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Measuring the Evolution and Devolution of Folkbiological Knowledge

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Although science continues to deliver new insights into the basis for life, it is hard to escape the impression that, on an individual and cultural level, knowledge about living kinds is diminishing. Anthropologists studying traditional societies often note with concern the loss of indigenous language and a lessening of knowledge about the natural world (e.g. Diamond & Bishop, in press; Nabhan & Antoine, 1993; Wester & Yongvanit, 1995). In technologically-oriented cultures contact with biological kinds may be so minimal that researchers can demonstrate significant differences in children's biological reasoning as a function of whether they do or do not have goldfish as pets (Inagaki, 1990; Hatano & Inagaki, 1987).

A recent survey we conducted at Northwestern University provides some index of what undergraduates know about one domain of biology, namely trees. We provided the names of 80 trees and asked the students to circle the trees that they had *heard of* before, regardless of whether they knew anything about them. More than 90% said they had heard of birch, cedar, chestnut, fig, hickory, maple, oak, pine, and spruce. But fewer than half indicated any familiarity with alder, buckeye, catalpa, hackberry, hawthorn, honeylocust, horsechestnut, larch, linden, mountain ash, sweetgum, and tuliptree--all of which are common to the Evanston area where Northwestern University is located. Of course, these observations by themselves do not implicate a loss of knowledge. It may be that Northwestern undergraduates from a hundred years ago would have proved to be equally unfamiliar with biological kinds. Nevertheless, such low levels of knowledge are consistent with the possibility that knowledge about trees is declining.

The devolution hypothesis

With modernization, it may be that knowledge about living kinds has decreased, or as we will say *devolved*. We will refer to this possibility as the devolution hypothesis. Devolution might results from two kinds of historical change. For one, the shift from rural to urban settings may result in significant decrease in people’s contact with the natural world. This reduced contact could lead to declines in knowledge, but not necessarily. The effects of reduced exposure may be offset by sufficient amounts of indirect experience

with the natural world, through a culture's media, talk and values. We will refer to this kind of exposure as *cultural support*. The idea of cultural support has to do with the degree to which a society promotes a particular area of knowledge. It does not, then, have to do with whether there are specialists who know or care about particular kinds. Rather, it has to do with the level to which people focus on a domain of knowledge in their everyday interactions. For example, to what extent do parents call children's attention to plants and animals and when they do so is their reference to robins, trout, and maples or to birds, fish, and trees? Declines in cultural support, like declines in exposure to the natural world, could lead to devolution.

In this chapter, we summarize our work on the devolution hypothesis with respect to the life-form trees.[1] Trees are of special interest because they could represent a particularly strong test of the devolution hypothesis. In terms of contact with the natural world, we may not expect devolution in respect to trees at all. While people in urban environments may have only limited exposure to all but a few mammals (e.g. cats, dogs, squirrels), they are likely to have seen many different kinds of trees. And trees, because of their size, are not likely to be ignored. As argued by Hunn (in press), size is a key factor in determining which natural kinds in a culture attract attention and get named. If the prerequisites for conceptual organization consist solely of an inherent curiosity about living kinds and a perceptual system tuned to discontinuities in nature (Berlin, 1992), then even urbanized cultures should show an appreciation for different kinds of trees. On the other hand, it is possible, despite continued direct exposure, that knowledge about trees has devolved because cultural support for trees has declined.

Measuring cultural support

Cultural support may take a variety of forms, many of which may be difficult to measure, especially across time. Nevertheless, we are likely to have a pretty good measure of cultural support in terms of what people write about. Are people writing about plants and animals as much as they used to? When they do so are they writing at the life-form level (e.g. bird, tree) or at what Berlin (1992) refers to as the folk-generic (sparrow, oak)

[1] A fuller account is provided in Wolff, Medin and Pankratz (in press).

level? Not only are written records available, but these records are accessible in on-line databases that permit automated search. To the extent that there have been historical changes in the amount and specificity of discussion of biological kinds across a representative sample of sources, we have evidence for the changes in the cultural support for learning about the natural world. Note that this measure of cultural support is likely to be a conservative measure of what people may know. An author might write about noticing cottonwoods along a riverbank without being able to pick a cottonwood out of a biological lineup. The use of writing as a measure of what people know is therefore likely to overestimate the knowledge of an average citizen, hence underestimate devolution. By the same token, if changes are found, they are most likely to be historically significant.

