CLex: A Lexicon for Exploring Color, Concept and Emotion Associations in Language

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I. Motivation

People use color terms to describe visual characteristics of objects.

sky - blue
snow - white
sun - yellow
grass - green

People take advantage of color terms to strengthen the message and convey emotion in natural interaction.

Colors are indicative and have an effect on our feelings and emotions.
- positive emotions – joy, trust, admiration (Ortony et. al, 1988);
- negative emotions – aggressiveness, fear, boredom.

Color-concept-emotion associations [brown-darkness-boredom] vary by culture and are influenced by the beliefs of the society:
- green – danger in Malaysia, envy in Belgium, happiness in Japan. (Sable and Akcay, 2010).

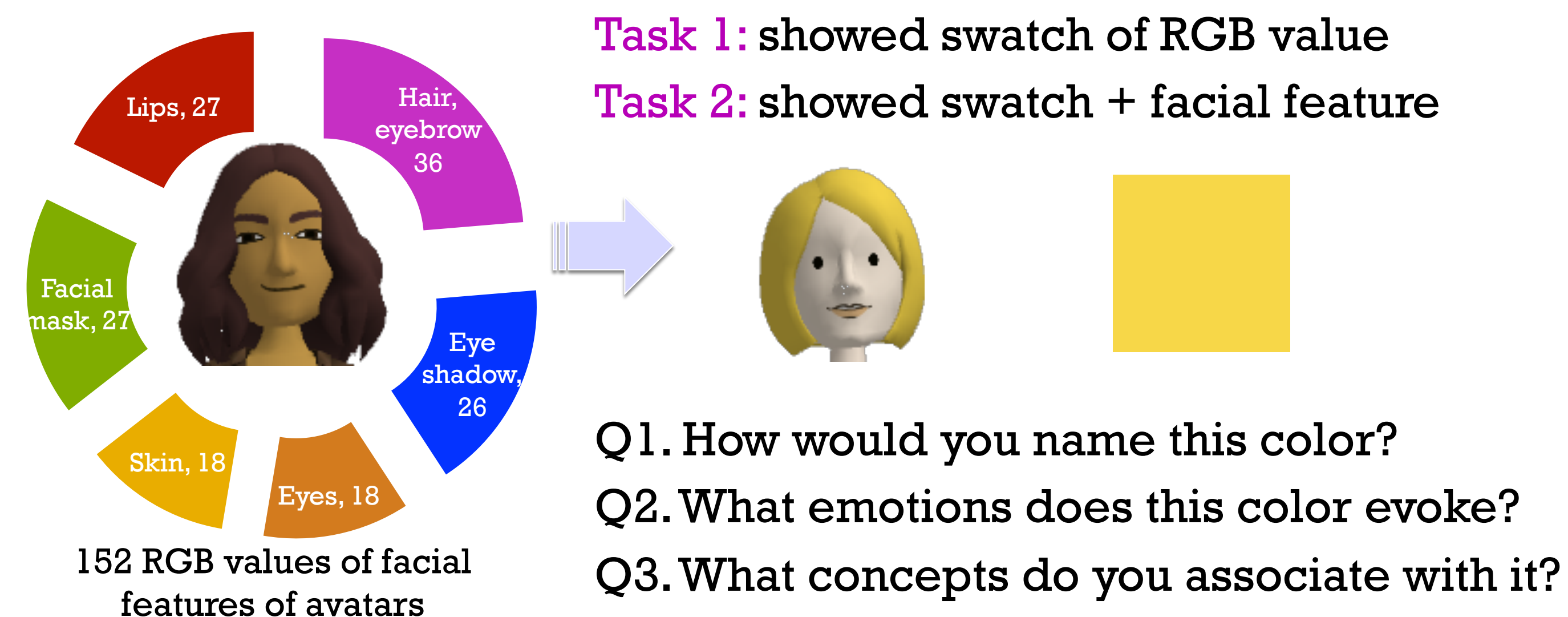Some expressions involving colors share meaning across languages:
- "read heat", "blue blood", "white collar".

Deeper understanding of the associations between colors, concepts and emotions [red – blood – anger] may be helpful for:
- Sentiment analysis: understanding emotion new article evokes.
- Machine translation: as a source of paraphrasing.
- Textual entailment: question answering in dialog systems
- Human-computer interactions in real- and virtual word domains: online shopping, avatar construction in gaming environments (clearer & natural descriptions "sky-blue shirt" vs. "blue shirt").

