Think 53: Food Talks
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Sound Symbolism and Synesthesia
(and Wheat Thins and Rocky Road)

Thursday, April 13, 2017
Conventionalism vs. Naturalism

Conventionalism:
What’s in a name? that which we call a rose
By any other name would smell as sweet

*Shakespeare, Romeo and Juliet*

Naturalism:
There is an inherently correct name for everything for both “Greeks and barbarians.”

*Plato, Cratylus*
“Thus we may conceive how words, which were by nature so well adapted to that purpose, came to be made use of by men as the signs of their ideas; not by any natural connection that there is between particular articulate sounds and certain ideas, for then there would be but one language amongst all men; but by a voluntary imposition, whereby such a word is made arbitrarily the mark of such an idea.”

Of the Signification of Words Book 3 Chapter II
“Names have no intrinsic appropriateness. One agrees to use a certain name and issues an order to that effect, and if the agreement is abided by and becomes a matter of custom, then the name may be said to be appropriate... Names have no intrinsic reality.”
What could Naturalism Mean?

- Now the letter *r*, as I was saying, appeared to the imposer of names an excellent instrument for the expression of motion; and he frequently uses the letter for this purpose: for example, in the actual words *rein* and *roe* he represents motion by *r*; also in the words *tromos* (trembling), *trachus* (rugged); and again, in words such as *krouein* (strike), *thorauein* (crush), *ereikein* (bruise), *thruptein* (break), *kermatixein* (crumble), *rumbein* (whirl): of all these sorts of movements he generally finds an expression in the letter *r*, because, as I imagine, he had observed that the tongue was most agitated and least at rest in the pronunciation of this letter, which he therefore used in order to express motion,

Plato, *Cratylus*
Sound Symbolism: modern naturalism

- A version of naturalism
- Suggests that certain sounds naturally are associated with certain meanings
MRIs from USC’s SAIL Lab
Shri Narayanan and Dani Byrd
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Shri Narayanan and Dani Byrd
To make the vowel sound, phonation must occur in the larynx to send a sound through the tube. This sound is changed by its passage through the supra-laryngeal vocal tract, and the vowel sound radiated from the lips is thus a modified or coloured form of larynx buzz.

3. The Vowel Quadrilateral

We can define an articulatory vowel space in terms of the limits to the extremes of tongue position that still give rise to non-nasal resonant sounds. The idea is that if the tongue position became more extreme than these limits then turbulence would occur. Three tongue positions can be used to demonstrate this: [i] the closest frontest tongue position, [ɯ] the closest backest tongue position, and [ɑ] the openest backest tongue position, as can be seen in the diagram below [from Catford, 1988]:

John Coleman
http://sail.usc.edu/span/rtmri_ipa/
Sound symbolism in vowels

- Front vowels used for little things
  - *little, itsy bitsy, teeny weeny*
  - -y used for children (Robby, Becky)
- Back vowels used for big things
  - *huge, humongous, large*

- Not an absolute, but a strong statistical tendency
Sound symbolism across many languages

- French *petit* ‘small’, *grand* ‘big’
- Spanish *-ito*,
- Italian *–ino* ‘small’, *-one* ‘large’
- Mandarin *xì* 细 ‘fine’, *cū* 粗 ‘coarse’, *qīng* 轻 ‘light’ *zhòng* 重 ‘heavy’

Studies find this pattern across hundreds of languages
Sound symbolism in fiction

Gulliver’s Travels
  Lilliputians
  Brobdingnagians
Sound symbolism in fiction

Harry Potter

**Bludgers**: big and dangerous
**Quaffle**: big and round
**Golden Snitch**: small and fast

A red quaffle, two bludgers and the golden snitch
Klink (2000)


Which brand of laptop seems bigger, Detal or Dutal?
Which brand of vacuum cleaner seems heavier, Keffii or Kuffii?
Which brand of ketchup seems thicker, Nellen or Nullen?
Which brand of beer seems darker, Esab or Usab?

- In each case, the product named with back vowels (Dutal, Nullen) was chosen as the larger, heavier, thicker product.
Yorkston and Menon


1. “Read this press release on a new ice cream
   ...“called Frish"
   ... “called Frosh”
2. Rate the (untasted) ice cream from 1-7 on
   creaminess, richness, and smoothness

• Results:
  • Frosh (5) more creamy/rich/smooth than Frish (4)
  • People more likely to want to buy Frosh
But do marketers use this in practice?

