Carol Sweeney
Computational Ling
Final Assessment
14 March 2005

The Effects of Status Drop in a Community: Modeling the Cause of Language Death

While militarily dominant societies have consumed weaker groups, colonized "unclaimed" land, and redefined cultures for eons, the industrial and technological advances of the past two centuries have propelled unprecedented contact between geographically distant communities. Even though colonial powers lost most of their overseas territories as national movements swelled in the mid-20th century, the ramifications of coerced economic and cultural export persist as dominant societies continue to sway less powerful ones. As nations jockey to assert international presence in today's hypercompetitive world, they typically seek to centralize their governments and standardize elements of their culture. Though extensive communication between nations and other results of globalization are not wholly without benefit, a casualty of this complex interaction has been language diversity.

According to recent estimates, 50 to 90 percent of the world's 6000 languages will disappear within the next century (Crystal, 2000; Krauss, 1992, cited in Abrams & Strogatz, 2003). If one accepts the modest projection that only half of the world's languages will become extinct in this time span, at least one language will die every two weeks. Though some believe that such a reduction could benefit mankind by fostering mutual understanding between communities, the trend toward rapid extinction worries linguists, sociologists, anthropologists, historians, and certainly speakers of threatened languages (Crystal, 2000). While language loss has failed to draw public attention and "is not [as] self-evidently life-threatening" as crises such as disease and famine, language researcher David Crystal argues that it is nonetheless a significant matter of concern in *Language Death* (2000:32). In an application of the ecological frame of reference, Crystal relates linguistic diversity to the biological diversity crucial for maintaining the delicate network of relationships between species. "If diversity is a prerequisite for successful humanity," he writes, "then the preservation of linguistic diversity is essential, for language lies at the heart of what it means to be human" (2000:33-4). Additionally, he stresses the ability of language to express cultural identity, contribute to the sum of human knowledge, and provide otherwise irretrievable historical information about communities. Thus, when the last speakers of a language die, the world loses much more than a string of speech sounds that few people care to understand.

What is an endangered language?

What is it about the 3000 languages referenced above that qualify them as endangered? A rather basic description includes any language that will have no speakers left within a few generations. Defining language endangerment, though, is clearly more complicated than drawing a distinction between "endangered" and "non-endangered" languages. Since "it is more accurate to consider endangerment as a sort of continuum…with 'safe' languages at one end and extinction looming at the other," several multi-level classification systems have been developed in the past fifteen years (Bobaljik & Pensalfini, 1996:8-9). A language is considered to be "viable" if it claims a large population of speakers or is spoken in an isolated community with "strong internal organization" (Krauss, 1992, cited in Crystal, 2000:20). "Any decline in the transmission of [a] language to children," however, "can be viewed as a sign of endangerment" (Bobaljik & Pensalfini, 1996:9). At the endangered stage, when the youngest good speakers of a language are young adults, survival is still a possibility, but "only in favourable circumstances and with a growth in community support" (Krauss, 1992, cited in Crystal, 2000:20). Once a language has only a few good speakers left, most of whom are elderly, it is classified as "moribund" and will inevitably become extinct (Wurm, 1998, cited in Crystal, 2000). While the revitalization of languages like Hebrew presents some exceptions to this rule, "preserving a language as a medium of communication" is nearly hopeless at this end of the continuum (Bobaljik & Pensalfini, 1996:9).

How does a language become endangered?

As difficult as identifying and classifying the world's threatened languages may be, one attribute makes them somewhat simpler to define than languages themselves. Bobaljik and Pensalfini write,

> In each and every case, language endangerment is preceded by a drop in the social and economic status of the speakers. It is accompanied by ongoing oppression of speakers and/or economic disparity between speakers of the endangered language and speakers of the 'colonizing' language. Speakers of endangered languages find themselves having to demonstrate fluency in the colonizing language in order to obtain basic needs and freedoms, thus associating their native tongue with socio-economic inferiority (1996:11).

With this 'status drop' of native languages in mind, they proceed to detail two ways in which languages become endangered. In the first case, colonists exploit indigenous populations and expose them to foreign diseases, wiping out all of a language's speakers in a relatively short period of time. In the second case, which is a "slower but potentially reversible kind of loss," a native language dies because speakers stop using it (1996:11). Once social or economic prominence comes to be associated with the colonizing language, the use of the native language diminishes and it "decreases in complexity and richness" as words are lost and distinctive morphological and grammatical properties vanish (1996:11).

In a further elaboration of this second cause of endangerment, Bobaljik and Pensalfini describe a pattern that begins with the introduction of a colonizing language and ends with the extinction of the native one (1996). Before colonists enter an indigenous community, all of its members speak the native language. After the introduction of powerful foreign individuals, however, the linguistic make-up of the community begins to shift. While one generation of speakers is monolingual and fluent in the native tongue, they may start to associate economic advantage and prestige with the colonists' language and encourage their children to learn the foreign form. Thus, the next generation of individuals will become bilingual, and each successive generation will be bilingual for a time but will prefer to use the colonizing language in education, government, and other realms of social and political significance. Consequently, the functional load of the native language is reduced, and the community of speakers uses it less and less. Eventually one generation will be able to understand some of the native language but will never speak it, and for their children, it will be as if it never existed. This trend toward language death can be summarized in the following manner:

monolingual: native language→bilingual: native and colonizing language→monolingual: colonizing language

As stark as this pattern may be, the gradual nature of its development implies that with some effort, native languages can be preserved even as a few dominant languages become lingua franca for international business and politics. To better understand how the adverse effects of this trend may be reduced, though, it is essential to clarify the conditions under which a native language disappears with no chance of recovery. To examine a small portion of this progression toward language death, I have modified a computational model of language change to explore how the status drop of a native language and the percentage of colonists in its community of speakers result in language extinction.