II. Data Collection

We use Amazon Mechanical Turk to collect color-concept and color-emotion associations:

Task 1: showed swatch of RGB value
Task 2: showed swatch + facial feature

Lips, 27 / Hair, eyebrow 36 / Eye shadow 26 / Facial mask, 27 / Skin, 18 / Eyes, 18

152 RGB values of facial features of avatars

Q1. How would you name this color?
Q2. What emotions does this color evoke?
Q3. What concepts do you associate with it?

Example annotations:

➤ [R=222, G=207, B=186]
light golden yellow ➡ purity, happiness ➡ butter cookie, vanilla
gold ➡ cheerful, happy ➡ sun, corn
golden ➡ sexy ➡ beach, jewelry

➤ [R=218, G=97, B=212]
pinkish purple ➡ peace, tranquility, stressless ➡ Justin Bieber's headphones, someday perfume
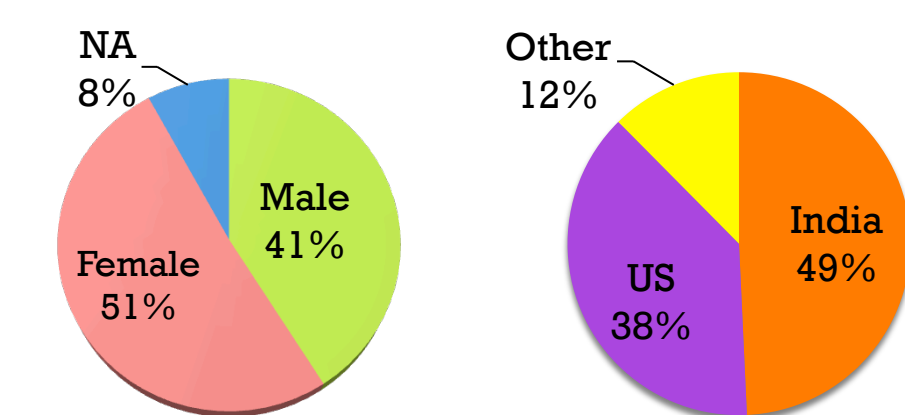pink ➡ happiness ➡ rose, bougainvillea

III. Data Analysis

Lexicon Statistics

CLex contains 15,200 annotations:
- 2,3K color term types
- 1,9K concept types
- 3,4K affect term/emotion types

Color dimensions:
- hue, darkness, brightness, saturation

NA 8% / Male 41% / Female 51%
Other 12% / India 49% / US 38%

Affect Terms
- feelings, emotions, attitudes, moods

	anger	sadness	disgust	fear	joy	trust	surprise	anticipat.
(white)	-	0.3		0.8	1.0	-	-	-
(black)	3.6	24.0	2.3	43.0	0.2	-	-	-
(red)	43.4	0.3	1.1	8.9	0.2	1.2	-	-
(green)	0.3	0.6	11.2	2.0	3.4	3.5	3.3	5.3
(yellow)	0.3	4.2	1.1	1.2	5.7	1.2	6.7	5.3
(blue)	0.3	4.2	1.1	0.4	4.2	17.4	6.7	-
(brown)	3.3	11.4	24.7	6.1	4.2	8.1	3.3	5.3
(magenta)	0.6	0.3	1.1	0.4	9.1	1.2	3.3	5.3
(purple)	0.3	2.2	3.4	0.8	4.4	1.2	6.7	-
(orange)	1.5	0.3	1.1	0.4	4.0	5.8	13.3	15.8
(gray)	2.1	10.3	-	2.0	0.6	1.2	3.3	5.3

Top 10 Color Term Collocations for Berlin and Kay (1988) Colors

White – 0.62	Black – 0.43	Red – 0.59	Green – 0.54	Yellow – 0.63	Blue – 0.55
off, antique, half, dark, black, bone, milky, pale, pure, silver	light, blackish brown, brownish, brown, jet, dark, green, off, ash, black grey	dark, light, dish brown, brick, orange, brown, indian, dish, crimson, bright	dark, light, olive, yellow, lime, forest, sea, dark olive, pea, dirty	light, dark, green, pale, golden, brown, mustard, orange, deep, bright	light, sky, dark, royal, navy, baby, grey, purple, cornflower, violet