Oxford English Dictionary (OED). Because our interest is in a longer time span than U.S. written history affords (in terms of databases we might access), we selected a database from England for study: the OED, a historical dictionary. We chose the OED for a variety of reasons. The OED seeks to capture the evolution of all words in the English language except those that became obsolete before 1150 or are intelligible to only the specialist. The first edition was published in 1933 after nearly seven decades of work. The second edition, the OED2 was published in 1989. It combines the original edition, four supplemental volumes published after 1933, and results from a fourth major reading program.

The dictionary contains approximately 616,500 word forms (Berg, 1993; Murray, 1989). Definitions for these words are illustrated with quotations from each century of use with extra quotations provided for significant changes in meaning. The quotations were drawn from a wide range of books, with special emphasis on great literary and scientific works, but also among other things, books of foreign travel, letters of foreign correspondents, magazines, and diaries. The total number of quotations in the OED2, roughly 2.5 million, was drawn from a sample of between 5 and 6 million quotations. Given the breadth of the inquiry, we have no reason to expect that the quotations represent a biased sample with respect to the questions we aim to address. The sample may well be biased in terms of reflecting interests, values, and accessibility, but these sorts of biases are more or less orthogonal to our focus.

Recently, the entire 12-volume set was retyped into a special computer database format allowing for online searching of all definitions and quotations. The OED on-line corpus may be searched for any key words (e.g. "tree," maple tree," "maple," etc.) and search codes may be written such that the date, source, and full quotation context will be returned.

General Predictions. Evidence for devolution may be found with two kinds of measures: 1) the number of quotations referring to trees (including kinds of trees) relative to the total number of quotations associated with a given historical period (we used 100-year blocks for our analyses), and 2) the number of sources (kinds of publications from which the quotes are drawn) relative to the total number of sources associated with a given period. Our first analysis examines the general prediction that if knowledge of trees is devolving, there should be an overall drop in the number of quotes and number of sources across time. A second major analysis examines more specific hypotheses concerning the relative usage of tree-terms at different levels of taxonomic organization.

Of course, there may be historical periods of time where cultural support for biological knowledge is increasing (evolution rather than devolution). The predictions here would be more or less reversed. As we shall see, our analyses suggest both periods of evolution and devolution. Before turning to specific procedures, we first state our assumptions about levels of specificity and identify potential problems that may arise with analyses such as ours.

Levels of Specificity.

In our analysis of taxonomic levels (Analysis 2), we adopt Berlin and his colleagues' (1972, 1973, 1992) approach to taxomonic organization. According to Berlin, categories can be viewed as belonging at one of five levels of organization. At the most inclusive level, there is the unique beginner, typified by categories like *plant* and *animal*. The next level of organization, the life-form level, is commonly referred to by a single word and includes such classes as *tree, vine, grass*, and *mammal*. At the next level, the generic level, there is an explosion of categories, such as *oak*, *pine*, *catfish*, *perch*, *robin*, *maple tree* or *box tree*. The generic level, according to Berlin, is the basic building block of all

folk taxonomies. Among other things, it is the level most often used in describing an object, the level that is most psychologically salient, and the level to first be learned by children. The next two levels are the specific and varietal. Linguistically, categories at the specific level usually require two words such as *blue spruce*, *white fir*, or *post oak*.

Methodological Issues

Threats to Validity. There are five general concerns associated with using text to assess change across time. One problem involves changes in spelling and in naming. For example, our search revealed twenty different spellings of oak and twenty-five different spellings of tree. Spelling consistency only became fairly uniform in the 19th century. Obviously, one needs to search the corpus for each of the alternative spellings. Likewise, some trees have multiple common names; for example in England another name for linden is whitewood. The same prescription holds here.