- **Hypothesis:**
  - **Cracker names** will use front vowels
    - small, light, delicate
  - **Ice cream names** will use back vowels
    - rich, heavy, solid

- **Dataset:**
  - 592 US cracker brands from a dieting website
  - 81 ice cream flavors sold by Haagen Dazs/Ben & Jerry’s
Methodology

Cracker list from a dieting website

- Barnum's Animal Crackers
- Premium Crackers
- Premium Crackers Soup & Oyster
- Premium Crackers Saltine Crackers Fat Free
- Premium Crackers Saltine Crackers Low Sodium
- Premium Crackers Saltine Crackers Multigrain
- Premium Crackers Saltine Crackers Original
- Premium Crackers Saltine Crackers Unsalted Tops
- Ritz Bitz Cracker Sandwiches Graham Cracker S'mores
- Ritz Bitz Cracker Sandwiches Graham Crackers S'mores
- Ak Mak Crackers
- Nabisco Fat Free Saltine Crackers- Weight Watcher Points, Carbs, Protein, Calories
- NABISCO ORIGINAL PREMIUM Saltine Crackers
- Nabisco RITZ Crackers
- Nabisco Wheat Thins Crackers
- Pepperidge Farm Goldfish Baked Snack Crackers
- Wasa - Fiber Rye with Sesame & Oats Crispbread
- Wasa Crackers Sesame Crispbread
- Wasa Crackerbread, 7-Grain, Crisp'n Light
- Wasa Fiber Rye
- Wasa Multi Grain
- Wasa Light Rye Crispbread
- Ritz Crackers Whole Wheat
- Keebler Town House Bistro Rye Crackers
- 100% Whole Wheat Crackers, low-fat
- Asiago Cheese Cracker
- Babyfood, crackers, vegetable
- Bell Pepper Corn Bread Crackers
- Bremner Caraway Crackers
- Bremner Crackers made with pure sunflower oil
- Bremner Oyster Crackers made with pure sunflower oil
- Bremner Soup & Chili Crackers
- Brown Rice Crackers
- Butter Corn Bread Crackers
- Carr's Table Water Crackers
- Cheddar Dill Crackers
- Cheese Crackers
- Cheese Nips Crackers 100 Calorie Pack thin Crisps
- Cheese Nips Crackers Bold Cheddar Chips
- Cheese Nips Crackers Cheddar
- Cheese Nips Crackers Four Cheese
- Cheese Nips Crackers Mini Go-Pak
- Cheese Nips Crackers Nacho Chips
- Cheese Nips Crackers Peanut Butter
- Cheese Nips Crackers Real Cheese
- Cheese Nips Crackers Reduced Fat
- Cheese with Cheddar Jack Sandwich Crackers
- CHEETOS Bacon Cheddar on Cheese flavored Crackers
- CHEETOS Cheddar Cheese on Golden Toast Flavored Crackers
- Choc. Graham Cracker Chip
- Classic Rounds Crackers
- Cracker Crunchers Fun Kits, Bologna
- Cracker Crunchers Fun Kits, Turkey
- Cracker Crunchers, Bologna
- Cracker Crunchers, Chicken
- Cracker Crunchers, Cooked Ham
- Cracker Crunchers, Turkey
- ...
- ...
- ...
Barnum's Animal Crackers Crackers Crackers:  b aa1 r n em z ae1 n ah0 m ah0 l k r ae1 k er0 z k r ae1 k er0 z k r ae1 k er0 z
Barnum's Animal Crackers Crackers Snak Saks:  b aa1 r n em z ae1 n ah0 m ah0 l k r ae1 k er0 z k r ae1 k er0 z s n ae1 k s ae1 k s
Premium Crackers Crackers Gold:  p r iy1 m iy0 ah0 m k r ae1 k er0 z k r ae1 k er0 z g ow1 l d
Premium Crackers Crackers Soup & Oyster:  p r iy1 m iy0 ah0 m k r ae1 k er0 z k r ae1 k er0 z s uw1 p ae n d oy1 s t er0
Premium Crackers Saltine Crackers Fat Free:  p r iy1 m iy0 ah0 m k r ae1 k er0 z s aa l t iy1 n k r ae1 k er0 z f ae1 t f r iy1
Premium Crackers Saltine Crackers Low Sodium:  p r iy1 m iy0 ah0 m k r ae1 k er0 z s aa l t iy1 n k r ae1 k er0 z l ow1 s ow1 d iy0 ah0 m
Premium Crackers Saltine Crackers Multigrain:  p r iy1 m iy0 ah0 m k r ae1 k er0 z s aa l t iy1 n k r ae1 k er0 z m ah1 l t iy g r ey1 n
Premium Crackers Saltine Crackers Original:  p r iy1 m iy0 ah0 m k r ae1 k er0 z s aa l t iy1 n k r ae1 k er0 z er0 ih1 jh ah0 n ah0 l
Premium Crackers Saltine Crackers Unsalted Tops:  p r iy1 m iy0 ah0 m k r ae1 k er0 z s aa l t iy1 n k r ae1 k er0 z ax n s aa1 l t ix d t aa1 p s
Ritz Bitz Cracker Sandwiches Graham Cracker S'mores Simpsons:  r ih1 t s b ih1 t s k r ae1 k er0 s ae1 n d w ih0 ch ah0 z g r ey1 ah0 m k r ae1 k er0 s m ao1 r z s ih1 m p s ah0 n z
Ritz Bitz Cracker Sandwiches Graham Crackers S'mores:  r ih1 t s b ih1 t s k r ae1 k er0 s ae1 n d w ih0 ch ah0 z g r ey1 ah0 m k r ae1 k er0 z s m ao1 r z
Ak Mak Crackers:  ae1 k m ae1 k k r ae1 k er0 z
Now count front vowels versus back vowels

