Dynamic Social Impact: The Creation of Culture by Communication

by Bibb Latané, Florida Atlantic University

I propose a dynamic theory of social impact to account for how coherent structures of cultural elements emerge from the interactions of people located in space. In this conception, social structure is seen to result from individuals, differing in their ability to influence each other and in their spatial location, affecting each other in a dynamic iterative process of reciprocal and recursive influence. I will show that the tendency for people to be more influenced by nearby rather than faraway people gives rise to local patterns of consensus in attitudes, values, practices, identities, and meanings that can be interpreted as subcultures. These self-organizing properties can lead initially random distributions of social attributes to become clustered in space and correlated, with less popular elements becoming consolidated or reduced in frequency but surviving in minority subgroups. Dynamic social impact theory thus provides a view of cultures as complex systems exhibiting four forms of self-organization: clustering, correlation, consolidation, and continuing diversity.

This paper will attempt to account for how culture could emerge from individual experience and everyday interaction. By culture, I mean the entire set of socially transmitted beliefs, values, and practices that characterize a given society at a given time. These shared ideas and habits produce the concrete manifestations of a particular culture, its religious doctrines and ceremonies, its etiquette and cuisine, its politics and ways of speech. Such elements become combined in coherent if not logically necessitated sets or patterns of related ideas, similar to the entities termed "social representations" by Moscovici (1984b). Culture provides a common understanding transcending immediate individual experience, a social reality to guide our actions.

I suggest that simple social scientific principles, as expressed in dynamic social impact theory (Latané, 1981; Latané, 1996a), may help explain how culture comes about. Dynamic social impact theory is based on a view of society as a self-organizing complex system composed of interacting individuals each obeying simple principles of social impact. It can be described with five propositions.

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Five Propositions and Six Derivations

In this article, I will present five propositions and six derivations.

Proposition 1: Individuals differ.

Individual human beings differ with respect to a multitude of demographic, physiological, and psychological variables, including age, sex, social status, health, intelligence, temperament, and life circumstance. These differences are due in varying degrees to genetic causes, inherited wealth or social position, and individual experience and achievement. Many of these differences involve attributes that can, at least in part, be affected by social influence, such as tastes, preferences, moods, values, cognitions, beliefs, attitudes, habits, and lifestyles, among others. These characteristics are important because they shape how people act and react toward the world and each other. The domain of dynamic social impact theory is any socially influenceable attribute or aspect of an individual.

A particularly important class of individual differences includes those that affect an individual's credibility, willingness to exert influence, or power to affect other people. Fully understanding how to win friends and influence people is still an elusive goal, but for present purposes, I use the term *strength* to refer to the net of all the individual factors making a person influential. Strength can be understood to be composed of two basic types of factors: stable, trans-situational, intrapersonal components (e.g., physical size, intellect, wealth) and dynamic, situation-specific, relational components (e.g., belonging to the same group). For simplicity, my focus here is on the former rather than the latter, but there is no theoretical reason why strength cannot be computed from interpersonal as well as intrapersonal factors.

The existence of these and other forms of individual difference means that human systems differ fundamentally from physical systems composed primarily of more or less identical particles that vary only with respect to a few attributes or states, suggesting that human social systems may have some different dynamics than otherwise similar physical systems (Lewenstein, Nowak, & Latané, 1992). The existence of such individual differences and people's self-consciousness about them has made most social scientists deeply skeptical of attempts to develop a "social physics" (Stewart, 1952) based on deterministic, objective laws.

A final important form of individual difference, since more than one person cannot be in the same place at the same time, is in spatial location. Differences in spatial location turn out to have significant theoretical and empirical consequences for the dynamics of social interaction.

Proposition 2: Individuals have relatively stable locations in space.

People do not jump randomly from one location on the surface of the earth to

another, but rather tend to move in circumscribed orbits around their homes and workplaces (see Golledge & Stimson, 1987, for an introduction to behavioral geography). As territorial animals, humans need stable sources of shelter and food, and since the discovery of agriculture, these needs have been satisfied most efficiently by establishing relatively stable communities. Even highly nomadic peoples (and jet professors) have a relatively restricted range of movement through space, especially when you consider the surface of the planet as the realm of possibility. Most people exhibit patterns of relative stability of location punctuated by periodic short-range and occasional longer range movements. It seems likely that human mobility patterns approximate bivariate normal distributions around their home bases, similar to those found in other species (Calhoun, 1963), facilitating optimal resource allocation among the members of a population.