A second concern is that the results may be affected by the particular meaning of the term being invoked in a quotation. For example, the term *pine* can be used to refer not only to a particular kind of tree, but also a particular kind of wood (e.g. pine floor), location (e.g. pine grove), activity (e.g. pine away), or proper name (e.g. the cleaning product, Pine Sol). In the following analyses, only direct references to particular kinds of trees (the first use) were included in the analyses because it is for these uses that the devolution hypothesis makes the clearest predictions.

A third concern is that the sources for quotes may change across time in a systematically biased manner. For example, during the age of exploration and colonization, new publications appeared (e.g. Australian Journal) devoted not to life in England, but rather to life in the British colonies. These often include descriptions of the (novel) flora and fauna. The rise of science also led to technical publications. We decided to omit technical and foreign quotations and focus on what we term folk quotations.

A fourth concern is that changes between levels of specificity might be affected by the introduction of new tree terms into the language. Descriptions involving new trees may elicit more attention and favor more specific descriptions. We addressed this and some related problems by selecting a subset of 22 tree generics that were common from the 15th

century in English to the present day. Differences between levels of specificity cannot, then, be attributed to the introduction of novel kinds.

A final concern involves possible biases in our sampling of quotations due to the inherent nature of the dictionary, which seeks to include all but the most specialized terms. This means that even low frequency terms may have entries with a certain number of quotations; thus, the number of quotations within a term's entry may not reflect its actual frequency of usage. For instance, the number of quotations for low frequency tree terms might be significantly inflated compared to their actual frequency in everyday speech. In practice, however, the OED does not generally include entries for tree terms at the specific level or lower (e.g. pin oak). Nevertheless, to eliminate any chance of quotation inflation, all quotations found in the entry of any tree term were eliminated from the analyses. In other words, all quotations used in these analyses came from entries of other terms.

Other concerns. The use of the OED constrains our focus to England and its associated history of wars, colonialism and increasing globalization of interests. Our task would have been more straightforward were we able to pick a more insular culture (though insularity of more traditional cultures may be more a myth than a reality). This factor, however, cuts both ways. It is precisely because of its technological and global orientation that evolution or devolution of folkbiology in England is of interest. Given the importance often attached to science education it is only reasonable to ask about the cultural supports for learning about the natural world.

Analysis 1: Examining the overall use of tree terms over time

The purpose of this first analysis was to test the main prediction of the devolution hypothesis: If knowledge about trees is declining, there should be an overall drop in the use of tree terms.

Method

The process of preparing the quotes for analysis had three main phases: 1) abstracting of entries containing quotations, 2) coding the entries, and 3) correcting for uneven sampling in the OED. These three phases are discussed in turn.

Abstracting Entries. In the first phase, quotations containing tree terms were drawn from the OED using Open Text Corporation's PAT search engine. In searching for the word "tree" all alternative spellings were considered (including trau, traw, tre, tren, treo, treu, treuwum, triu, troue, trow, as well as, fifteen other spellings.) Alternative spellings were obtained through a word's OED entry. In addition to the word "tree" we also searched for 22 folk-generic level tree terms, (including all associated 138 alternative spellings.) The folk-generic level tree terms included Alder, Ash, Aspen, Bay, Beech, Birch, Cypress, Elm, Fir, Hawthorn, Hazel, Juniper, Laurel, Maple, Mulberry, Myrtle, Oak, Pine, Poplar, Sycamore, Walnut, and Willow. All of these folk-generic tree terms have been in use since the 15 century or earlier. The search was limited to singular forms of these terms to avoid the problem of changes in pluralization conventions over time.

Once obtained, the output from these searches was reformatted for easier coding. In the online-version of the OED, the text contains tags that mark the start and end of entries and their associated components (e.g. definitions, quotes, sources and dates). A program was written that removed all extraneous text and formatting markers. The resulting file contained only quotes and their associated dates and sources. Sample quotations are shown in Table 1.

Insert Table 1 about here

Table 1: Example quotations with their associated dates and sources

Date	Source	Quotation
1510	(Lytell Geste R Hode)	They dyde them strayt to Robyn Hode Under the grene wode tre.
1613	(Hen VIII)	We take From euery tree lop barke and part of the timber.
1785	(Hen VIII)	Eight Nuts from a tree called the Kentucke Coffee tree.
1843	(Lett)	The bunya bunya tree is noble and gigantic.
1929	(New Yorker)	The big walnut tree that was an old timer even in her day.

