 1: Smart/Good**
High-achieving medical students in their last year of study can apply for a fellowship which lets them pursue cutting-edge research on certain devastating diseases. The fellowship is highly competitive and only the most intelligent students have a chance of winning it. The winners could make more money elsewhere, but the fellowship allows them to use their medical genius to help large numbers of people.

**Story 2: Smart/Evil**
A group of clever computer hackers infiltrated the online bank account of a major charitable organisation, bypassing the advanced security protecting the account. The hackers then transferred hundreds of thousands of dollars from the charity to their own bank accounts. Although the hackers had to be very intelligent to carry out this plan, they must also have been ruthless to steal money that was meant to feed and clothe starving people.

**Story 3: Stupid/Good**
Some clueless new recruits for an aid organisation drove to a neighbouring country, thinking they might rescue orphans who had lost their families in a natural disaster. The aid workers actually found some orphaned children and put them on a bus to bring them back. However, the aid workers were arrested for kidnapping because they obviously didn’t have custody of the children or permission to take them out of the country.

**Story 4: Stupid/Evil**
Some members of a political party were arrested for spray-painting walls with slogans which falsely suggested that politicians from other parties were sexual criminals. When interviewed, the arrested party members yelled at reporters and repeated their nasty accusations. On the TV news, the party members appeared stupid and mean, and made their own party look bad.