Humans are located in physical rather than psychological space, putting an important constraint on the dynamics of human interaction. Even though locations are not fixed, individual movements around home bases can be interpreted simply as adding a random quality to the spatial determinants of social influence. Surprisingly, such randomness, rather than complicating the deterministic system I propose, enhances its ability to organize itself

> *Derivation 1: The number of people located at any given physical distance from an individual should increase in approximate proportion to that distance.*

Since the habitable portion of the earth approximates a two-dimensional surface, we can derive some expectations about the relations of people to each other from simple geometrical principles once we assume relatively stable physical locations. Just as the circumference of a circle is proportional to its radius ($c = 2r$), we should expect that as we draw wider circles around a given individual, there should be larger numbers of people located at each successive distance. Although the simplifying assumption that people are distributed with more or less equal density is not particularly accurate, the derivation is relatively robust at most scales. A similar derivation relates the radius of a circle to its area—we should expect improvements in transportation to increase the total number of people available for influence in proportion to the square of the increase in movement range.

Thus the number of neighbors we have is necessarily less than the number of people who live at successively greater distances, at least up to some very large distance. The number of people expected to be found at any given distance from any given individual is likely to increase with distance (at least up to the rather large limit set by the size of the earth). This derivation poses an interesting problem for human society. If people were equally likely to be influenced by anyone else, people would be, on balance, more affected by strangers than by their neighbors, since there are so many more of them. This result arouses suspicions of action at a distance and would lead to highly

unstable social systems. The immediacy principle of social impact theory provides a solution to this paradox.

Although it has become thoroughly accepted in psychology that individuals respond to their cognitive representation of the space in which they live rather than directly to the space itself, physical and social constraints give this space an objective or at least intersubjective character. Latané and Liu (this issue) introduce a concept of social space as the intersubjective matrix within which people influence each other and discuss how this matrix, although itself the product of social influence, is fundamentally constrained by physical realities of space and time.

Proposition 3: Social influence is proportional to a multiplicative function of the strength, immediacy, and number of sources.

Latané's (1981) social impact theory (SIT) provides general guidelines for categorizing and understanding the effects of variables that affect the direction and magnitude of the social influence impinging on an individual. The theory assumes that, although people influence each other in a variety of ways through differing psychological processes, most of these seem to operate in accordance with a few very general principles.

The basic metaphor for social impact theory is that influence is a result of social forces operating in social force fields, similar to how physical forces operate in physical force fields. For example, a social force field might involve a set of people with differing opinions on some topic located in proximity to one another in social space. According to SIT, three broad classes of variables, multiplicatively combined, determine the degree to which an individual is affected by a social force field. We have already discussed *strength*, which represents stable characteristics of the individuals who are the sources of influence. A second class of determinants can be labeled *immediacy*, and includes variables relevant to the relationship between the sources and target of influence. Immediacy is defined by a variety of factors, among the most important of which is that it should be an inverse function of physical distance. The third determinant is simply *number*, or how many sources of influence there are. For a variety of different forms of social influence it has been shown that impact grows in approximate proportion to the square root of the number of people involved (Latané & Harkins, 1976; Latané & Wolf, 1981). This can be thought of as a *psychosocial* principle comparable to Steven's (1957) psychophysical law. The hypothesized multiplicative combination of these variables simply means that if any one of them approaches zero, so, too, will net impact. In mnemonic summary, then, we can say that impact $\hat{\imath} = f(SIN)$.

Social impact theory is a metatheory summarizing several basic principles of social influence. These principles, together with the principles of social space outlined previously, provide the basis for a rigorous dynamic model of social impact.