Coding Entries. The second phase of preparing quotations for analysis involved coding each entry's source, quotation and time period. The source of the entry was coded as folk or non-folk. An entry was considered folk if its source was neither technical (e.g. *Fruit trees, Nature, Elementary Botany, Science News, British plants, Dictionary of Gardening*) nor foreign (e.g. *Jamaica, New York Times, Barbados, Journal of Upper India, Central America, Pennsylvania Archives, African Hunting).*

Each quotation was coded as either direct or indirect. Only quotes making direct references to trees were included in the analyses, as discussed earlier. Quotations were coded as indirect if they were used to modify other nouns, as in the phrase *stump of **pine***. In this example, the term "pine" modifies the word "stump" which, of course, is not a tree. Tree terms were coded as indirect if they were used as the first term in a compound noun, as in ***maple** syrup*. In this case the thing being referred to directly is "syrup," not a tree. Finally, a tree term was coded as indirect if it referred to a substance, as in *The wall is **maple***. Here, "maple" refers to a kind of wood.

In addition to eliminating indirect references to trees, we also eliminated quotations that referred to something other than a tree, and quotations that included 2 tree terms at different levels of specificity. (The purpose of this latter restriction will be discussed in Analysis 2.) As for cases of non-tree uses, quotations were excluded if the tree term was used metaphorically, as a part of speech other than a noun (e.g. verb), or as a proper name.

Coding dates. In the preface of the OED, it is noted that prior to the 1400's, dialectal differences in the English language were quite pronounced. Hence, words and forms that occurred after 1500 and were dialectal were excluded from the dictionary. These factors led us to choose the late 1400's as a cutoff for our analyses. Because the most recent quotations in the OED were entered in 1987, we rounded this date down slightly to look at quotations from 1975 back to 1475 in 100-year intervals. In the following analyses, the five resulting time periods are labeled by their median dates of 1525, 1625, 1725, 1825, and 1925.

Correcting for Uneven Sampling in the OED. The total number of quotations across time periods varied widely. For example, the number of quotations in the 1625 time

period (N = 424,711) was much higher than the number of quotations in the 1725 time period (N = 281,342). These differences were most likely due to new words entering the language and/or changes in the production of written sources. Importantly, though, in order to properly interpret the shifts in the number of tree quotations and sources, the total number of quotations and sources in the dictionary must be taken into account. That is, we need to be sure that differences in tree counts are due to factors relevant to tree terms, not sampling.

To correct for variation in number of quotes between time periods, tree counts were analyzed relative to the estimated number of folk quotations and sources in the OED. These estimates were obtained by taking a 1% random sampling of quotations in the OED and coding them for source type (i.e. folk versus non-folk) and then multiplying them by 100. A comparable adjustment was made in evaluating number of sources.

Results and Discussion

Our search for tree terms generated a total of 22,319 quotations. An automatic coding of each quotation's source was performed using a program that checked lists of 134 foreign and 45 technical sources. The resulting 15,146 quotations with sources not present on these lists was roughly equivalent to 900 pages of text and was further analyzed by hand according to the criteria described in the methods section. The resulting 6,548 quotations that both made direct reference to trees and came from folk sources were roughly 29% of the original set of quotations.

The findings provided strong support for the main prediction of the devolution hypothesis: Cultural support for trees, as measured by the relative number of quotations and sources in the OED, declined markedly in the last century. As described above, tree counts were analyzed relative to the estimated number of folk quotations and sources in the OED in order to eliminate differences due to sampling. Figure 1 shows the resulting proportions for each period of time. The confidence intervals in Figure 1 represent ranges having a 95% probability of covering the true population values, assuming a binomial distribution.

