SYNAESTHETIC ADJECTIVES: A POSSIBLE LAW OF SEMANTIC CHANGE

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The century-old failure of historical linguistics to discover regularities of semantic change comparable to those in phonological change, as described by Grassmann or Grimm, has forced us to entertain as 'semantic laws' proposals that express mere tendencies, or are so restricted to a particular time, language, or narrow inventory, that the 'law' is indistinguishable from a description of a discrete historical event. But in the lexical field of English adjectives referring to sensory experience, there has been a continuing semantic change so regular, so enduring, and so inclusive that its description may be the strongest generalization in diachronic semantics reported for English or any other language. On the basis of very similar evidence from Indo-European cognates and from Japanese, the possibility exists that the regularity described here might characterize more than just these languages. It qualifies as a testable hypothesis in regard to future semantic change in any language.*

1. THE STUDY OF SEMANTIC CHANGE. Despite the increasingly intense interest in theoretical descriptive semantics, theoretical historical semantics continues to languish in the backwaters of lexicography and comparative philology, or in the shallows of histories of the English language. Indeed, we have little more of a theory of semantic change today than when Paul dealt with the problem in 1880. This lack of interest or of any significant current progress is reflected in a number of ways. Recent texts and anthologies in comparative-historical theory devote relatively little attention to the problems of historical semantics, and use terms which would have been familiar to Greenough & Kittredge in 1901. Of the several histories of the English language published in the last decade, only one (McLaughlin 1970) attempts more in historical semantics than Stern in 1932. Journal articles dealing with the theory of semantic change are remarkable by their scarcity. In a series of lectures reviewing recent developments in semantic theory and practice, Ullmann 1973 ignores historical semantics almost entirely. And in two recent book-length studies devoted entirely to semantic theory (Chafe 1970, Leech 1974), the fewer than ten pages devoted to semantic change are very superficial.

The one possible exception to this scholarly dearth is Berlin & Kay's 1969 monograph on the inferred historical order of the development of color terms in several unrelated languages. Whatever the reliability of their data, they have proposed the first universal principle of semantic evolution based on structuralist principles. But except for this single study, recent work in historical semantics has provided little more than etymologies of individual words, and nothing that helps us understand the systematic way in which structures of meanings can change.

There are at least two reasons for this failure. First, of all the areas of language behavior, meaning is of course the most intractable, even as regards merely posing

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a question that might be answered. It is not at all clear what we want to know when we ask what a word means, even after 25 centuries of debate.

More pragmatically, general linguistic theory has offered no way, until relatively recently, to represent in formal terms what we take to be the meaning of a word. Though we might not universally agree on the particular formal system in which to couch a description of phonological or grammatical change, we are now able to discuss such matters in a more or less fruitful way, because we have a variety of formal systems with symbols that we can change in order to represent how real-language behavior changes. In traditional phonology, we understand change in terms of the symbols *p t k* becoming or replacing the symbols *f θ h*. In generative phonology, we understand change in terms such as rule addition, simplification, loss, and re-ordering. In each case, we interpret and understand an historical event through symbolic changes, within formal systems that encompass bodies of data amenable to analysis through those systems.

1.1. A formal system for representing semantic structure is no less a prerequisite to describing most patterns in change of meaning. Voyles 1973 has attempted to represent change of meaning, building on the formal semantic theory of features and markers first proposed by Katz & Fodor 1963. He tries to demonstrate that semantic change can be systematically explained by changes in rules that generate semantic representations, much as phonological change can be represented as rule change. But a great deal of investigation is still necessary before we understand what should go into a semantic representation, much less what one should look like and how it might change. Berlin & Kay avoid this problem because they do not have to define the internal semantic structure of particular lexical items either discursively or symbolically. Rather, they are able to map their color terms onto a 2×2 grid representing hue and saturation—an entirely ostensive, language-free method for representing this particular semantic area. Indeed, the fact that they need no formal symbolic representation contributes to their ability to formulate a very strong generalization about semantic change.

1.2. When we search linguistic scholarship for any other strong generalizations of this kind, we find very few. On the one hand, those generalizations which claim to apply to languages everywhere are usually phrased only as statistical tendencies. Sperber (1922:67) asserted, e.g., that if one word in a field of highly charged emotional words changes metaphorically, then other words in the same field will also tend to change. Wundt (1900:580) claimed that semantic areas of particular relevance to a speaker are the primary source for transferred lexemes. Bloomfield suggested (1933:429) that concrete terms are the usual source for words referring to abstract referents. Unfortunately, all these claims are supported by little more than a few examples and the linguist's statistical intuition.

On the other hand, generalizations claimed to be exceptionless are usually restricted to an extremely narrow range of data, within a very restricted time period. Most frequently cited as an example of an exceptionless semantic change of this kind in English is Stern's claim (190) that if any Middle English adverb meant 'quickly' before 1300, it later developed the meaning 'immediately'. No adverb meaning 'quickly' after 1300 changed in this way. But in comparison to more powerful generalizations like Grimm's Law, such an exceptionless generalization is

so restricted that it serves merely to emphasize how little we know about diachronic semantics.

2. SEMANTIC CHANGE IN ENGLISH SYNAESTHETIC ADJECTIVES. What follows is a proposed generalization about semantic change. As formulated, it comprehends only English. But some good evidence suggests that it may apply to other languages; indeed, after further investigation, it may turn out to be a principle of semantic change. It is of rather general scope, covering all English adjectives—well over 100, borrowed as well as native, from their first citations (as evidenced by the Oxford English Dictionary and the Middle English Dictionary) to the present—which refer to any primary sensory experience: touch (*hot, sharp* etc.), taste (*sweet, sour* etc.), smell (*pungent, acrid* etc.), visually perceived dimension (*high, low* etc.), color (*bright, dark* etc.), or sound (*loud, quiet* etc.) Like Berlin & Kay's color terms, this is an ostensibly definable semantic field, requiring no discursive definitions.