*overall agreement on color terms (exact match – 0.49, substring – 0.46), free-marginal kappa (exact match – 0.46, substring – 0.42)
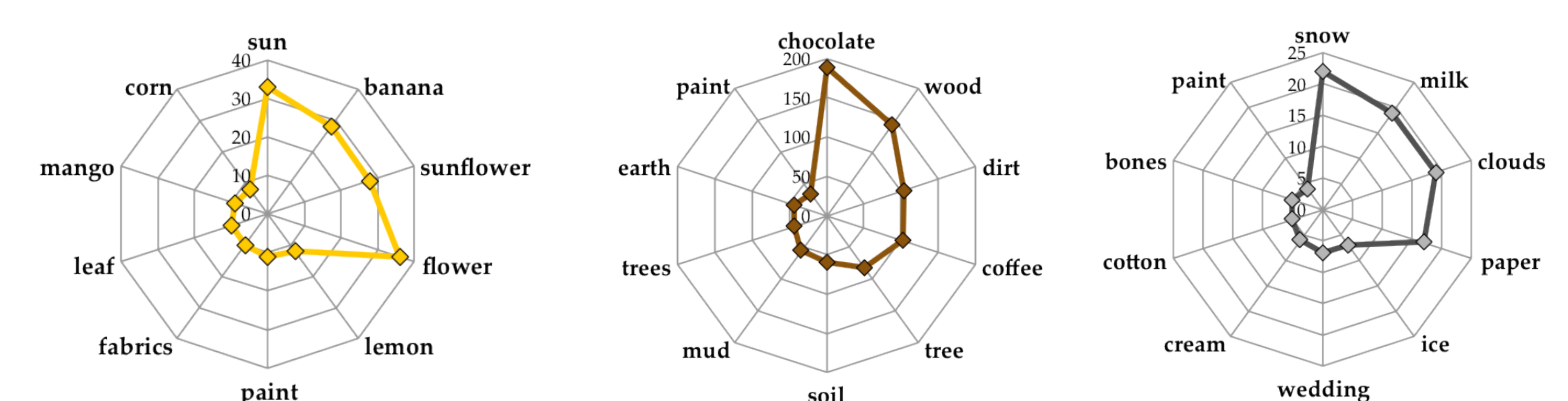
Cross-Cultural Differences in Color-Emotion Associations: US and India, %

Joy US: 331 I: 154
US: pink 10.6 / I: yellow 7.1
US: blue 4.8 / I: brown 5.8
US: yellow 4.5 / I: pink 5.2
US: purple 4.2 / I: purple 4.5
US: orange 3.9 / I: green 3.9

Trust US: 33 I: 47
US: dark brown 12.1 / I: blue 29.8
US: brown 9.1 / I: light blue 6.4
US: green 6.1 / I: orange 6.4
US: beige 3.0 / I: dark blue 4.3
US: aubergine 3.0 / I: brown 4.3

Surprise US: 18 I: 12
US: purple 11.1 / I: orange 16.7
US: orange 11.1 / I: indigo 16.7
US: bright blue 5.6 / I: fanta orange 8.3
US: blue 5.6 / I: classic grey 8.3
US: azalea purple 5.6 / I: blue 8.3

Anger US: 133 I: 160
US: red 40.6 / I: red 46.9
US: dark red 4.5 / I: dark red 4.4
Human-brown 4.5 / I: dark brown 4.4
US: black 3.8 / I: reddish 4.4
US: crimson red 2.3 / I: black 2.5

Sadness US: 171 I: 142
US: black 22.2 / I: black 29.6
US: gray 12.3 / I: dark brown 10.6
US: brown 9.4 / I: brown 11.3
US: blue 5.3 / I: grey 6.3
US: purple 4.1 / I: blue 3.5

Fear US: 95 I: 105
US: black 29.5 / I: black 58.1
US: red 10.5 / I: red 6.7
US: dark brown 4.9 / I: blue grey 4.8
US: gray 4.2 / I: brown 4.8
US: brown 3.2 / I: dark brown 3.8