An examination of Figure 1 shows that the proportions for quotations and sources was fairly constant through the 16th, 17th, and 18th centuries. In the 19th century, the relative

number of quotations and sources increased, suggesting that knowledge of tree terms evolved during this period. However, the gains of the 19th century were completely lost in the 20th century, which witnessed a striking decline in both quotations and sources using tree terms. Note the start of the decline corresponds closely with the start of the industrial revolution. The confidence intervals indicate that the evolution occurring in the 19th century and the devolution occurring in the 20th century are significant. The confidence intervals also indicated that the 20th century decline was so great that writing about trees is lower now than in any other time in the history of the English language.

Insert Figure 1 about here

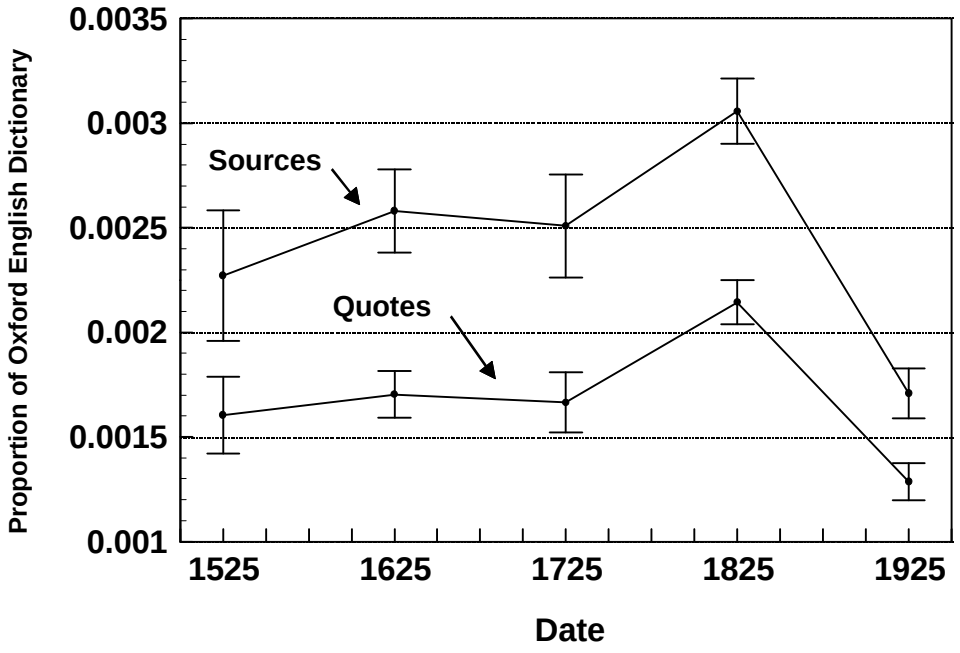

Figure 1. Proportion of quotations and sources in the OED referring to trees along with associated 95% confidence intervals.

The only difference seems to occur between the 16th and 17th centuries: quotations indicate evolution while sources do not. This difference does not change the important conclusion that we can be confident that the observed changes in quotations are not due to an overrepresentation from a particular kind or set of sources. Of limited interest, the

proportions for sources were slightly higher for each time period than the proportions for quotations. These differences merely indicate that quotations containing tree terms come from a wider range of sources as compared to quotations containing other terms, on average.

In sum, the findings are perfectly consistent with the idea that there have been periods of evolution and, more recently, devolution in knowledge about trees. However, the findings are also consistent with another possibility. Specifically, the overall decline in tree terms may be masking important evolutionary trends at more specific levels of organization. If such counter-trends are present, the overall decline in tree terms in the 20th century may not necessarily indicate loss of knowledge. Rather it might reflect a shift from a folk biological view to a more scientific view of trees. We will refer to this possibility as the shift-in-knowledge hypothesis. This hypothesis assumes the presence of two kinds of underlying changes. First, the drop might reflect a tendency to use terms not covered in our searches. For example, people might talk less about particular kinds of trees and more about DNA, evolution, and the biochemical reactions associated with photosynthesis. Indeed, the concept, TREE, has no status in scientific taxonomy. Short of an exhaustive analysis of all of the scientific talk in the OED, this change cannot be tested. Alternatively, the drop could be due to a shift towards the use of more specific terms that do refer to trees. Such a shift could occur, even with an overall decline in tree terms, assuming the overall pattern in Analysis 1 was dominated by the word “tree.” This second possibility can, in fact, be tested.