Even in English, the generalization is not exceptionless. But its regularity varies between 83% and 99%, depending on how we compute what counts as an observation of it. Moreover, each of the exceptions is mildly anomalous in a way that helps explain why it might be a special case, not subject to the generalization. What we have, then, is the strongest statement about semantic change that has been suggested for English or for any other language.

2.1. One of the most common types of metaphoric transfer in all languages is synaesthesia—the transfer of a lexeme from one sensory area to another: *dull colors, brilliant sounds, sharp tastes, sour music* etc. Less frequently noted are those potential transfers which, at least in English, do NOT occur (except perhaps in poetry): *loud heights, bright tastes, sweet blades* etc. On the one hand, these may be merely accidental gaps in the semantic field of sensory experience. But on the other hand, as Ullmann points out in regard to synaesthesia in 19th-century poetry (1957:266 ff.), there is a regularity that exceeds chance. He found, in the poetry of Byron, Keats, Wilde, Symons, Gautier, and others, that the semantic field of tactile experience provided the largest number of lexemes transferred to other sensory modalities; the semantic field of acoustic words received the greatest number of items. Others have noted similar regularities.

The transfer of lexemes from one sensory modality to another, as reflected in the citation dates from the OED and the MED, also reflects this regularity. But what Ullmann's data do not hint at is the highly regular diachronic movement among the meanings, plus a refinement to the central generalization which is probably peculiar to English. (The data on which the following discussion is based may be found in Appendix I. A statistical summary appears in Appendix II.)

THE MAJOR GENERALIZATION is this: if a lexeme metaphorically transfers from its earliest sensory meaning to another sensory modality, it will transfer according to the schedule shown in Figure 1.

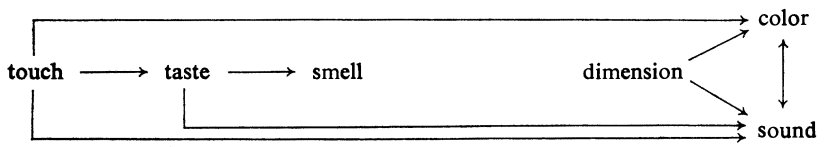

FIGURE 1

The schedule gives us the following information:

(1) If a touch-word transfers, it may transfer to taste (*sharp tastes*), to color (*dull colors*), or to sound (*soft sounds*). With one exception (*sharp angles*), tactile words do not shift to visual dimension or directly to smell.

(2) Taste-words do not transfer back to tactile experience or forward to dimension or color, but only to smell (*sour smells*) and sounds (*dulcet music*).

(3) There are no primary olfactory words in English (i.e. none historically originating in the area) that have shifted to other senses.

(4) Dimension lexemes transfer to color (*flat color*) or to sound (*deep sounds*). *Thin* and *flat*, as in *thin/flat tastes*, are exceptions. *High* in *high temperature* is not a sensory word, but rather a degree-word (as in *high number* or *high weight*).

(5) Color-words may shift only to sound (*bright sounds*).

(6) Sound-words may transfer only to color (*quiet colors*).

Below are listed correct first-order transfers, the first metaphorical extension of a lexeme from its original sensory modality to a new one. 'Original' here means (1) etymologically original—in that, e.g., the roots for *sharp* and *cold* have always referred to tactile experience—or (2) derivatively original—in that, e.g., *keen* and *mild* originally referred to non-sensory experience, but transferred to the sensory modality of touch, and then from touch to other sensory modalities. Not all these items still retain the meanings indicated.

TOUCH TO TASTE: *aspre, bitter, bland, cloying, coarse, cold, cool, dry, hard, harsh, keen, mild, piquant, poignant, sharp, smooth.*

TOUCH TO COLOR: *dull, light, warm.*

TOUCH TO SOUND: *grave, heavy, rough, smart, soft.*

TASTE TO SMELL: *acrid, sour, sweet.*

TASTE TO SOUND: *brisk, dulcet.*

DIMENSION TO COLOR: *full.*

DIMENSION TO SOUND: *acute, big, deep, empty, even, fat, flat, high, hollow, level, little, low, shallow, thick.*

COLOR TO SOUND: *bright, brilliant, clear, dark, dim, faint, light, vivid.*

SOUND TO COLOR: *quiet, strident.*

There are some non-predicted transfers:

TOUCH TO DIMENSION: *crisp.*
TOUCH TO SMELL: *hot, pungent.*
TASTE TO TOUCH: *eager, tart.*
TASTE TO COLOR: *austere, mellow.*
DIMENSION TO TASTE: *thin.*
DIMENSION TO TOUCH: *small.*
SOUND TO TASTE: *loud.*
SOUND TO TOUCH: *shrill.*

There are 54 correct transfers in 65 cases, or 83% agreeing with the prediction. From the non-predicted transfers, we can infer a second regularity: If a lexeme transfers against the predicted pattern, that new meaning does not tend to maintain itself in what I shall loosely term 'Modern Standard English'. That is, of the incorrect transfers cited above, only the taste-meaning of *thin* and the smell-meaning of *pungent* are, for most of us, active and natural. If we add this refinement to the generalization, then 63 of the 65 cases follow the prediction, or 97% of the instances.

This alone is a significant enough generalization. Sensory words in English have systematically transferred from the physiologically least differentiating, most

evolutionary primitive sensory modalities to the most differentiating, most advanced, but not vice versa. It should be emphasized that there is no intrinsic reason why this order should be observed. In a forced-choice test, 25 undergraduates displayed a high level of agreement (90% +) on the meaning of metaphors such as *loud heights* (high or low?), *sour blades* (sharp or dull?), and *quiet angles* (acute or obtuse?) Since such metaphors can be understood, there seems to be no principled reason for them not to develop. But except in poetry, they do not.