Basic Emotions in Colors, %
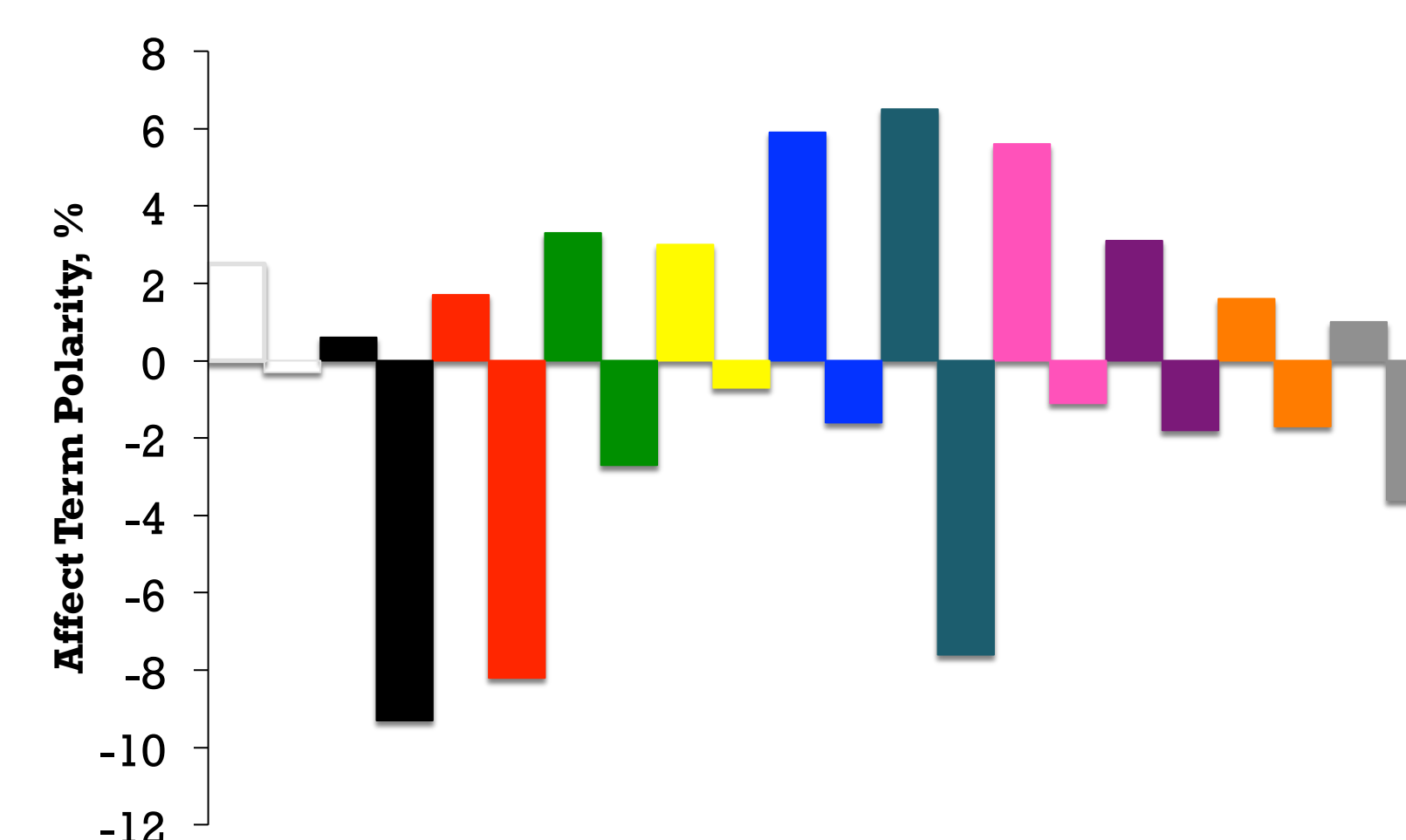
Top 10 Color-Concept Associations for Ambiguous Colors

sun, corn, banana, sunflower, flower, lemon, paint, fabrics, leaf, mango

chocolate, wood, dirt, coffee, tree, soil, mud, trees, earth, paint

snow, milk, clouds, paper, ice, wedding, cream, cotton, bones, paint

IV. Summary

- Constructed large-scale color-concept-emotion lexicon by crowdsourcing
- Studied cross-cultural differences in color-emotion associations (US and India)
- Identified frequent color-concept associations (may help to identify sentiment expressed by a concept)

V. Related Work

- EmoLex (Mohammad, 2011)
- WordNet-Affect (Strapparava and Valitutti, 2004)
- General Inquirer (Stone et. al., 1966)
- Affective Forms of English Words (Stone et. al., 1966)