n ah0 b **ih1** s k ow0 r **ih1** t s k r **ae1** k er0 z
Nabisco Ritz Crackers
3 front vowels

r **ih1** t s k r **ae1** k er0 z hh **ow1** l w **iy1** t
Ritz Crackers Whole Wheat
3 front vowels, 1 back vowel
Crackers
Vowels in:

Crackers Names
- Ritz, Cheez It, Wheat Thins, Triscuit, Thin Crisps, Cheese Crisps, Chicken in a Biskit, Krispy

Ice Cream Flavors
- Rocky Road, Jamoca Almond Fudge, Chocolate, Caramel, Cookie Dough, Coconut
One control

• Some vowels are more common than others
  • Front vowels slightly more common than back vowels overall

• Need to divide by the expected frequency of front versus back vowels

• Called the “Observed / Expected” ratio
Vowels: Crackers vs. Ice Cream

Vowel Counts (Observed / Expected)

- Front vowels
- Back vowels

CRACKERS

ICE CREAM
Sound symbolism in numbers

- English Front vowels 3, 6, 7, 8, 10
- English Back vowels 1, 2

3 and 6 sound smaller than 2 even though they are bigger.

- Mandarin Front vowels 1, 7
- Mandarin Back vowels 3, 5, 8, 9
Sound symbolism affects reasoning


Our beautiful scoop down from $10.00 to only $7.66

Our beautiful scoop down from $10.00 to only $7.22

• Repeat the price over and over in your mind
• Now answer:
• How much lower is the sale price than the regular price in %?
Sound symbolism affects reasoning


Our beautiful scoop down from $10.00 to only $7.66

- 7.66 is more expensive but “six” sounds smaller

Our beautiful scoop down from $10.00 to only $7.22

- 7.22 is less expensive but “two” sounds bigger
Sound symbolism affects reasoning: Results

<table>
<thead>
<tr>
<th>Sale Price</th>
<th>Discount</th>
<th>Rehearsal</th>
<th>No Rehearsal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Estimated Discount</td>
<td>Perceived Value</td>
</tr>
<tr>
<td>$7.66</td>
<td>23.4%</td>
<td>28.70%</td>
<td>4.87</td>
</tr>
<tr>
<td>$7.22</td>
<td>27.8%</td>
<td>25.93%</td>
<td>3.73</td>
</tr>
<tr>
<td>$2.33</td>
<td>22.3%</td>
<td>28.10%</td>
<td>4.73</td>
</tr>
<tr>
<td>$2.22</td>
<td>26%</td>
<td>24.13%</td>
<td>3.70</td>
</tr>
</tbody>
</table>

Results held even for people who could not remember the prices when they made their decision

Table from Mark Liberman
What about across languages

• $7.88
  • English “eight eight (front vowels)”
  • Mandarin “ba ba” (back vowels)

• $7.01
  • English “oh 1 (back vowel)”
  • Mandarin “ling yi (front vowel)”

• English: $7.88 discount from $12.00
• Mandarin: $7.01 discount from $9.50
Bilingual speakers, back vowel prices seem higher in both lgs (less discount)
What’s going on with vowels?

- Why do front vowels symbolize SMALL and back vowels symbolize LARGE?
The Frequency code

- High pitched sounds are associated with small animals
- Low pitched sounds are associated with big animals
Vowels and frequencies

• Front vowels have high pitched resonance
  • “High second formant”
• Back vowels have low pitched resonance
  • “Low second formant”
High frequencies associated with children

![Graphs showing high frequencies associated with children's speech](image-url)
High frequencies associated with babies

Both mothers and fathers raise their pitch when talking to infants
Ohala’s “Frequency Code”

- Based on work of Morton (1977)
- Morton looked at vocalizations of 28 avian and 28 mammalian species in “agonistic displays”, face-to-face competition
  - Confident aggressor: a low-pitched vocalization
  - Submissive nonthreatening: a high-pitched sound.
- Morton’s idea: both parties put on displays of size to avoid actual competition
  - Look big: Erection of hair/feathers
  - Look small: flatten feathers, wings
- This might have evolved
Ohala’s Frequency Code

• Maybe this led to an implicit association between high pitch and size
• Even in vowels
Evolutionary Implications: why do we smile?