2.2. A large number of these lexemes, of course, transfer a second, third, even fourth time. Thus *harsh* refers to the senses of touch, taste, color, and sound; *sour* to taste, smell, and sound; *flat* to dimension, taste, color, and sound. We might ask whether second-, third-, and fourth-order transfers behave in ways similar to first-order transfers.

Accounting for these post-first-order changes is a less clear-cut problem than accounting for first-order transfers. We might be reasonably certain that the taste-meaning of *sharp* is more probably related to the touch-meaning than to any of the other earlier attested meanings; but we cannot be certain whether the later sound-meaning is directly (i.e. genetically) related to that of touch or of taste—or, for that matter, whether the notion of direct semantic lineage is even appropriate to these cases. That is, part of the semantic extension of the lexeme *sharp* might be represented as in Figure 2.

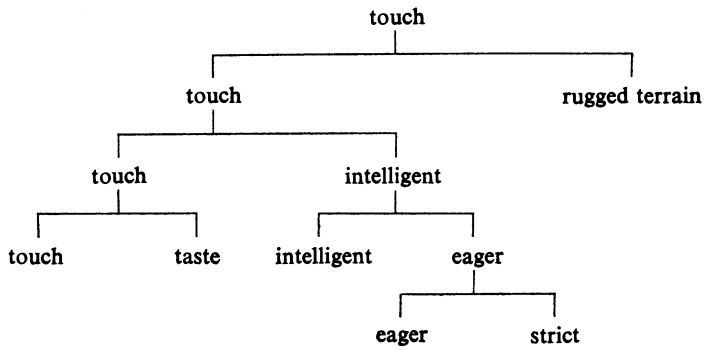

FIGURE 2

When we attempt to add the sound-meaning, we cannot be certain whether to derive it from that of touch or of taste—or whether the sound-meaning is in some way a result of their dual influence, and therefore not uniquely attributable to one or the other. What is presented below, then, must be understood only as a description of the chronological sequence of post-first-order transfers. We might be more or less confident in postulating most semantic genealogies; but those lexemes with many meanings associated with them complicate the question, and forbid us to be entirely confident about particular lines of descent.

In light of the qualification, it can be claimed that post-first-order transfers obey the same general constraints as first-order transfers in that their sequence of development is determined by the most 'advanced' sense of a lexeme. For example, upon its first-order transfer, the lexeme *dull* by-passed the modalities of taste, smell, and dimension, moving to color; see Figure 3.

	TOUCH	TASTE	SMELL	DIMENSION	COLOR	SOUND
dull	1230				1430	1475

FIGURE 3

Because color was then the most advanced sense among the modalities, it determined the direction of the second-order transfer. Because of the general constraint cited above, sound was the only modality with which *dull* could associate. Furthermore, in those cases where this constraint is violated, non-predicted post-first-order senses, like non-predicted first-order transfers, tend not to maintain themselves in the language of most English speakers.

Below are listed all the predicted and non-predicted second-, third-, and fourth-order transfers. The senses of the asterisked entries among the incorrect items have not disappeared, and so are counted as genuine exceptions to the generalization. The letters refer to the various sensory modalities: T = touch, G = taste, O = smell, D = dimension, C = color, S = sound. Senses in parentheses are the earlier senses of the word arranged in the order of their preceding development.

Second-order correct:
TOUCH: *aspre* (TG)S, *bitter* (TG)O, *coarse* (TG)S, *cold* (TG)C, *cool* (TG)C, *crisp* (TD)C, *dry* (TG)S, *dull* (TC)S, *grave* (TS)C, *hard* (TG)S, *harsh* (TG)S, *keen* (TG)S, *light* (TC)S, *mild* (TG)S, *sharp* (TG)S, *smooth* (TG)S, *warm* (TC)S.
TASTE: *sour* (GO)S, *sweet* (GO)S.
DIMENSION: *deep* (DS)C, *even* (DS)C, *full* (DS)C, *small* (DT)S, *thin* (DG)C.
SOUND: *loud* (SG)C.

Third-order correct:
TOUCH: *cold* (TGC)S, *cool* (TGC)S, *harsh* (TGS)C, *hot* (TOG)S, *keen* (TGS)C, *mild* (TGS)C.
TASTE: *mellow* (GCO)S.
DIMENSION: *flat* (DSG)C, *thin* (DGC)S.
SOUND: *shrill* (STG)C.

Fourth-order correct:
TOUCH: *hot* (TOGS)C, *soft* (TSGO)C.

Second-order incorrect:
Modality incorrect:
TOUCH: *smart* (TS)G.
TASTE: *brisk* (GS)C.
DIMENSION: *acute* (DS)G, **flat* (DS)G, *fat* (DS)G, *high* (DS)G.
COLOR: **faint* (CS)O.
SOUND: *shrill* (ST)G.
Order incorrect:
TOUCH: **hot* (TO)G, *pungent* (TO)G, *rough* (TS)G, *soft* (TS)G.
TASTE: *mellow* (GC)O.

Third-order incorrect:
Modality incorrect:
TOUCH: **sharp* (TGS)D, *smart* (TSG)D.
DIMENSION: *small* (DTS)G.
Order incorrect:
TOUCH: *soft* (TSG)O.

Fourth-order incorrect:
Modality incorrect:
TASTE: *mellow* (GCOS)T.
Order incorrect:
TOUCH: **harsh* (TGSC)O, **sharp* (TGSD)O.