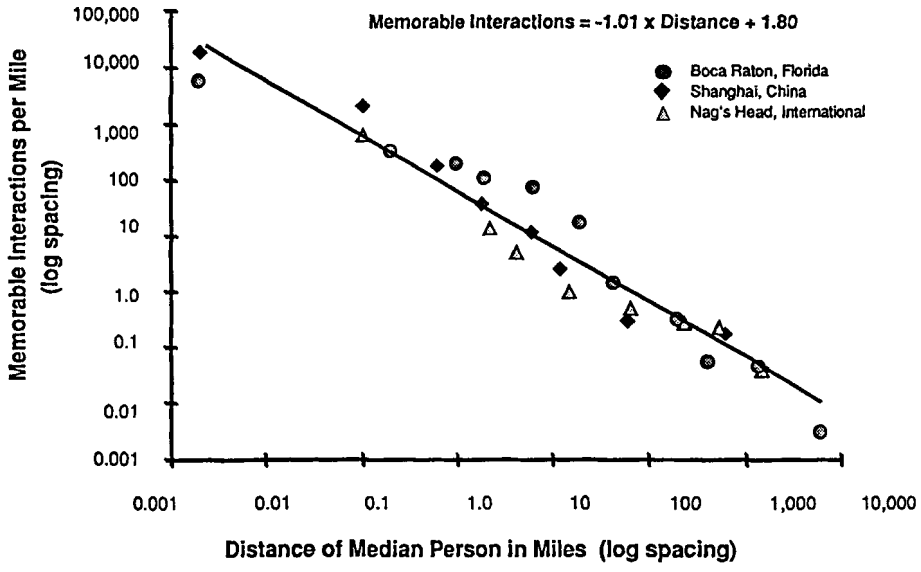


Figure 1. Social impact as a function of distance among South Floridians, Shanghainese, and social psychologists

Derivation 2: Influence will be inversely proportional to the distance between people.

According to social impact theory, if other factors are held constant, influence is directly proportional to the immediacy of the source of influence. Immediacy is conceived to be the net of a variety of conceptually related factors, such as the clarity or richness of the communication channels among people, the lack of barriers, filters, or static, or the ability to monitor. An especially important aspect of immediacy is closeness in space. Closeness may increase the salience, the intensity, or the power of social influence by making a source of influence more immediate.

Latané, Liu, Nowak, Bonevento, and Zheng (1995) present data showing that the relationship between physical distance and social influence is astonishingly regular. Students and older adults in South Florida, students in Shanghai, and social psychologists who have attended Nags Head conferences in Florida were asked to recall people with whom they had recently discussed matters important to them and to estimate how far away they lived. For each of these three samples, which varied widely in age and culture, the number of memorable interactions (those having enough impact to merit recall) decreased as a linear function of distance; that is, a graph of the density of social contacts as a function ($1/d$) of distance plotted in logarithmic coordinates yielded a slope of

- 1.01, explaining 96% of the variance in the categorized data. Given that the number of potential contacts increases as a function (d) of distance (Derivation 1), the overall pattern of results was entirely consistent with the possibility that impact decreases as a function of distance squared ($1/d = d/d^2$). Social influence thus seems to be very much a local phenomenon, even for academic social psychologists whose disciplinary interests often correspond most with those of people located at great distances.

Proposition 4: The iterative, recursive outcome of individual influence processes will lead to the global self-organization of socially influenceable attributes and the emergence of group-level phenomena.

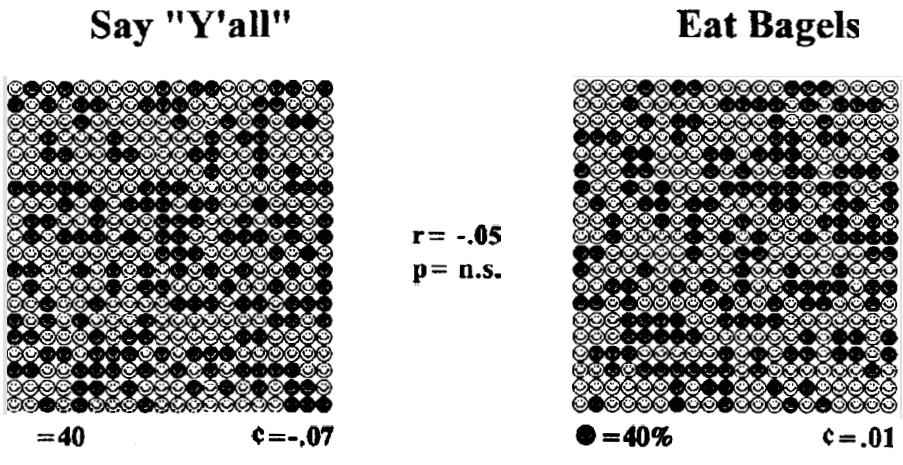
What will happen in a population of interacting people as each person influences and is influenced by others? Dynamic social impact theory suggests that the answer to this question can be found by considering the population as a self-organizing system or multiagent cellular automaton, where group-level regularities emerge from the interaction of individual elements. Unfortunately, the new realm of complex dynamical systems (see Lewin, 1992; Poundstone, 1985; Waldrop, 1992; Wolfram, 1986, for applications from other areas of science) is not particularly conducive to traditional methods of formal analysis, and computer simulations are often used to model the system's temporal evolution and behavior (Latané, 1996b).