Modeling the dynamics of language death

In an attempt to reproduce the trend toward language extinction discussed above, I altered the Netlogo version of the computer simulation presented in *Using Social Impact Theory to simulate language change* (Nettle, 1999). Nettle employs this program to uncover the crucial variables involved in the S-shaped propagation of a rare language variant in a community.[1] While readily admitting that the behavior of individuals in his model cannot perfectly represent the behavior of actual speakers, he nonetheless presents a useful tool for examining how the interaction of real-world factors like imperfect learning, functional bias, and social status may permit a once-rare language variant to spread through a population.

By incorporating properties of true communities into his simulation, Nettle tests the claims of Social Impact Theory (Latané, 1981, cited in Nettle, 1999) and in the end argues that "the combination of inherent variation in language acquisition and difference between individuals in local social influence" is the "fundamental engine driving language change" (1999:95). In a departure from earlier models of language change, he includes the variables of social status and functional bias in his community of speakers. As proffered by Social Impact Theory and sociolinguistic literature, actual language learners are sensitive to these factors:

> There are two possible sources of [a learning] bias. One is social; the learner may favour the speech of some individuals more than others, and so, if socially influential people are from time to time the bearers of new variants, transmit those variants. The other is linguistic or functional; certain linguistic variants may have some functional attribute which makes them easy to acquire or use...(1999:99).

To implement these sources of bias, Nettle designed his code to assign an age grouping[2] and status ranking to each community member at simulation setup. In each simulation run, a few individuals (< 2.5 percent of the population) are designated to be "superstatus;" based on the governing algorithm of the program, these community members exhibit a particularly strong effect on language learners. He also added in a functional bias "slider" to facilitate the application of varying levels of favor toward an old (P) or new (Q) language variant. Indeed, the inclusion of these social and linguistic bias variables produces the predicted results. S-shaped,

[1] the so-called "threshold problem" (1999:98-9)

[2] 0-4, in the Netlogo version of Nettle's code; learners belong to groups 0 and 1. With each iteration of the simulation, individuals age by 1. Old members (4) die and are replaced by young children (0).

population-wide language change may occur if a new variant enters through improper learning[3] in a community with superstatus individuals, and sufficient functional bias causes a complete reversal in language dominance.

To further probe the impact of these variables on language change, I modified this program to model language death by adding three new features to the basic code: a 'status drop' switch and slider, a status group variable, and a third language variant. At setup in each run of the simulation, a slider setting in the simulation's interface governs the percentage of 'colonists' present in the 440-turtle community. In the initial condition of this world, all individuals speak the native language P (p-prob = 1.0). With a flip of the Use-Status-Drop? switch, though, a slider-designated percentage of the community's P-speaking superstatus individuals are redefined as colonists who speak language Q. The switch and the slider, then, are used in the altered model to implement the aforementioned real-world phenomenon of status drop. While the number of superstatus individuals in the community stays constant, colonists who speak a different language overtake a varying amount of esteemed positions once held by native speakers. In each cycle of the simulation, young turtles will only be able to acquire this new language based on the influence of Q-speakers and bilinguals (discussed below). By setting the mutation rate to zero, I have eliminated the potential for adoption of the new language through acquisition error to observe the effects of the crucial variables for language death in isolation.

To distinguish foreign colonists from native community members, I created a status-group variable. At setup Q-speaking colonists are assigned to status group 1, while P-speaking natives are assigned to status group 2. In this simulation, if a turtle is defined as a colonist initially, it will remain a colonist and speak Q throughout the run. To maintain the influence of