The shift-in-knowledge view makes a set of predictions concerning the relative use of different levels of organization. The primary prediction is that if knowledge is increasing, generic and specific level terms should be increasing. The opposite pattern would count as evidence against the shift-in-knowledge hypothesis and for devolution hypothesis.

Analysis 2: Examining Tree Terms are Different Levels of Specificity

The same set of quotations used in Analysis 1 was used in this analysis. In the current analysis, however, the quotations were coded according to level of organization. One of the main goals in this analysis was to better understand the observed decline in tree terms

in the 20th century. However, a closer examination of the quotations could also be used to provide further insight into the apparent lack of change existing between the 16th and 18th centuries and the observed evolution of tree terms in the 19th century.

Method

Three levels of organization were coded. The life-form level was indicated by use of the word "tree", or one of its 22 other spellings. The generic level was indicated by quotations containing one of the 22 pre-chosen tree-terms listed in Analysis 1. Quotations demonstrating the specific level contained one or another of the 22 pre-chosen generic tree terms.

Insert Figure 2 about here

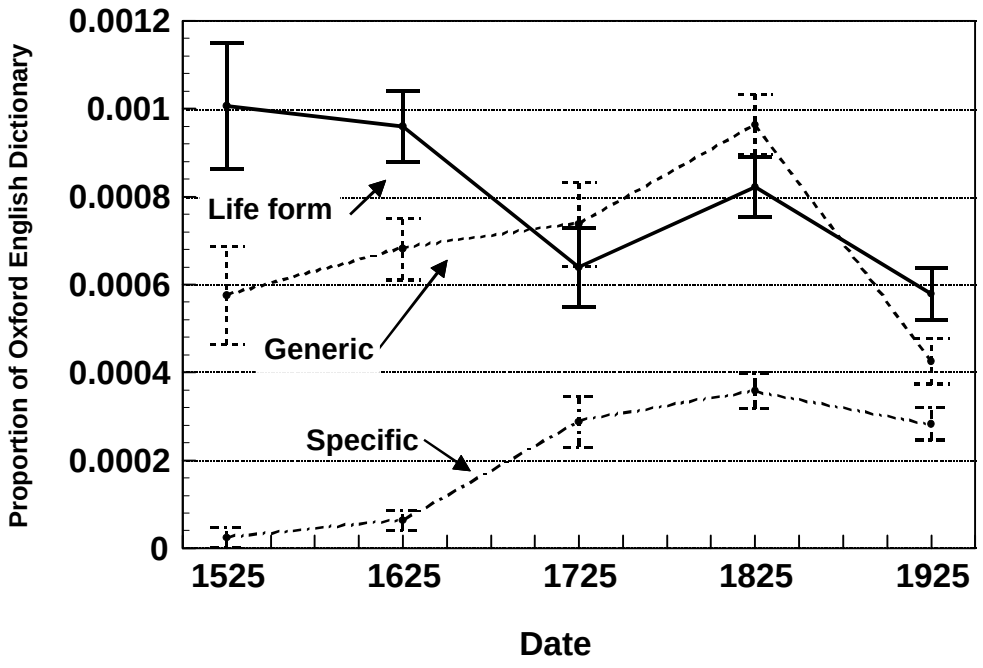

Figure 2. Proportion of quotations in the OED for different levels of specificity along with associated 95% confidence intervals

Results and Discussion

The findings from this second analysis provide further support for the devolution hypothesis: Cultural support for trees in the 20th century, as measured by the relative number of quotations in the OED, declined over time for all levels of organization. As in Analysis 1, tree counts were analyzed relative to the estimated number of folk quotations and sources in the OED. Figure 2 shows the resulting proportions for level of specificity in each period of time along with 95% confidence intervals. Due to the fact that the proportions for sources and quotations did not differ in their overall patterning, only the proportions for quotations are displayed. The patterns of change shown in Figure 2 indicate both periods of evolution and devolution. Periods of evolution are indicated by the steady rise in frequency counts between the 16th and 19th centuries for both the generic and specific levels and a rise in frequency counts between the 18th and 19th centuries for the life-form level. As noted in Analysis 1, the period between the 16th and 18th centuries seemed to be absent of change. In fact, this apparent absence belied significant shifts in use of different levels of specificity (Figure 2). The 19th century seems to represent the evolutionary climax for knowledge of trees. Talk about trees was both more frequent and at a level of greater specificity than in any other time in the history of English. All this changed in the 20th century.