Computer simulation as a instrument of theory. Computer simulation can be used as a "derivation machine," a way of finding out what theories predict. Computer simulation requires a concrete, well-specified theory, but in order for the results to be meaningful, the theory must be quite general. Social impact theory is a well-tested general metatheory of social influence stated with sufficient specificity to provide the basis for SITSIM (Nowak & Latané, 1994; Nowak, Szamrej, & Latané, 1990), a computer program designed to conduct dynamic simulations of social influence.

In SITSIM, individuals are assigned initial attribute values, including their spatial location, persuasive strength, and position with respect to a target attribute (these are usually assigned randomly within some distributional constraints). SITSIM then determines the net social impact of the total group on each individual by calculating both persuasive impact ($\hat{\imath}_p$), the total force to change coming from those with opposing positions, and supportive impact ($\hat{\imath}_s$) coming from individuals who share the same position, including oneself. Both $\hat{\imath}_p$ and $\hat{\imath}_s$ are assumed to be proportional to S/d, where S and d are the strength and distance of each persuader or supporter. Change is a simple function of the relative strength of $\hat{\imath}_p$ and $\hat{\imath}_s$. As the simulation progresses, the attitude of each individual is recalculated either until the system reaches equilibrium (there are no further changes) or for a specified number of steps. Each individual simultaneously influences and is influenced by his or her neighbors over several iterations of the algorithm until the system stabilizes or a maximum number of interactions has been carried out.

Example of a SITSIM Outcome

Before influence, values of two attributes of each of 400 people varying in strength are spatially random and uncorrelated.



After 30 rounds of influence, attributes have become spatially clustered and correlated, while the minority although reduced in size, persists.

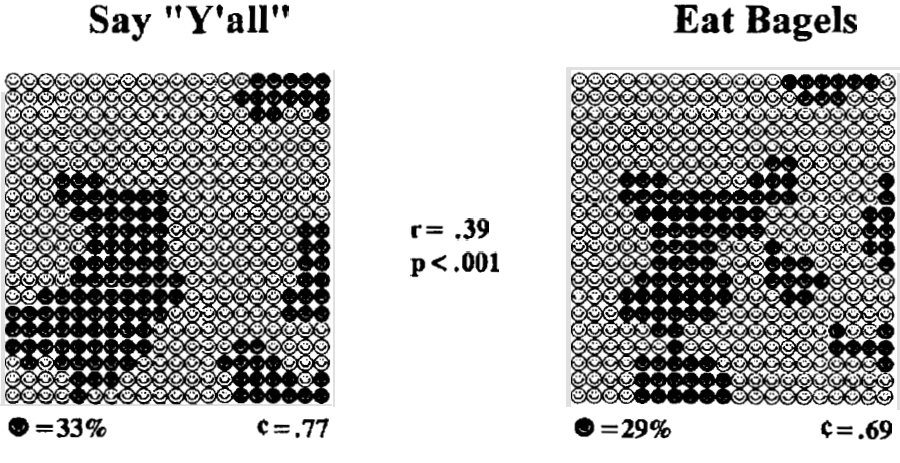


Figure 2. Individual attributes before and after influence

To reflect the fact that factors other than social influence are likely to affect attributes, a probabilistic component can be included in the form of a random number added to the calculated value of $\hat{\imath}_s$ for each individual on each trial. This term, labeled *b* for bias, represents the sum of individual interests and experiences other than those emanating from the social environment.