The level of agreement among these post-first-order transfers is not as high as among the first-order. There are 37 correct and 20 incorrect, or only about 65% agreement with the prediction. But 14 of the 20 non-predicted senses correct themselves by not becoming established in Modern Standard English, leaving only six incorrect out of 57, giving over 89% agreement. When the first- and post-first-order transfers are combined, there are 114 correct, on the basis either of their predicted transfers or self-correction, and eight incorrect, giving an agreement of over 93% with the prediction. And as we shall see, several of the eight are dubious exceptions.

It is even more difficult to formulate any intrinsic reason for this pattern of post-first-order transfers. Few speakers carry the etymological development of metaphors around in their minds, to test new metaphors against. Perhaps we infer that the least frequent meaning is the most recent, and then apply that conclusion to determining the ultimate acceptability of a metaphor. But that is a far-fetched explanation at best.

2.3. I should point out that the self-correcting disappearances of non-predicted meanings is not a function of the random loss of a large number of meanings. The data consist of 187 items, original and transferred. Of these, 46 disappear or do not become established in Standard English. If these 46 were randomly distributed among the 65 original, 91 correctly predicted, and 31 non-predicted meanings, there would have been 16 disappearances among the original meanings, 22 or 23 among those correctly transferred, and seven or eight among the non-predicted ones. In fact there are not 16, but only 11 disappearances among the original meanings; not 23, among the predicted ones, but only 12; and not seven, but 23 disappearances among the non-predicted ones—a set of figures which strongly indicates we are not dealing with random distributions.

2.4. There is another way to compute the level of agreement. Let us state the constraint negatively: Lexeme_x may not transfer from modality_y to modality_z. Then every specific non-occurrence of a proscribed transfer must also count as fulfilling the generalization. Consider the entry for *sour*, as shown in Figure 4. ('W3' indicates that the acoustic sense of *sour* is not recorded in the OED, but is in an undated citation in Webster's Third.)

	TOUCH	TASTE	SMELL	DIMENSION	COLOR	SOUND
sour		1000	1340			W3

FIGURE 4

The two transfers of *sour*, first to smell and then to sound, observe the rule. But the failure to transfer back to touch, against the rule, or forward to dimension and color, also proscribed for taste-words, counts as an observation of the regularity as well. Computed in this way, in addition to two instances of rule observance in the correctly selected transfers, the first-order non-selected modalities show three 'units' of rule observance. Altogether, there are 167 correct first-order non-selected modalities, two incorrectly chosen, or about 99% agreement.

But this is not the final answer either, for once *sour* has transferred to a gustatory modality, that in effect creates a new condition for a new implicit rule observance. Since such words are also proscribed from transferring back to touch, or forward to dimension or color, there are three more units of rule observance. And when the sound-meaning of *sour* develops, the rule applies yet again. *Sour* has not moved back, against the generalization, to dimension or touch, so we have two more units of rule-observance:

1st order: Three correct non-transfers.
2nd order: Three correct non-transfers.
3rd order: Two correct non-transfers.

When we compute the proportion of rule agreement in this way, including all 422 correct non-transfers, the level of agreement approaches 99%.

But even this is not the last body of relevant data. For while the 65 items and their 187 meanings observe these generalizations 99% of the time, we can say that words which have never metaphorically transferred observe the generalization 100% of the time, by not transferring to the incorrect modality: i.e., *pallid sound*, *pallid taste*, and *pallid smell* are all entirely transparent, yet they are not found in the OED or W3; nor do transferred meanings of sensory words such as *wet*, *damp*, *long*, *short*, *blunt*, *sultry*, *chilly*, *jejune*, *sapid*, *mordant*, *stridulous*, *raucous*, *lucid*, *radiant*, *lambent*, *tenebrous*, *wan*, *plane*, and *steep*. Were these added to the inventory of items, the level of agreement with the prediction would be virtually 100%.

There are, then, a number of ways to compute the level of agreement with the generalization. Depending on which we choose, agreement ranges from 83% to over 99%. But however it is computed and however it is stated, the rule remains the strongest diachronic semantic generalization suggested for any language. Sixty-five words (in addition to many more that have not provided incorrect synaesthetic metaphors), from six semantic sub-fields constituting a larger semantic field, participate in 552 'events', only eight of which do not agree with the generalization.

2.5. Two additional questions might be briefly investigated, to illustrate the strength of this generalization further. First, are the eight exceptions to the generalization anomalous in any way? In two cases, *harsh* and *sharp*, we are obliged to stipulate exceptions, because no olfactory meanings are cited in either the OED or the MED, but they are in W3. It is virtually certain that such omissions are entirely fortuitous. That *sharp* was never used to describe smells before modern times is a claim difficult to accept. In another case (*pungent*), the olfactory meaning is cited only eight years before the gustatory, a meaningless difference. In another (*hot*), the olfactory meaning is cited almost two centuries before the gustatory. Though it disappears, we still must count the subsequent development of the gustatory meaning as a violation. In brief, four of the eight exceptions involve mere ordering problems of gustatory and olfactory meanings—which, of course, are physiologically very similar.

Faint, another exception, originally meant 'feigned, simulated'. But what is more important than its origin, *faint* in *faint smell* does not really refer to quality-of-taste or smell. It does not occur in a frame such as *How does that soup smell? It smells* ____. Other transferred words do fit: *pungent*, *acrid*, *sour*, *sweet* etc. *It smells faint* is not at all parallel to those, and is somewhat anomalous.

The OED cites *sharp* from 1340 as a dimension-word referring to noses. It is questionable, though, whether this might not have implied a metaphor for penetrating or cutting, rather than describing merely the shape of the nose. The earliest unambiguous dimensional reference to *sharp angles* does not occur until the early 16th century, not long before the first citation of *acute* in *acute angles*. It is not impossible that the geometric sense of *acute* was borrowed from Latin and associated with *sharp*.