- Smiles pull back the corners of the mouth
  - front vowel
  - cheese!
  - makes us sound smaller
- Phonetician John Ohala suggests the smile evolved in hominids (or earlier) as an appeasement gesture
  - don’t hurt little old me
“Martian” words.
Which is “maluma”? Which is “takete”?
How about bouba or kiki?
Summary of bouba/kiki

- First studied by Wolfgang Köhler in 1929.
  - Founder of Gestalt psychology, refugee from the Nazis to the US
- Replicated in lots of languages
Results from Spence lab at Oxford

Dark chocolate (Lindt 70% cocoa)    takete
Milk chocolate (Lindt extra creamy 30% cocoa)  maluma

Carbonated beverages: takete
Still water: maluma

We also found:

Crackers: more t and k
Ice cream: more l and m

m and l sounds associated with creamier, gentler tastes, t and k with bitter, sharp tastes
Charles Spence lab at Oxford: chocolate

Taste 2 chocolates:

dark chocolate (Lindt 70% cocoa) takete
milk chocolate (Lindt extra creamy 30% cocoa) maluma


Please make a mark along the line above that you think best matches the flavour of the chocolate that you are about to try. If the flavour better matches the shape/word on the left of the page mark a point to the left of centre, whereas if the flavour better matches the shape/word on the right of the page mark a point to the right of the centre.
Water:

Carbonated water  takete
Still water  maluma

Please select a point along the scale according to the image that best matches your experience when drinking

Por favor seleccione un punto a lo largo de la escala de acuerdo a la imagen que más se parezca a su experiencia cuando bebe
Charles Spence lab at Oxford: water

Water:

Carbonated water  takete
Still water  maluma

Summary

Spence Lab

**Takete**: Carbonated water, dark chocolate

**Maluma**: Still water, milk chocolate

Our lab:
more **t** and **k**: crackers
more **l** and **m**: ice cream

**m** and **l** sounds associated with creamier, gentler tastes, **t** and **k** with bitter, sharp tastes
Sound wave of me

![Sound wave diagram with time and amplitude axes, showing the words "maluma" and "takete" highlighted]
The sound /t/
The sound /k/
Synesthesia: across the 5 senses

**Hearing**: perception of acoustic smoothness is somehow linked to perception of smoothness by **Vision** (curvy not jagged figure) and **Taste** (creamy not sharp taste)
Synesthesia

• Real input to one sense accompanied by a perception in another sense

• 1 in 23 are strong synesthetes
  • Sound $\rightarrow$ color
    • My friend Dan Slobin has colors for musical keys
    • C major is pink, C minor is dark red tinged with black
  • Letter $\rightarrow$ color
  • Word $\rightarrow$ taste
‘Oh, dear […] there aren’t enough points on this chicken. […] I know it sounds crazy, but I have this thing, see, where I taste by shape. […] Flavors have shape, […] I wanted the taste of this chicken to be a pointed shape, but it came out all round. […] Well, I mean it’s nearly spherical, […] I can’t serve this if it doesn’t have points.’ (the synaesthete Michael quoted in Day 2011: 392-393).
Synesthesia and Bouba/Kiki

- Main theory:
  - synesthesia results from "crossed-wiring" in the brain
- Implications from Bouba/Kiki
  - Everyone is slightly synesthetic
Not all of these mappings are universal


- The Himba of Northern Namibia
  - little exposure to Western cultural and environmental influences. No written language
  - Speak Otjiherero, a Bantu language

- Results:
  - Bouba/kiki mapped onto shapes
  - But carbonation not mapped onto an angular (as opposed to a rounded) shape.
  - Milk chocolate mapped to angular rather than rounded shapes (opposite of Westerners)
Vowels matter for bouba-kiki too: real kitchen objects


<table>
<thead>
<tr>
<th>/i/</th>
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Summary

- Conventionalism (“arbitrariness”) is the norm, but naturalism (“sound symbolism”) plays a role as well.
- Two kinds of naturalism extensively studied
  - Front vs. back vowels/high vs. low (“frequency code”)
  - Smooth vs. sharp sounds (“bouba/kiki”)
- Some aspects of these may be universal (weak versions of synesthesia).
- But others may be culture specific
  - Namibians and chocolate/carbonation
Evolutionary Implications: how did language evolve?

- How did the first listener know what the first speaker was talking about?

- Bootstrap theory!

- The first cavewoman
  - says a high-pitched ‘i’ to mean “baby”
  - says a low-pitched ‘o’ to mean “big”
  - says ‘kikiki’ to mean “sharp”
For Tuesday!
While you read Strauss:

Identify your favorite food or favored food in your culture, and describe the sensation you feel when you eat it.

Is your description similar to those used in the American TV advertisements given by Strauss?