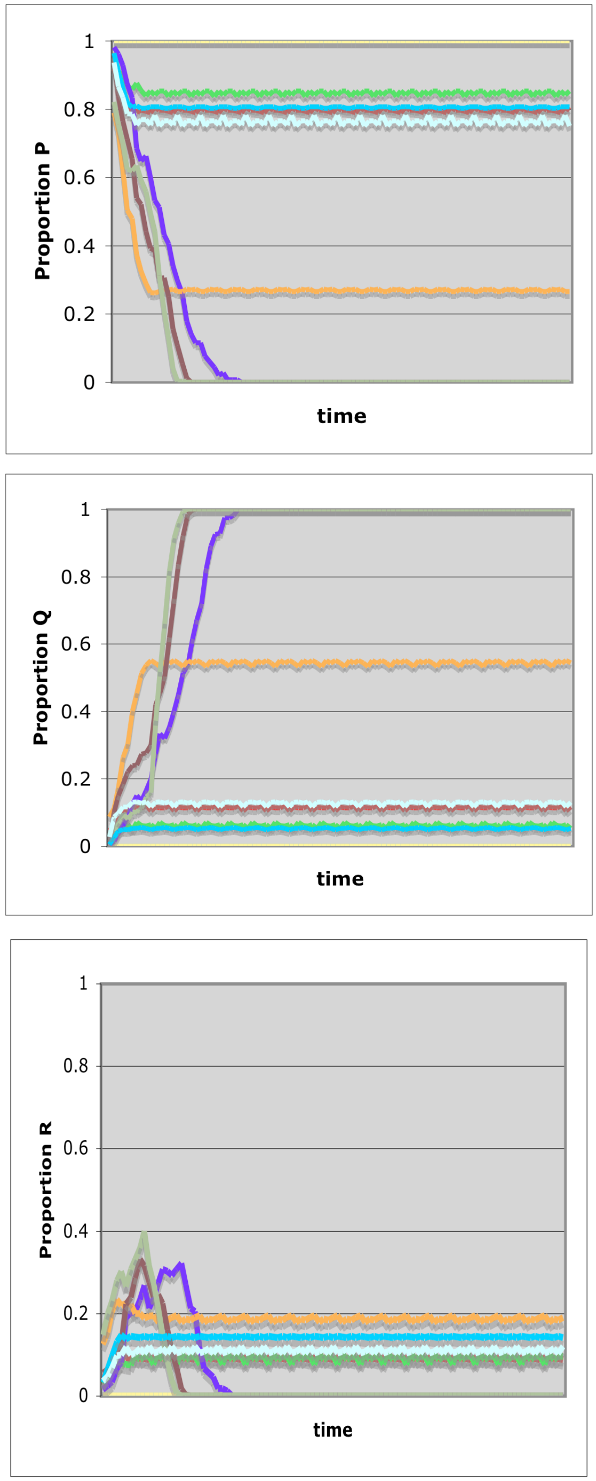
[3] The rate of improper learning is referred to as "mutation rate" in the simulation.

the colonizing language established at setup, turtles of status group 1 are always able to impact surrounding turtles but are immune to the effects of P-speakers (i.e., they are always adults aged 2-4). This assumption of the code is not so bold; privileged colonists would presumably have little incentive to assimilate into a native community and adopt its language (and historically have not done so).

In contrast to the colonists, native turtles age normally (0-4) and can acquire P, Q, or both when they are young. In my version of the three variant extension to Nettle's code, language R is assigned to bilingual turtles. If the relative difference between impact-p and impact-q on a young turtle is less than 10 percent, it will acquire R. Since such turtles speak both languages, their impact on nearby turtles is halved and added to impacts-p and q. I also could have added the full value of impact-r to each; as long as the impact of R-speakers is distributed equally between the languages, though, the outcome should be the same. The assumption underlying this equation, of course, is that R-speakers will use both P and Q around young community members rather than choosing to use one or the other. This third variant addition is essential for properly modeling the shift toward extinction as described by Bobaljik and Pensalfini (1996); simply populating a world with a large proportion of colonists and watching their language take hold immediately would not accurately reflect the gradual pattern observed in actual instances of language death.

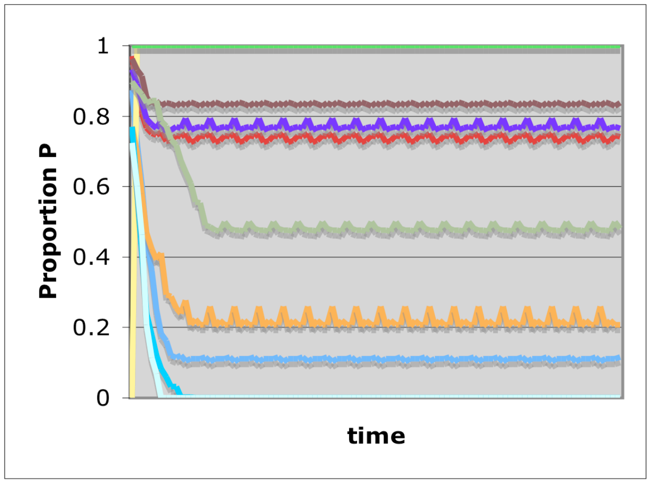
In my manipulations of this model, I hope to do more than recreate the *monolingual native language→bilingual→monolingual colonizing language* pattern. By varying the percentage of colonists in the simulated community and investigating how status drop interacts with functional bias, I expect to be able to quantify the causes of this well-documented phenomenon. The following graphs display the results of ten runs at each specified parameter setting. For all runs, p-prob is set at 1.0 (all native turtles speak P in the initial stage).