Flat as a taste-word appears to be a clear-cut violation—though if *flat* had been classed as a touch-word, *flat taste* would have been considered an ordinary transfer, from touch to taste. The only clear-cut, unambiguous violation of the predicted movement is *thin* to taste; and even that is in a sense anomalously restricted to liquids, unlike any of the other taste-words.

A second question which we might briefly explore can be put in the form of an objection: it might be that a large percentage of this agreement rests on a specific failure of touch and dimension to attract transfers, because there is no 'felt need' in our culture to increase its ability to refer to new tactile and dimensional experience. This possibility can be easily examined by studying the sources of words introduced into these areas since Old English. Ignoring all the tactile and dimension words except those we have listed here, we have a total of 44 items. The following are borrowed: *aspre*, *cloying*, *bland*, *coarse*, *crisp*, *grave*, *piquant*, *pungent*, *acute*, *big*, *level*. The following are metaphorically derived from non-sensory semantic fields: *dull* 'stupid', *mild* 'sweet in disposition', *soft* 'pleasant', *empty* 'at leisure', and *keen* 'intelligent'. Thus, of the 44 items we are dealing with here, 18 are not indigenous to the field—a fact which argues strongly against any alleged lack of need for new words in those areas.

If the areas of touch and dimension provide other sensory modalities with words, it is not apparent why other areas do not reflexively supply touch and dimension modalities with needed words. But in fact, the restriction against transferring from those other sensory modalities appears so strong that we can observe a contradiction of Bloomfield's generalization concerning the derivation of abstract from concrete words: touch and dimension, areas of relatively concrete reference, draw on words representing more abstract meanings. So it is not the case that the fields of touch and dimension are closed to transfers. Indeed, the fact that they draw on other fields, but not from those proscribed by the generalization, simply underscores the power of the generalization.

3. SYNAESTHETIC CHANGE IN INDO-EUROPEAN AND JAPANESE. Whether this pattern can be found in the semantic history of other languages is obviously a question of some magnitude and considerable interest. There is some evidence that the investigation might yield positive results; thus, the development of cognates in the several Indo-European languages strongly supports the pattern described here. Many cognates develop according to the prediction; relatively few contradict it, and those only in very special ways.

Buck 1949 notes many of these same transfers in a fragmentary way. But the order in which he presents the various semantic categories (dimension, smell, taste, sound, color, and touch) obscures the intermodal transfers and the particular consistencies within the categories. The following sampling of these changes,

using data from Buck and from Pokorny 1959, is not all adjectival; but enough of the outlines of the system described above can be found among them to suggest that a law-governed system of changes may apply to more than just English.

TOUCH TO TASTE

IE *(*s*)*ker-t-* 'cut' > Lith. *kartus* 'bitter'.
IE **aḱri-* 'sharp' > Latin *ācer* 'biting'.
Irish *gēar* 'sharp' > *gēar* 'acid'.
Greek *pikrós* 'sharp' > *pikraínō* 'make bitter'.
Skt. *tiktá-* 'sharp' > *tiktá-* 'bitter'.
Skt. *çuc-* 'burn' > *çuktá-* 'acid, sour'.

(Buck, 1024, mentions Aristotle's observation in *De Anima*, 2.9, that there are no olfactory words indigenous to Greek, to underscore the same condition in Indo-European—a condition we found in English, as well.)

TOUCH TO COLOR

IE **tep-* 'warm' > Skt. *tap-* 'glowing'.
IE **dheg^{u}h-* 'burn' > Irish *dedol* 'dawn'.

DIMENSION TO COLOR

Greek *bathús* 'deep' > *bathús* 'dark'
Italian *cupo* 'deep' > *cupo* 'dark'.

DIMENSION TO SOUND

Latin *altus* 'high' > Italian *alto*.
Latin *suprā* 'highest' > Italian *soprano*.

SOUND TO COLOR

Latin *clārus* 'clear in sound' > *clārus* 'clear in color'.
Middle High German *hel* 'loud' > New High German *hell* 'bright'.

Some cases contradict this pattern, but they appear to constitute a limited group:

TOUCH TO DIMENSION

IE **pi$\hat{k}$-* 'sharp' > English *peak* (borrowed through Celtic or Romance; a doubtful case.)
IE **$\hat{k}$ent-* 'to prick' > Greek *kéntron* 'center point'.
Latin *pungo* 'to prick' > *punctum* 'point in space'.

COLOR TO DIMENSION

Middle High German *kleine* 'clean' > New High German *klein* 'little'.

COLOR TO TOUCH

Latin *nitidus* 'shining' > Rumanian *neted* 'smooth'.

The last two are dubious cases. *Kleine* is marginally a color-word, though its source, Old High German *kleini* 'shining', was a color-word. The change from *nitidus* to *neted* is closer to metonymy than to metaphor.

Obviously, very little can be inferred from such a small sample. But both the confirmed pattern and the exceptions are suggestive. More interesting, perhaps, would be a non-IE language like Japanese, which presumably would be uncontaminated by any cultural patterns of change that might characterize those languages we have described so far.

There are two kinds of evidence to consider. First is the sort of evidence found in the OED for English. Unfortunately, Japanese does not have a reference work like the OED, in which citation dates of earlier and later meanings are available. But Kōjien, one of the standard Japanese dictionaries, does list its entries in a roughly historical order. Second, we have the intuitive sense of native Japanese

speakers in regard to how any sense adjective can collocate with a new referent. Thus *ōkī* 'large', is not cited in Kōjien as an acoustic word; but my informants judge it to be acceptable as meaning 'loud'.

Listed below are the two kinds of evidence. In parentheses are those senses which are not given in Kōjien for the relevant word, but are acceptable to my informants.