To ensure that predicted outcomes will reflect the general properties of social systems and not some specific quirk of operationalization, SITSIM is designed to allow the factorial combination of 20 variables that might affect the dynamics of social systems, with two to five levels of each, including the specific computational model, method of simulating parallel processes, existence or absence of borders, size of the system, initial minority-majority split, and assumptions about the distribution, relationship, and change of strength parameters. These variables are chosen to represent all the plausible theoretical assumptions, parameters, and initial conditions we could imagine, and to allow more than 200 billion combinations. Extensive experimentation with SITSIM shows these factors to have little effect on the behavior of the system, although they can make a big difference in determining the fate of specific individuals (Latané & Nowak, in press). In other words, the predictions of dynamic social impact theory are remarkably robust.

Derivation 3: People will become more similar to their neighbors, leading to spatial clustering.

The top half of Figure 2 shows the initial positions of a single group of 400 inhabitants of SITSIM with respect to two different attributes. You can think of the figure as aerial views of the new residents in a small town in Florida taken by a special x-ray camera that can detect, not only their spatial location (shown by the location of their faces), but whether they say "y'all" and eat bagels. The picture does not show, but the computer knows, the persuasive strength of each person. To begin with, these attributes are randomly distributed in space and are uncorrelated.

The bottom half of Figure 2 shows the distribution of attributes after 30 rounds of influence. Although people have not changed their locations in space, they have adapted to their local environment so that their characteristics have become spatially organized into clusters consisting of local islands of minority characteristics floating in the majority sea. The degree of clustering is indicated by the index ¢, which can range from 0 (random distribution) to 1.00 (perfect clustering), shown in the lower right corner of each figure (see Latané, Nowak, & Liu, 1994, for a derivation of this index). Although clusters often formed near borders, borders are not necessary for the effect, since similar clustering indexes are obtained from simulations in which borders are eliminated by assuming that everyone on the top row is neighbor to the corresponding person on the bottom, and everyone on the right column is neighbor to the corresponding person on the left. In fact, the only condition necessary for spatial clustering is that influence decreases more rapidly with distance than the

number of people increases. Thus, it appears that spatial clustering is a ubiquitous phenomenon, occurring whenever people are more influenced by their neighbors than by strangers.

Derivation 4: As a result of clustering, attributes will become correlated.

A second remarkable feature of Figure 2 is that despite the fact that the exertion of influence on each attribute was independent, characteristics have become correlated. Although there is obviously no logical link between saying "y'all" and eating bagels, the social process has imposed the beginnings of a pattern or structure. Latané (1996c) describes two reasons for this outcome: Strong individuals impose their own pattern of attributes on their neighbors (cf. Abelson, 1979), and the reduction of degrees of freedom due to clustering itself allows chance variations in the overlap of clusters across issues to become significant. Overall, system-wide correlations resulting from clustering will tend to be modest, especially in large populations, but they can be quite large locally.

Surprisingly, Latané et al. (1994) have shown that adding a random component to the change rule actually enhances the ability of these social systems to organize themselves, at least up to some point. Indexes of clustering and correlation both increase with moderate degrees of randomness, presumably as a result of preventing the system from stabilizing at less well-organized levels.

Derivation 5: Since minorities are necessarily more exposed to opposing influence than majorities, they will typically decline in numbers except to the extent that they can be protected by clustering.

A third notable feature of Figure 2 is that the minorities have been reduced from their initial 40% to an average of less than one third. This phenomenon is labeled *consolidation* because it represents a reduction in diversity. Simply by consequence of being fewer in number, people with minority attributes are more likely than those with majority attributes to experience pressure to change, and this disadvantage will be larger the smaller the minority.

Consolidation tends to be especially rapid at first, before clustering has had a chance to shield minority members from exposure to the majority. Unless there is something to prevent it, however, even a fully clustered system will continue to consolidate as minority islands are eaten away at their predominantly convex borders (Latané, 1996d; Latané & Nowak, in press). Nonlinear influence processes provide the opportunity for minority clusters to survive in the majority sea.

Proposition 5: Social influence will be incremental for unimportant issues, catastrophic for important ones.