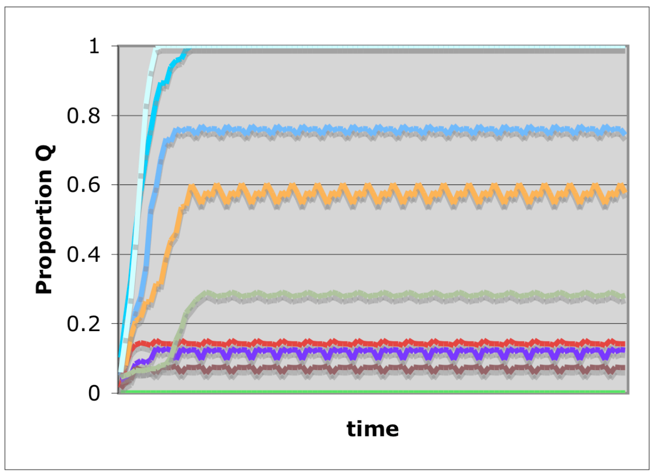
Status Drop: 10 percent colonists*

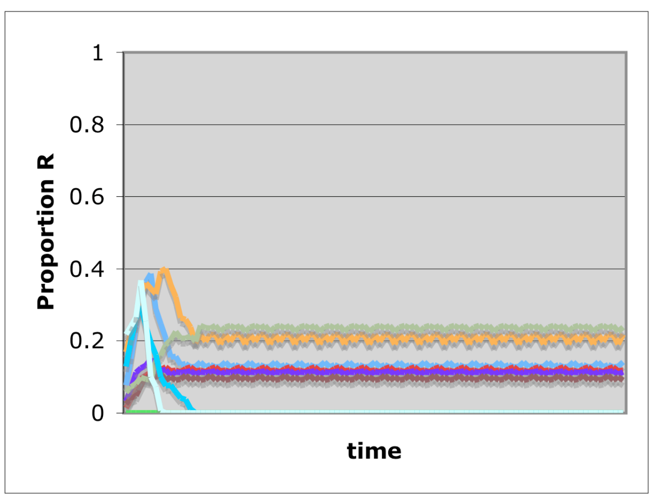


* 10 percent of the superstatus individuals, NOT the total population, are colonists.