The pattern of frequency counts during the 20th century is most consistent with devolution. Crucially, the 20th century is the only century where frequency counts for all levels of organization declined. Thus, in contrast to the shift-in-knowledge hypothesis, an overall drop in tree terms cannot be explained as a drop in the life-form level alone, which masked increases at more specific levels of organization.

Although the overall pattern of results is consistent with devolution, at least two possible problems could be raised. The first concerns the relative resilience of the specific level to devolution and the second concerns statistic properties of the database. These two concerns will be dealt with in turn.

Resilience of the specific level. An examination of Figure 2 shows that the specific level declined the least among the other levels of organization during the 20th century.

That is, the specific level appears to be relatively immune to devolutionary forces, which could be taken as weak support for the shift-in-knowledge hypothesis. However, we believe that this counter-current is most consistent with a mixture of general devolution and a specialization of knowledge, the latter representing something of a "cognitive

Let's take a closer look at reasons for why the specific level might be somewhat more immune to devolution than the other levels. First, because our search was limited to 22 kinds of trees at the generic level, changes in frequency counts at this level are primarily in terms of changes in tokens. However, because the specific level is not limited to 22 categories of trees, changes in frequency counts at this level reflect changes in both tokens and types which may have inflated the proportion of specific level categories relative to the other category levels. The ideal analysis would hold specific level categories constant throughout time. The primary reason why this analysis cannot be done is that there are very few terms at this level of organization that have survived across even two time periods, let alone five. Note also that it appears it wasn't until the 17th century that the specific level even emerged.

A second and potentially more interesting rationale for expecting specific level terms to be relatively immune from devolution is based on the idea that cultures are comprised of both a general population and a small subset of specialists who act as keepers of technical knowledge. This subset may be motivated or required by the nature of their activities to operate at ranks below the generic. If the general population's knowledge is undergoing devolution in terms of how much it talks about trees, then discourse from the subset of experts or specialists will gradually comprise a greater proportion of the total amount of discussion of trees. In the limiting case, only specialists will talk about trees and name them at the specific or varietal level. In that event the number of specific and varietal terms would *increase* relative to the use of generic terms (though the absolute numbers of all three might decline).

Statistical properties of the OED. One potential challenge to the devolution hypothesis is that the observed decline in tree terms in the 20th century may be a statistical artifact of the OED. Assuming the 20th century has experienced an enormous explosion in new

categories, it is certainly possible that talk about any one category may be diluted. Thus, the apparent decline in the 20th century may not be due to devolution, but rather to decreased talk about any one thing because there are more things to talk about. This possibility is relatively easy to check. If the 20th century decline is due to dilution, similar rates of decline should be observed for categories other than tree categories. If however, the decline is due to changes in knowledge, rates of decline are likely to vary widely between the categories. To test this possibility, life-form level terms (or their equivalent) from three other domains were analyzed using the same criteria as used in Analyses 1 and 2. The specific categories analyzed were *fish*, *weapon* and *bird*.

The findings provide further support for the devolution hypothesis. In contrast to the dilution hypothesis, not all the categories declined during the 20th century. Specifically, quotations referring to the category fish steadily increased from the 16th century until the present. This may partially be a function of the fact that "fish" also appears in food contexts. Quotations containing the category weapon slowly declined during the 16th to 19th centuries and then asymptote during the 20th century. Changes in the category bird mirrored those of the category tree, but not as dramatically. In sum, because declines in the 20th are not inevitable, we can be more confident, then, that the observed declines in tree terms are due to changes in knowledge and not dilution.