I. Evidence from Kōjien
  A. Agreeing with prediction:
    1. *nibui*: dull; dim light; muffled sound. T-C-S.
    2. *suzushī*: cool; clear color; (clear voice). T-C-(S).
    3. *shibui*: astringent; a not-gaudy color; (voice quality). G-C-(S).
    4. *awai*: thin; pale. D-C.
    5. *asai*: shallow; pale. D-C.
    6. *chisai*: small; low sound. D-C.
    7. *fukai*: deep; deep color; (rich odor in Kōjien, but not acceptable to my informant); (deep voice). D-C-(O)-(S).
    8. *hikui*: low; low sound. D-S.
    9. *takai*: high; high sound. D-S.
    10. *usui*: thin viscosity; thin color; *thin taste. T(?)-C-*G.
  B. Disagreeing with prediction:
    1. *amai*: sweet; *blunt; (voice quality). G-*T-(S).
    2. *koi*: rich color; *thick fluid; *deep taste/smell. C-*T(?)-*G.

II. Confirmed by informants
  A. Agreeing with prediction:
    1. *arai*: rough; (taste; sound). T-(G-S).
    2. *atatakai*: warm; (color; sound). T-(C-S).
    3. *atsui*: hot; (color). T-(C).
    4. *karui*: light weight; (taste; sound (?)). T-(G-S).
    5. *katai*: hard; (sound). T-(S).
    6. *nameraka*: smooth; (voice quality). T-(S).
    7. *omoi*: heavy; (taste; sound). T-(G-S).
    8. *samui*: cold; (color). T-(C).
    9. *surudoi*: sharp-edged; (voice quality). T-(S).
    10. *yawarakai*: soft; (sound). T-(S).
    11. *suppai*: sour; (smell). G-(O).
    12. *dekkai*: large; (sound). D-(S).
    13. *futoi*: wide; (deep voice). D-(S).
    14. *hosoi*: narrow; (thin sound). D-(S).
    15. *ōkī*: large; (sound). D-(S).
    16. *taira*: flat; (voice quality). D-(S).
    17. *akarui*: bright; (sound). C-(S).
    18. *kirei*: brilliant; (voice quality). C-(S).
    19. *kurai*: dark; (sound). C-(S).
    20. *kiroi*: yellow; (shrill). C-(S).
  B. My informants could think of no cases that contradicted the generalization.

The 32 items provide lexemes for 39 correct transfers, plus one possible corrected transfer. The four incorrect items transfer to an incorrect modality (*usui* from color to taste, *amai* from taste to touch; *koi* from color to tactile, if viscosity is a tactile modality, and to taste/smell). Considering only the positive transfers and the single correction, and ignoring the correct non-transfers, we find 40 correct predictions, four incorrect, or 91% rule agreement. (It might further be noted that three of the

four exceptions involve reference to the viscosity of liquids. Recall that the only unambiguous exception in English is *thin*, which behaves similarly.)

In short, the rule seems to apply not just to English and to a substantial number of cases among Indo-European cognates, but seems to predict sense transfers in Japanese as well. Obviously, the value of such a small sampling of languages is merely to indicate that pursuing the question in a wider variety of languages might yield results that would allow us to speculate more fruitfully about universal principles of semantic change.

4. PARALLEL SYSTEMS. The sequences touch–taste–smell and sight–hearing or hearing–sight are reflected in so many areas of scholarly inquiry that we might legitimately speculate whether some principle of sequential relationship might underlie not only semantic change but other sensory systems as well. (It should be strongly emphasized that the following are presented only as striking parallels, to pique interest. No cause–effect relationship whatever is claimed.)

4.1. Aristotle, in *De Anima* (2.7–2.11), discusses the five senses in the order sight–hearing–smell–taste–touch, observing (as we noted) the lack of any non-metaphorical olfactory word in Greek—a condition reflected in Indo-European and possibly in Japanese as well. Like Democritus before him, Aristotle regarded touch as the primary sense, and vision as the most advanced—with taste as a special kind of touch, and smell so closely related to taste that we draw upon its vocabulary for reference to olfactory experience.

Aquinas, in his *Summa theologiae*, echoes Aristotle in making touch the basis of all the other senses, with smell the least well-developed, because a keen sense of smell requires a dry brain, while upright man has a moist one (13.19.3). Since taste is a kind of touch (78.3), and the order of the higher senses is smell–hearing–sight (77.4), we conclude that Aquinas's ordering of the senses reflects what we have established for semantic change.

4.2. The question which all this immediately poses, of course, is whether these sequences might be reflected in any physical basis of sensation. There is bountiful evidence of strong parallels. First, the physical evolution of the sensory modalities appears to follow the order of transfers: tactile, gustatory, olfactory, acoustic/visual or visual/acoustic. In early vertebrates, the hindbrain developed as an area that processed information from the immediate environment (tactile, gustatory, and vestibular experience), allowing the medulla to trigger instant motor reflexes. The midbrain specialized, developing processing areas for visual and olfactory experience—stimuli from more distant aspects of the environment. The acoustic sense apparently developed as an accidental by-product of the vestibular mechanism in the medulla (Sarnat & Netsky 1974:29 ff.)

Even some of the finer relationships in the pattern are reflected in smaller-scale evolutionary events. The later development of the optic nerve began with the evolution of rods; these process gross light features which are involved in the recognition of mere size and shape. The cones, which are sensitive to finer gradations of color and brightness, developed later. Historically, the olfactory sense very likely developed after the gustatory; but after evolving into a rather sensitive mechanism in many other creatures, including some contemporary primates, it seems to have

atrophied in man. Though I do not suggest that Fig. 1 represents more than chronological sequence, the 'dead-end' appearance of the olfactory sense is a striking visual metaphor for the evolutionary history of man's sensory development.