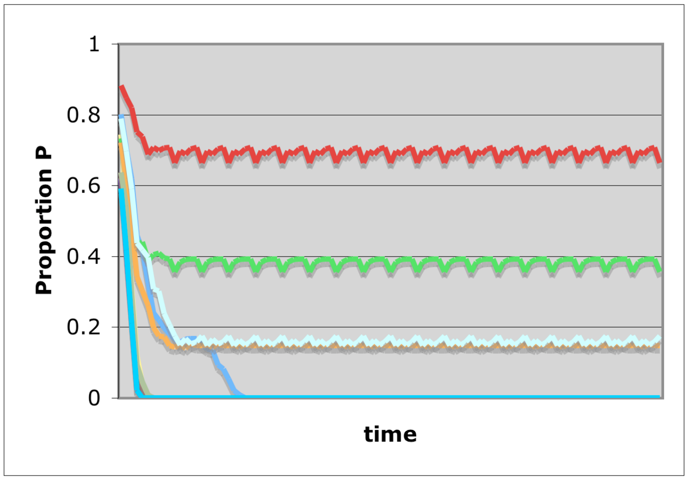
Status Drop: 20 percent colonists

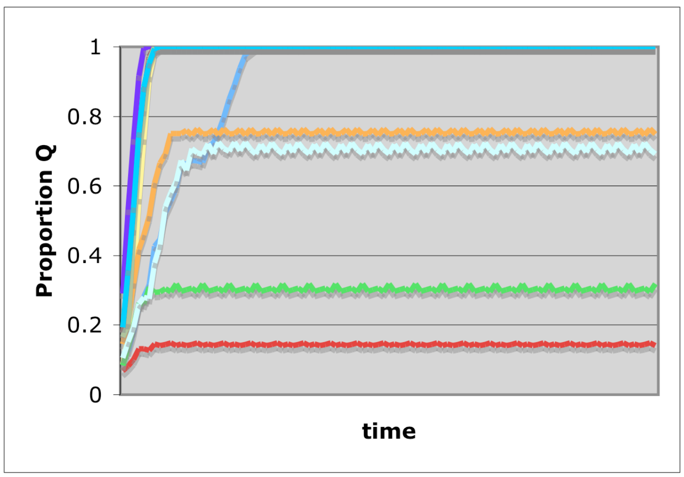


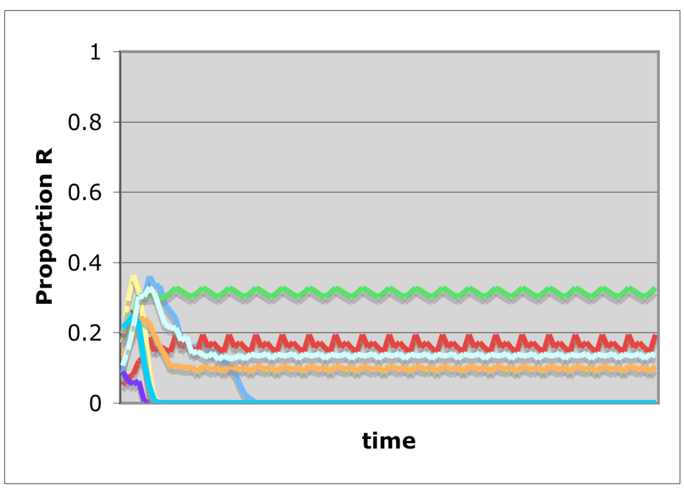




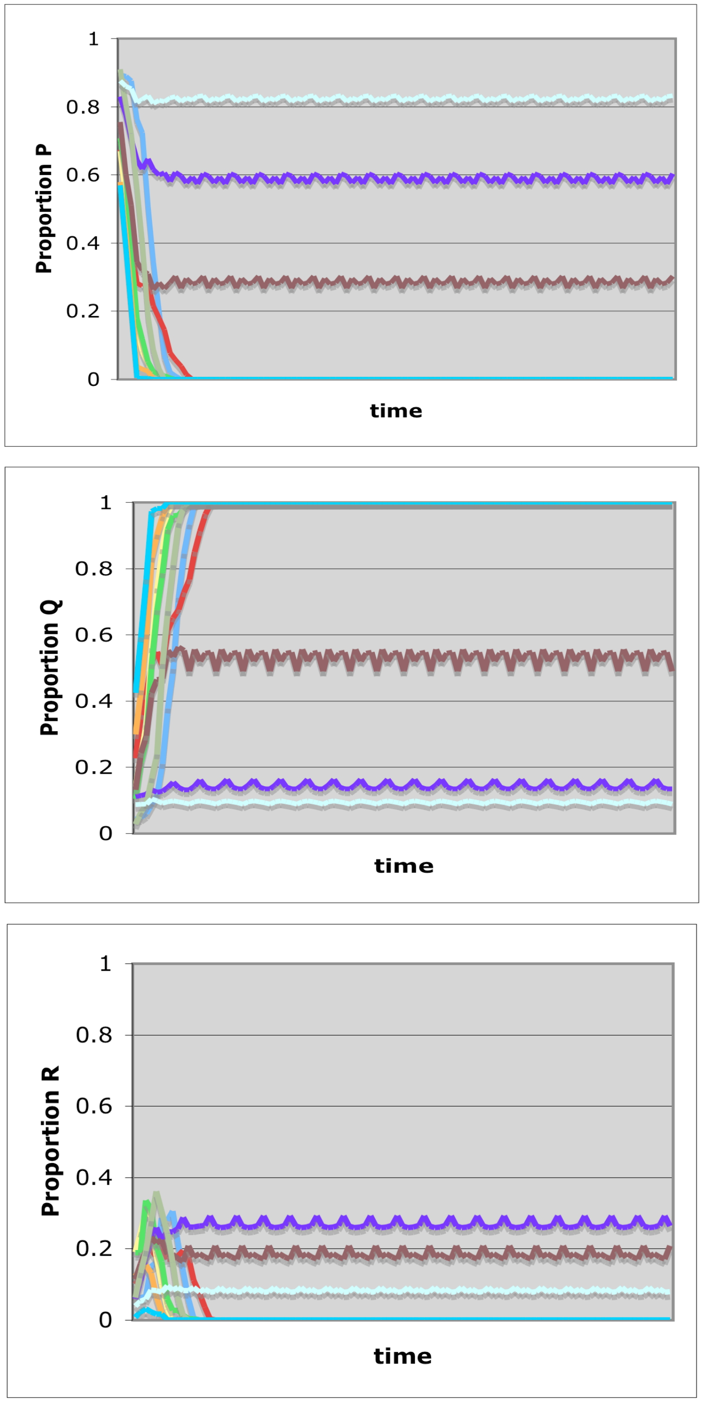
Status Drop: 30 percent colonists



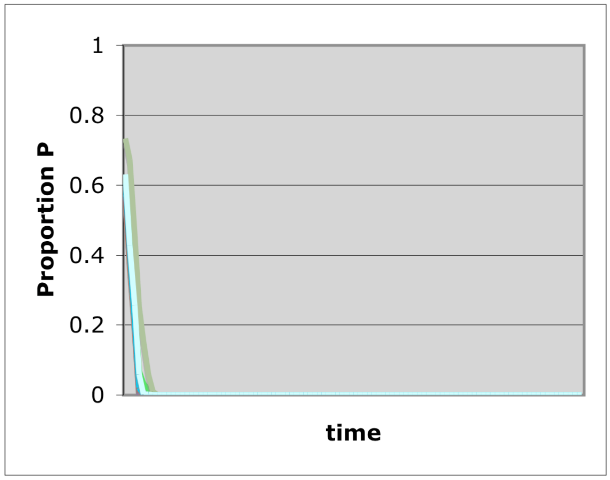


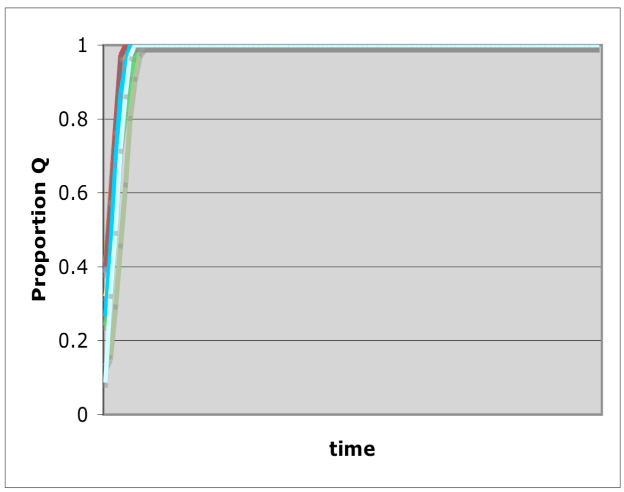


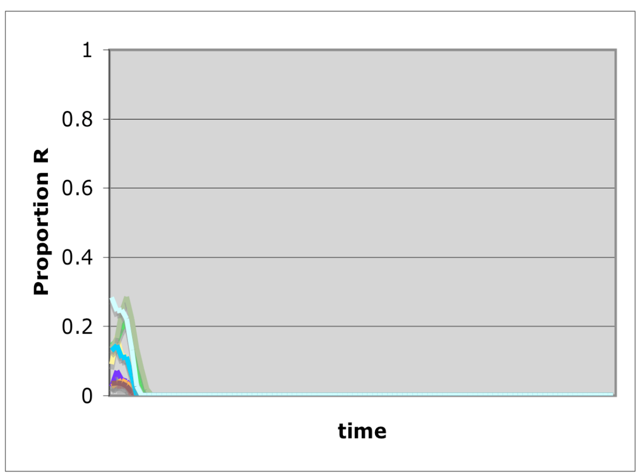
Status Drop: 40 percent colonists



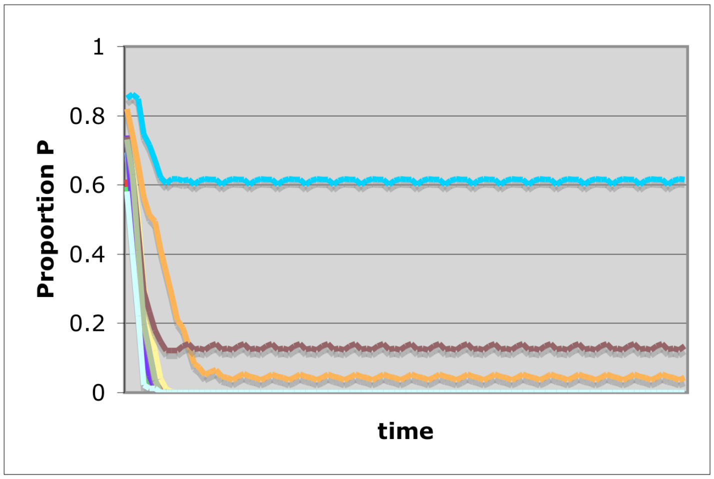
Status Drop: 50 percent colonists

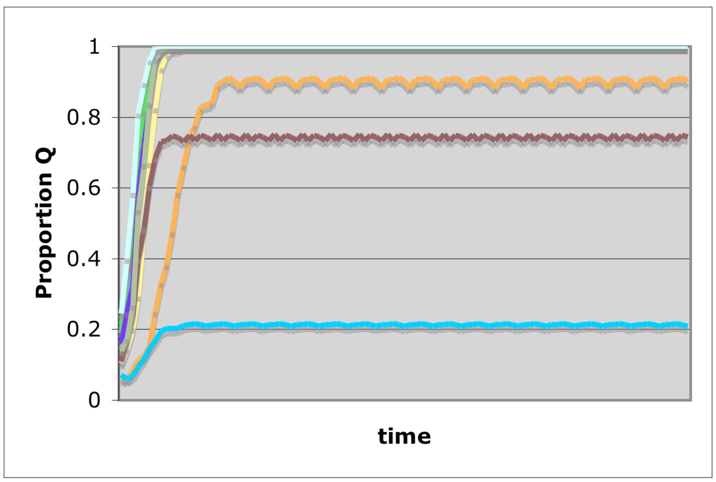


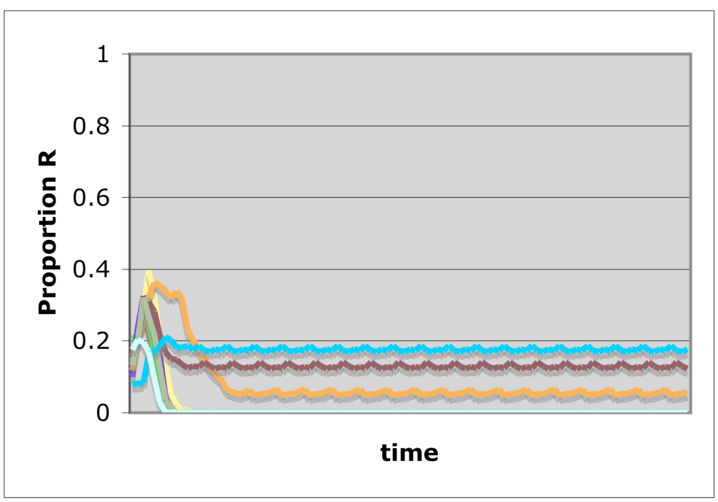




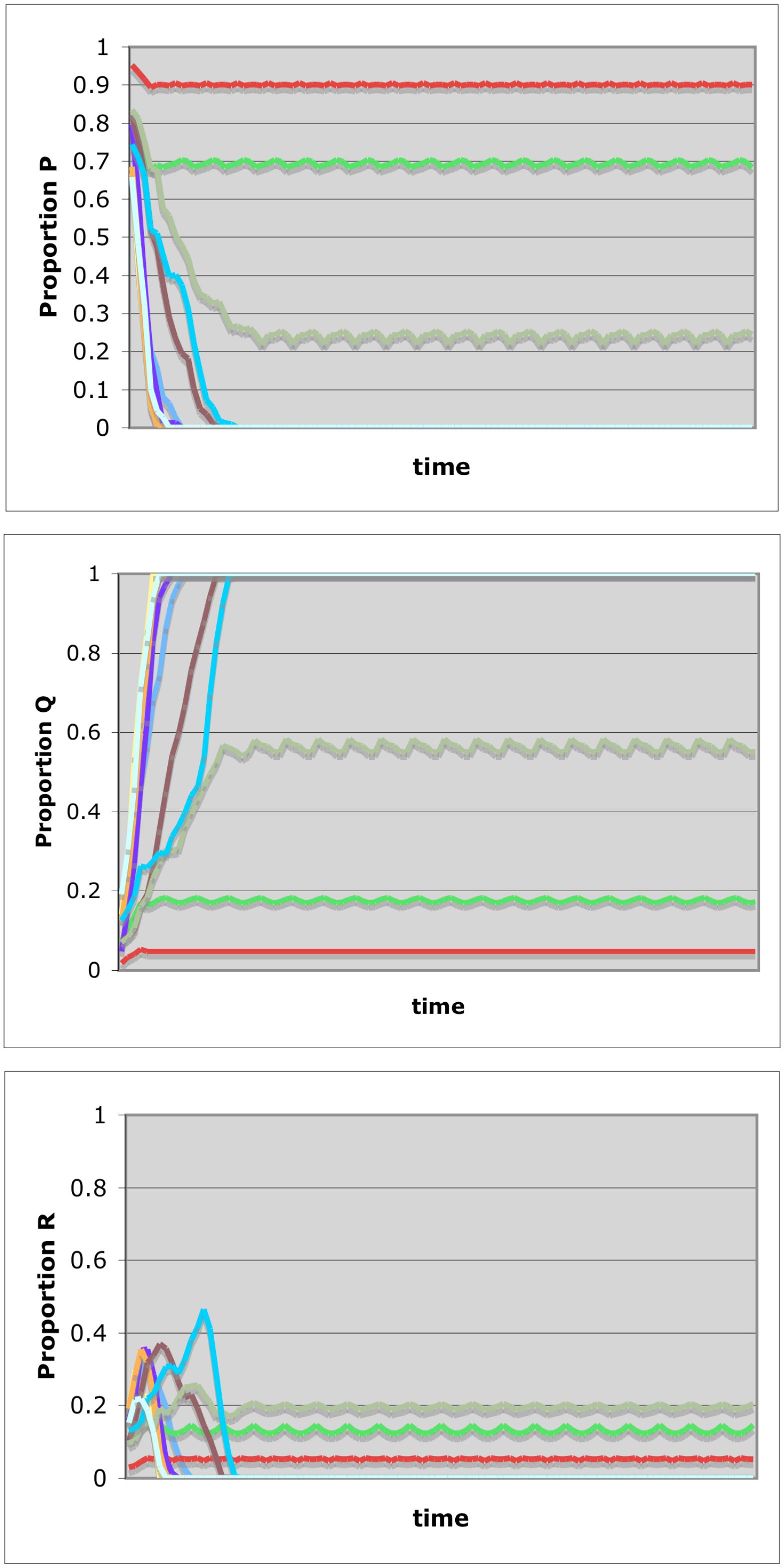
Colonists 40 percent; P-bias 55 percent



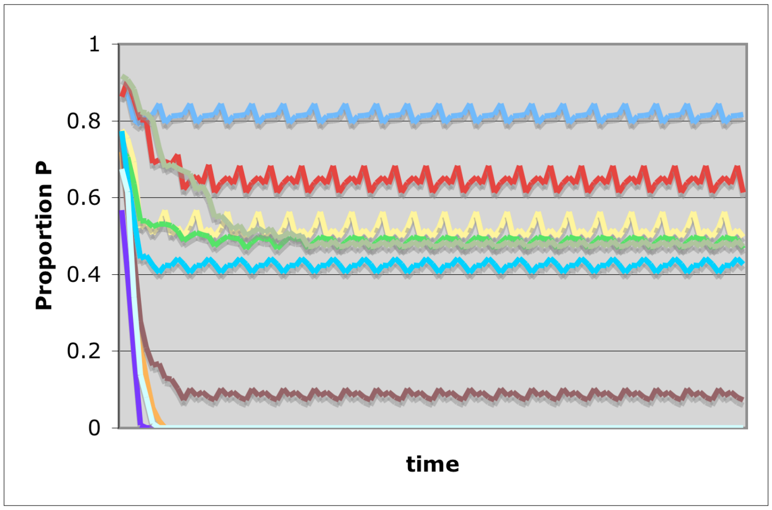


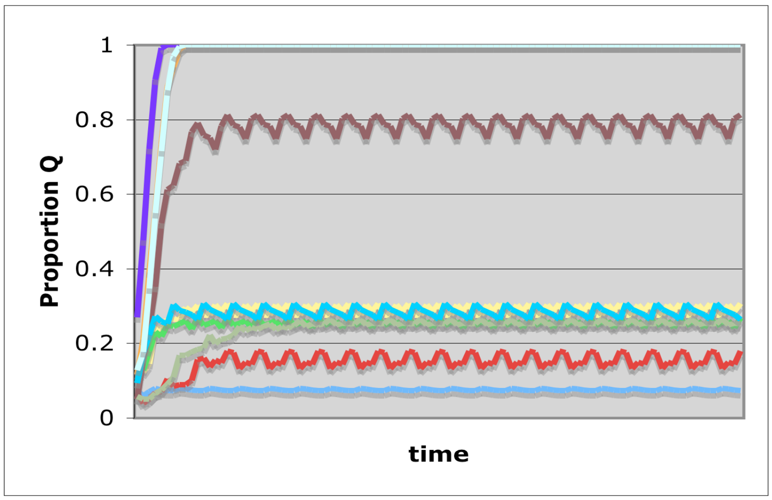


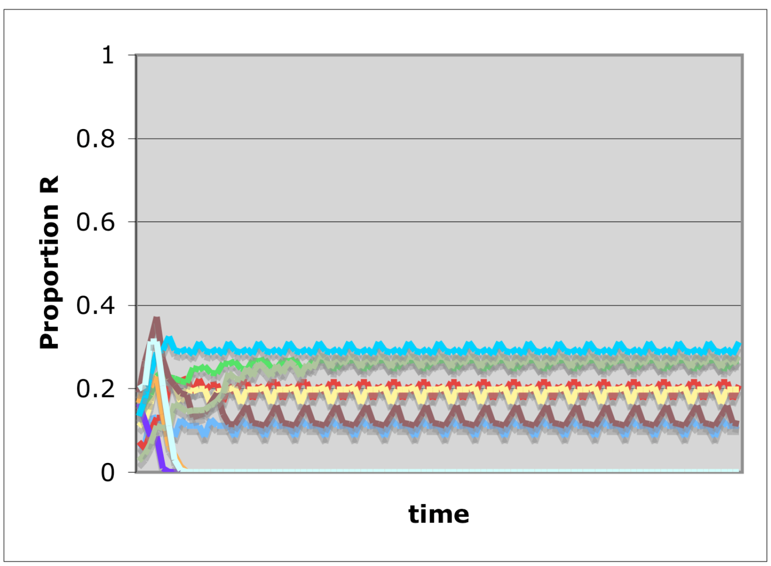
Colonists 40 percent; P-bias 65 percent



Colonists 40 percent; P-bias 75 percent







Results/Conclusions