Traditional views of how individual social influence should cumulate in societal change assume linear change and predict convergence (Abelson, 1964; Saltiel & Woelfel, 1975; Woelfel & Fink, 1983). To the extent that people are influenced

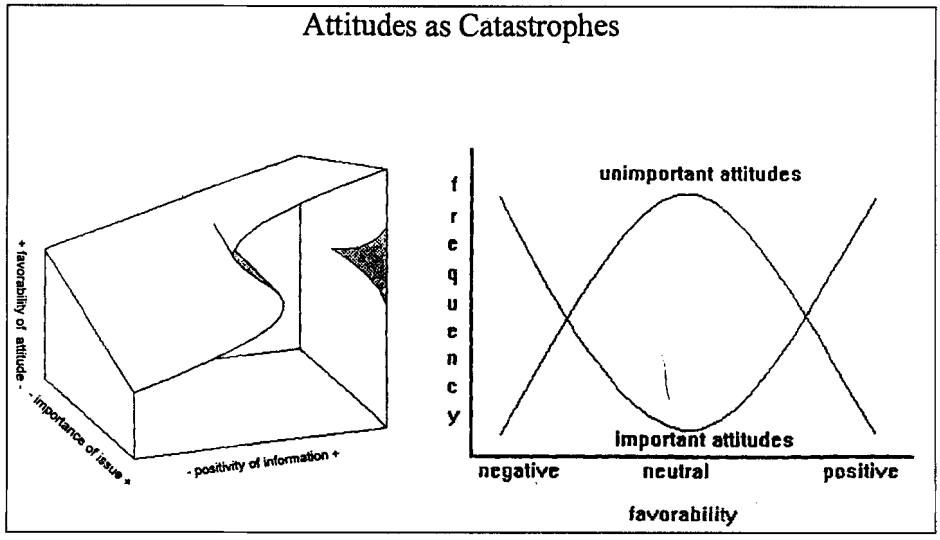


Figure 3. Attitudes as catastrophes

by each other in a linear, incremental fashion, they should gradually move closer to each other and become more moderate, eventually converging on a middle-of-the-road position that represents the average of their initial opinions. This type of theory, prevalent in the 1950s and 1960s, fed upon the fear that television and interstate highways might lead to everybody's sounding the same. Clearly they have not, and there is now widespread agreement that this approach has failed to give a good account even of public opinion on common issues, much less the evolution of culture.

To solve this paradox, Abelson has suggested that sometimes, instead of compromise, communication leads to an extremification of views (Abelson, 1994). Latané and Nowak (1994) have taken a similar position, suggesting that individual change is often nonlinear or nonincremental. Unlike traditional linear dynamics where people react to discrepancies by making small adjustments, nonlinear change is nonincremental or catastrophic, like the camel's response to the last straw. To the extent that people become committed to a position, they may exhibit little change in response to social pressure until the force to change outweighs the force to stay. Furthermore, Latané and Nowak suggest, commitment may be a function of issue importance or involvement.

Such a transition from linear to nonincremental influence with increasing issue importance can be depicted as a cusp catastrophe as shown in Figure 3. The top surface of Figure 3 is hypothesized to act as an attractor, promoting increases in favorability with increasing positivity of information. Importance acts as a "splitting" factor, leading people to become more extreme in whichever view they adopt.

Distributions of attitudes in a population can be used as a test of the catastro-

phe model. As indicated by the right panel of Figure 3, the linear change processes predicted to characterize unimportant issues should lead to normal distributions of attitudes, whereas bimodal distributions should result from the cusp representing the avoidance of intermediate, compromise positions on important issues. Latané and Nowak (1994) and Liu and Latané (in press) present a variety of attitude distributions suggesting that important or involving attitudes do tend to be more extreme. Harton and Latané (1996) show that exposing people to a common pool of balanced information about a topic can lead to extreme disagreement to the extent that it causes them to become more involved with the topic.

Derivation 6: Incremental influence processes will lead to convergence; nonlinear influence processes will lead to continuing diversity.

SITSIM can be used to predict the consequences of both incremental and nonlinear attitude-change rules. In the early stages of interaction under a linear rule such that individuals adopt a new position proportional to the weighted average of the influence they receive plus a random term b reflecting their individual interests and experiences, clustering and correlation are prevalent, and the rate of consolidation slows down as more and more minority members find themselves surrounded by like-minded peers. However, there is nothing to stop people on the edge of the border from adapting to their neighbors, and such systems inevitably compromise themselves to uniformity if b is not too large, just as proven by Abelson (1964).