Paralleling this phylogenetic sequence is the ontogenetic history of the human neonate's sensory maturation. It is born with its tactile sense already operational, as seen in its turning its head toward a touch on the cheek, a seeking-reflex associated with the nipple. Taste is also operational, if the infant's preference for milk over glucose and water is any indication. Olfactory responses apparently develop after this—but before sight and sound, which are the last sensory areas to mature fully, probably in that order (Rose 1973:148 ff.) The sensory maturation of many mammals seems to parallel this order (Volokhov 1970:582). An evolutionary reason for the sequence may be found in the nature of the immediate needs of the human neonate: it must find the nipple and accept milk. To be sure, infants only a few hours old can track visual stimuli, respond to face-like images more consistently than other figures, and evidence some desire to locate sound; but those responses appear to have no immediate function in life-sustaining behavior (Peiper 1963:95).

The neuro-physiological growth of the infant parallels this development. The order in which neural pathways in the sensory cortices myelinate (build up sheaths of myelin around them) parallels this basic sequence: tactile first, then olfactory, then either optic–acoustic or acoustic–optic (Peiper, 94). The position of gustatory development is unclear.

The mature neuro-physiology of sensation appears to parallel, though less clearly, the pattern of change described here. Now that much brain research has rejected the 19th-century notion of a brain neatly compartmentalized into mechanistic functions and areas, in favor of a holographic model (Pribram 1971), it is pointless to seek anything parallel to Fig. 1 in the arrangement of association cortices, despite an occasional correspondence in other regards. The axons extending out from bi-polar neurons in the mammalian central nervous system, e.g., are of varying lengths and, in their terminal branchings, of varying complexity. The length and complexity of branchings, however, seem to be least for those neurons associated with tactile sensation, longer and more complex for those associated with olfactory experience, and longest and most complex for auditory and visual experience (Pribram, 16).

5. CONCLUSION. Obviously it is presumptuous, to say the least, to seek a biological foundation for a phenomenon that may not universally exist, in an aspect of human cognition about which very little is known. But the parallels that do exist indicate that further research might not be fruitless. Indeed the possibility, however slight, that connections might exist among ontogeny, phylogeny, the neurophysiology of sensation, cognition, and naming suggests a point of interaction between mind and brain not quite as localized as the pineal gland, but perhaps somewhat more amenable to further exploration.

In any event, what is offered here constitutes not only a description of a rule-governed semantic change through the last 1200 years of English—a regularity that qualifies for lawhood, as the term LAW has ordinarily been used in historical linguistics—but also as a testable hypothesis in regard to past or future changes in

any language. Indeed, so stated, such a hypothesis qualifies as a scientific law on the criteria set by Hempel (1965:264) or Nagel (1961:47). It comprises, within the universe of human languages, a set of unrestricted universals (human sensory modalities) and an indefinite number of objects (lexemes referring thereto), in a stipulated relationship (sequence of changes) through indefinite time (past, and for the sake of the argument, future). Whether such a hypothesis eventually achieves the status of law in this sense depends, of course, on the additional data that can be brought to bear on the problem. This task is best accomplished by those with native-speaker knowledge of the acceptable metaphorical synaesthetic transfers in any given language.

APPENDIX I

The preceding discussion is based on the data assembled below, which include every word in English (which I could find) that has undergone a metaphorical transfer from one sensory area to another. As noted above, I have omitted sensory words that have not provided metaphors, e.g. *wet*, *damp*, *long*, and *short*. Also not included are words derived from other words (with the exception of *cloying*), e.g. *muddy*, *reedy* and *lemony*.

Each word is accompanied by two or more dates. The earliest date is the earliest citation for that word in its first reference to sensory experience found by the editors of the OED or the MED, whichever date is earlier. Where the citation date is from the MED, the date is in italics; otherwise, the date is from the OED. Although the MED generally has earlier citations for many words than the OED, it is significant that in only one case does the chronology of meaning developments (as evidenced only by dates) disagree. For *deep*, the OED has color 1555, acoustic 1591. The MED has color 1398, acoustic 1387. This single exception argues that when MED fascicles M–Z appear, they might predate, but will not seriously contradict, the chronological order of the OED citations.

Subsequent dates are the earliest citations for the transferred lexemes in the relevant semantic areas. Thus the earliest citation for *sharp* (or *scearp*) in its literal tactile meaning is 825. Its first citation as a metaphorical taste-word is 1000, for an acoustic word 1390.

When the first citation date is in square brackets, e.g. the [1430] date for *dulcet*, that meaning is obsolete, according to either its entry in the OED or its failure to appear in W3. The entry 'W3' (e.g. for *sour* in its acoustic meaning) indicates the meaning does not appear in the MED or OED, but does in W3. I assume that such entries invariably postdated the OED/MED citations for other senses. Parentheses without a date indicate that the relevant meaning appeared neither in the OED/MED nor in W3, but I judge the sense to be familiar enough in English to warrant inclusion. There are, it might be noted, only four of these: *little sounds*, *warm sounds*, *empty sounds*, *brilliant sounds*. An asterisk indicates an apparent violation of the predicted pattern.

What must be immediately acknowledged, of course, is the uncertain reliability of the dates cited in the OED and the somewhat less uncertain dates of the MED. Many citations are certainly not the earliest appearance of a word or meaning in English texts, particularly those cited here from volumes M–Z of the OED. And even for those that may be the first occurrence in written texts, it is certain that many had occurred in speech long before they appeared in writing or print. But because the information in the OED and the MED is all we have, we must rely on what we find there. I am also assuming here, unjustifiedly, that the earliest citation of a sense marks the beginning of its full acceptance and stabilization in the language, when in fact it may well have been only an early sport. For that reason, it may be that the OED dates are more reliable.