General Discussion

The results from this research support the claim that knowledge about trees evolved during the 16th to 19th centuries and devolved during the 20th century. We showed that the 20th century was marked not only by a major decline in frequency in tree terms overall (Analysis 1), but at all levels of specificity (Analysis 2). These 20th century declines cannot be explained as simply due to an explosion of categories diluting talk about any particular kind of category. Diluting would predict that all categories should decline, but as indicated by the categories fish and weapon, decline is not inevitable.

<u>The relationship between concepts and names</u>. One particular result from Analysis 2 deserves further discussion. Specific level categories decline less than predicted compared to the declines at other levels. As mentioned earlier, the resilience in the specific level

might be due to a relatively small group of experts. There is another possible explanation. Throughout this chapter we have assumed that when people use a term, they also have some relevant knowledge about it. However, when a domain declines, this tight coupling might begin to break down. As mentioned in the introduction, people may be able to recognize a number of tree terms, e.g. birch, cedar, chestnut, fig, hickory, maple, oak, pine, or spruce, but they may not be able to pair these terms with actual referents in the world. In a sense, these terms exist as loose categories: there is no longer a correspondence between the use of a particular (specific) term and knowledge of what the term actually refers to.

What happens when a domain dies? When a domain devolves, does it reverse the order of its evolution? The answer to this question appears to be a cautious no. When a domain evolves, knowledge of the domain motivates the creation of ever more precise category labels. When a domain dies, it may be that the knowledge of the associated concepts declines faster than knowledge of specific terms. Thus, the language may preserve certain distinctions beyond the time these distinctions are still understood. It is as if knowledge builds up a terminological structure in the language, but that when knowledge declines, the structure, like an abandoned building, may remain for a while. What makes this hypothesis particularly interesting is that it seems to support recent findings assessing people's induction strategies.

A set of studies by Coley, Medin, and Atran (1997) (see also Atran et al, in press), examined the question of how knowledge of a domain might affect categorical induction. The authors investigated the induction patterns of Urban Americans and Itzaj Maya for several folkbiological taxonomies including bird, fish and tree. Coley et al. predicted that the Maya would treat the generic level as privileged by questioning the validity of inferences from generic to life-form categories, but not varietal to specific or specific to generic. In contrast, Americans were expected to treat the lifeform level as privileged, by questioning the validity of inferences from the lifeform to the kingdom levels (e.g. animal, plant), but, importantly, not the generic to life-form like the Itzaj. These predictions were based on studies showing that the Itzaj possess a great deal more knowledge about living things than do American College students (López, Atran, Coley, Medin, & Smith, 1997)

and on the assumption that the privileged level should depend on expertise. However, despite these differences in knowledge, both Itzaj and Americans treated the generic level as privileged with respect to category induction. What makes this result surprising is that Americans have been found to treat the life-form, not the generic level, as privileged on other tasks (Rosch et al. 1976; Tversky & Hemenway, 1984). As in this paper, Coley et al. (1997) found a disparity between category use and knowledge. Their solution is similar to ours. When it comes to category induction, people may rely heavily on the nomenclature patterns of their language when their knowledge for the domain is weak.

Psychological implications of devolution. One question not fully resolved by Coley et al. concerns that question of why Americans have more than one privileged (basic) level. One possibility mentioned by these authors is that the privileged level may change depending on the task. For Americans, the privileged level may be the life-form level when the tasks involve explicit knowledge or perceptual distinctions and the generic level when task involves category induction. What might have lead to this dissociation? One possibility is suggested by the analyses in this paper, namely the emergence of another basic level. During the 19th century, the basic level for different kinds of tasks may have been the same, but as folkbiological knowledge devolved, asymmetries like the ones observed by Coley et al. (1997) may arise.

These mismatches in degree of structure and amount of knowledge may have other psychological implications as well. For instance, it may explain why we have the intuition that knowledge about trees is dying. It may be that people sense a disparity between what is known and the terminological sophistication of the language. To end on a more positive note, it may be that while knowledge about trees has devolved, not all has been lost. Much of what has been know about trees might still be preserved in the language, albeit indirectly, and its presence there could facilitate the process of its re-acquisition.

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