With a nonlinear change rule (e.g., an individual will change if and only if $\hat{\imath}_p > \hat{\imath}_s + b$), however, unification becomes rare, as the borders of clusters are stabilized. Simulation results show that in addition to nonlinear change, there must be some form of individual differences in strength or resistance to change, to enable high-strength individuals to anchor the borders between minority and majority. When these two conditions are met, groups, rather than unifying, reach dynamic equilibria in which, although individual members continue to change, the size of the majority and the degree to which it is clustered remain relatively constant.

Thus, dynamic social impact theory suggests that continuing diversity can be maintained despite strong pressures to uniformity, thanks to the laws of nonlinear dynamics. Ironically, these same laws suggest that continued diversity will be most likely for the most important issues, for which people most want consensus. Although greatly in need of empirical verification, these predictions seem consistent with the continuing societal polarization on fundamental political, religious, and cultural issues that so characterize the modern world.

The Creation of Culture by Communication

I have presented a theory of how individuals located in social space influence each other to create higher order patterns of structure. Presented here as five

propositions and six derivations, dynamic social impact theory accounts for four key features of culture: regional clustering, correlations among cultural elements, consolidation of minorities, and continuing diversity.

Dynamic social impact theory views culture as a continuing human creation to which everyone contributes. Based on the psychology of individual humans in a social world, dynamic social impact theory assumes that culture is generated from the bottom up in the form of inductive combinations of culture elements that become spatially distributed social representations. The theory sees human society as a collection of subcultures, an organic changing entity feeding on and evolving by communication. It enables predictions about some but not all aspects of culture.

Social process. Although acknowledging the existence of many forms of social influence, ranging from physical force to friendly persuasion, dynamic social impact theory looks to higher level commonalities in their operation. By assuming that most, if not all, social impact is a multiplicative function of three simple variables, the theory can derive general yet specific predictions, not about the outcomes of influence on the attributes of individuals, but about their distribution and change in society.

Individual determinism. The problem of individual-level determinism is moot, because even if the behavior of the individuals is unpredictable (or predicted by too many complex forces to model), the action of the system as a whole is patterned, organized, and emergent from their interactions. In fact, a remarkable feature of complex systems is that the existence of some degree of randomness can actually enhance their ability to self-organize.

Communication. By facilitating and controlling social interaction, the technology of communication helps determine the shape or geometry of social space and the kinds of social influence processes that can take place within it. Thus, the changing technology of communication may have profound effects on the future evolution of culture. Dynamic social impact theory may help us understand and possibly anticipate these effects.

Form vs. content. Although I hope this theory may lead to understanding sociological, political, and economic phenomena, it will be best suited to explaining the form rather than the content of historical, cultural, and regional differences. The theory does not tell us what the nature of a particular culture will be—what elements will be adopted and adapted and how they will be combined and interpreted. These tasks fall to history and to anthropology.

Anthropology, it is sometimes said, is a hermeneutic, meaning-centered discipline, whose goal should be to explore the interpretations people construct to make sense of their lives and to guide their acts. Dynamic social impact provides an account for how these meanings can arise and evolve with an associated set of constraints on how they will be distributed. Thus, although agreeing with social constructionists that culture is created by communication, it suggests limits to the degree of cultural relativism that can emerge.

In fact, dynamic social impact theory suggests two kinds of cultural universals, those originating in the nature and experience of individuals (bias) and the

macrolevel emergent consequences of their interaction (dynamic self-organization). Thus, the search for these universals should focus on the laws on nonlinear dynamics as well as on common human experiences rooted in biology and economics, while recognizing that particular combinations of cultural elements can arise and evolve with no apparent logic but historical accident. Dynamic social impact explains how cultures can seem to have an internal coherence even as they resist categorization as collections of objective facts. It seems to occupy a middle ground between the sterility of social physics and the swamp of radical constructionism.

Next Steps

Although promising, the theory is but a first step, a framework toward a full understanding of culture. The remaining articles in this symposium attempt to broaden this framework. Latané and Liu consider the nature of social space as the arena in which dynamic social impact takes place, Latané and Bourgeois present empirical evidence for the theory in the context of actual groups communicating by e-mail. Lavine and Latané describe parallel intra- and interpersonal processes leading attitudes to become organized. Huguet and Latané integrate the ideas of dynamic social impact theory with the thriving European tradition of theory and research on social representations. Finally, Schaller and Latané trace implications of the theory for the origin and evolution of stereotypes as social representations.