Indeed, this entire question of when a word is in the language or out of the language is very difficult to answer in any definitive way. Ideally, we would need a frequency chart for the occurrence of each word. We might then date its full acceptance into the language when it passed some arbitrary threshold of occurrence. But we have no such chart, and it is unlikely that

one will ever be forthcoming. In the light of that limitation, we must inevitably fall back on the citation dates in the OED and MED.

I have included some items that might be questioned and others that require some explanation. Even if all these items were rejected, however, the general proportion of agreement with the rule would hold:

(1) *Aspre* has disappeared entirely from the language, but that is no reason to omit it here.

(2) *Bitter* derives from *bītan* 'to bite', a tactile-associated word.

(3) *Cloying* derives from *cloy*, a tactile-associated word whose dates are cited here.

(4) *Crisp* is marginally dimensional.

(5) *Grave* is marginally quality-of-color.

(6) The occurrence of *hot smell* before *hot taste* is almost certainly an accident of the citation dates that happen to be found.

(7) The citation dates for *poignant* appear to contradict the classification as a touch-word, but its etymological development clearly makes it an original tactile word.

(8) *Smart* is a marginal dimension-word.

(9) *Austere* is a marginal quality-of-color/taste word.

(10) *Sweet* is cited in 900 for both smell and sound, but there can be little doubt that the smell sense developed before the sound sense.

(11) *Tangy* from *tang*, a tactile-associated word, might have been included here. Its senses follow the prediction.

(12) *Thick* is marginally a quality-of-sound word.

(13) *Shrill* developed a metathesized form, *shirl*, as a Northern dialect word referring to tactile experience.

I have not listed a number of transferred items that are part of the technical or dialectal vocabulary of Modern English. Most obvious, perhaps, are the four dimension words, *broad*, *narrow*, *slender*, and *wide*, which have become technical vocabulary in phonetics. It might be noted that they observe the same constraints as all the other dimension words. Again, the inclusion or exclusion of extremely limited words would not change the results of the investigation significantly one way or another. (Since writing the above, I have found another example that fits the pattern: *savoury*—taste, 1382; smell, [1560].)

	TOUCH	TASTE	SMELL	DIMENSION	COLOR	SOUND
TOUCH						
aspre	[*1350*]	[*1450*]				[1626]
bitter	[OE]	1000	W3			
bland	1667	1836				
cloying	[1530]	1807				
coarse	1582	[1587]				1879
cold	950	[1585]			1706	W3
cool	1000	1800			undated in OED	1947
crisp	900			[1398*]	[1565]	
dry	1000	1700				1961
dull	*1230*				1430	1475
grave	[1570]				[1611]	1585
hard	Beowulf	1581				1620
harsh	1300	*1425*	W3*		1894	1530
heavy	1000					*1398*
hot	1000	*1390*	[1200*]		1896	1876
keen	*1225*	*1398*	syn. *pungent* in MED		[1602]	1400
light	1000				*1398*	1887
mild	14..	1450–50			1645	1420

	TOUCH	TASTE	SMELL	DIMENSION	COLOR	SOUND
piquant	[1549]	1645				
poignant	[1386]	[1386]				
pungent	[1601]	[1675*]	1668*			
rough	1000	[1545*]				1400
sharp	825	1000	W3*	1537*		1390
smart	1023	[1648*]		[1668*]		[13..]
smooth	1050	1743				1836
soft	1205	[1398*]	[1400*]		1845	1250
warm	888				1764	( )
TASTE						
acrid		[1712]	W3			
austere		[1541]			[1680*]	
brisk		1597			[1727*]	[1660]
dulcet		[1430]				1450
eager	[1544*]	[1350]				
mellow	[1797*]	1440	[1644*]		[1563*]	1668
sour		1000	1340			W3
sweet		888	900			900
tart	[1500*]	1386				
DIMENSION						
acute		[1620*]		1570		1609
big				1386		1581
deep				854	*1398*	*1387*
empty				971		( )
even				893	1821	*1398*
fat		[1609*]		893		1398
flat		1607*		1400	1821	1591?
full				1000	[1657]	W3
high		[*1430**]		825		1390
hollow				*1250*		*1500*
level				*1431*		1802
little				1000		( )
low				1150		*1385*
shallow				14..		[1626]
small	[1000*]	[1676*]		725		1250
thick				888		1398
thin		1377*		900	1655	1660+
COLOR						
bright					1000	1000
brilliant					1681	( )
clear					1297	1300
dark					Beowulf	1899
dim					1000	*1330*
faint			1818*		*1450*	1660
light					825	*1450*
vivid					1665	W3
SOUND						
loud		[1641*]			1849	971
quiet					( )	1400
shrill		[1567*]	[1864*]		W3	1386
strident					1907	1656

APPENDIX II: STATISTICAL SUMMARY.

	TOUCH	TASTE	DIMENSION	COLOR	SOUND	TOTAL	
Items	27	9	17	8	4	65	187
Transfers	62	15	29	9	7	122	
Correct							
1st-order	24	5	15	8	2	54	91
2nd-order	17	2	5	0	1	25	
3rd-order	6	1	2	0	1	10	
4th-order	2	0	0	0	0	2	
Corrected							
1st-order	2	4	1	0	2	9	23
2nd-order	4	2	3	0	1	10	
3rd-order	2	0	1	0	0	3	
4th-order	0	1	0	0	0	1	
Incorrect							
1st-order	1	0	1	0	0	2	8
2nd-order	1	0	1	1	0	3	
3rd-order	1	0	0	0	0	1	
4th-order	2	0	0	0	0	2	
Not chosen							
1st-order	52	23	46	32	14	167	422
2nd-order	44	24	47	31	13	159	
3rd-order	39	9	17	3	5	73	
4th-order	12	1	5	0	2	20	
5th-order	2	1	0	0	0	3	

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