As expected, the additions of the status drop switch and slider, the status group variable, and the third language variant to Nettle's code allowed for the simulation of Bobaljik and Pensalfini's language death pattern. As the percentage of superstatus colonists in the population increased, the chances for a native language's survival decreased. When colonists replaced just 10 percent of the native population's superstatus individuals, the community's dominant language rapidly shifted from monolingual native language→ bilingual→monolingual colonizing language in 2 of 10 runs. Accordingly, with each boost in the percentage of colonists at setup, the probability that the colonizing language would propagate increased.[4] The 40 percent slider setting yielded the most reliable results; at this level, the colonizing language was highly likely to propagate[5], and a significant peak in bilingualism occurred before the turnover. While the 50 percent setting resulted in language P death 100 percent of the time, the diminished presence of bilinguals makes it a less ideal match to Bobaljik and Pensalfini's observation.

To test the strength of status drop against one of Nettle's most potent variables, I manipulated functional bias toward native language P at the 40 percent colonists setting. In Nettle's original code, sufficiently augmenting bias toward P or Q would invariably lead to swift propagation of the favored variant. If 40 percent of superstatus individuals at setup are colonists, then, will the shift toward their language be blocked by substantial bias toward the native language? Tellingly, the results of runs at 55 percent, 65 percent, and 75 percent bias indicate that the status drop variable proves to be quite a match for functional bias. Q is able to propagate

---

[4] The number of total superstatus individuals and their positions relative to one another in the grid seemed to have some impact on this effect. The shift to language Q was much slower when fewer superstatus individuals were present or when several native superstatus individuals were near each other.

[5] The population's language quickly shifted to Q in 7 of 10 runs.

occasionally even when bias for the native language is 25 percent greater than bias for the colonizing language.

Given these findings, it is clear that a drop in the social and economic status of a language's speakers poses a definite threat to the survival of a cornerstone of their culture. To save any of the 3000 languages headed toward extinction, a surge in community support and a collective realization of the importance of linguistic diversity is imperative.

References

Bobaljik, J. and Pensalfini, R. (1996). Introduction to *Papers on Language Endangerment and the Maintenance of Linguistic Diversity*. MIT Working Papers in Linguistics 28: 1-24.

Crystal, D. (2000). *Language Death*. Cambridge: Cambridge UP.

Nettle, D. (1999). Using Social Impact Theory to simulate change. *Lingua* 108: 95-117.