IDA

INSTITUTE FOR DEFENSE ANALYSES

Idea Spread: Toward a Research Program in Socio-Cultural Modeling and Cultural Engineering for Security, Defense, and Intelligence

Arthur Fries, Project Leader
William Frawley

October 2008

Approved for public release;
distribution unlimited.

IDA Document D-3601

Log: H 08-001219

This work was conducted under IDA's independent research program. The publication of this IDA document does not indicate endorsement by the Department of Defense, nor should the contents be construed as reflecting the official position of that Agency.

INSTITUTE FOR DEFENSE ANALYSES

IDA Document D-3601

Idea Spread: Toward a Research Program in Socio-Cultural Modeling and Cultural Engineering for Security, Defense, and Intelligence

Arthur Fries, Project Leader
William Frawley

PREFACE

This document was prepared by the Institute for Defense Analyses (IDA) under IDA's independent research program. The objective of this document is to describe key factors in a dynamic model of *idea spread* as a matter of intelligence, security, and defense and to outline the ways these factors form the basis of a longer-term, robust research program in the area.

The IDA Technical Review Committee was chaired by Rear Admiral Richard B. Porterfield, USN (Ret.), and consisted of Dr. Amy A. Alrich of the Intelligence Analyses Division, and Mr. James D. Morgeson and Dr. Caroline F. Ziemke of the Strategy, Forces, and Resources Division.

IDEA SPREAD: TOWARD A RESEARCH PROGRAM IN SOCIO-CULTURAL MODELING AND CULTURAL ENGINEERING FOR SECURITY, DEFENSE, AND INTELLIGENCE

List of Figures

List of Tables

EXECUTIVE SUMMARY

This document outlines a research program in *idea spread*, otherwise known as (*military*) *memetics* or *thought contagion*.[1] We use the frameworks of complexity and socio-cultural and cognitive-behavioral modeling. Throughout the document, we try to present the results in terms of a project of *cultural engineering* and in the context of *defense, security, and intelligence issues*.

Our focus is on the aspects of socio-cultural modeling and memetics that have been relatively unexplored, but offer great promise for research advancements and practical implementations. Six critical areas of inquiry are identified and discussed. Detailed presentations introduce each area, reduce the analytical complexity down to manageable levels, and outline specific research projects that can be undertaken immediately. The extent of the exposition thus should be viewed as a sign of viability of the future research, rather than any indication of overwhelming unwieldiness.

First, because idea spread involves individual behavior that must conform to group processes, we examine the relationship between U-shaped curves for individuals and the S-shaped population-level curves of idea change over time. The main issue is whether we can describe group traits in terms of individual behaviors. Second, we look at the difference between endogenous and exogenous variables in explaining idea spread. The core issue here is the split between the two and the use of robust endogenous variables to model and predict idea change. Third, we look at some models and issues in the rate and speed of idea spread, arguing that rate of change is critical to the notion of engineered ideas. Fourth, we examine how ideas can gain conceptual territory and the various processes at the frontier of idea spread: one key lesson is that at the frontier, there is intense individual computation, which may overtake group processes. Fifth, we look at the structure of ideas – ontologies – and how the proper information for idea spread can

---

1 The companion IDA Document D-3599, *Memetics – Overview and Baseline Models*, introduces and discusses more thoroughly various interpretations of the terminology *memetics*.

be captured. Issues that arise here are the appropriate representation schemes (in terms of nodes and relations/arcs) and ways to introduce ideas into an ontology for most effective spread. Sixth, we look at where idea spread plays out in social networks. Under this subject we analyze the structure of social networks and the role they play in “mindless thought” or social conformism. Idea spread works when new ideas are simply taken on and imitated.

The paper closes with 15 possible new research projects that follow from the foregoing. These projects range from technical mathematical studies to more sweeping accounts of ontologies and social networks. There remains a significant body of important and consequential theoretical and applied work ahead of us.

I. BACKGROUND

A. PURPOSE OF STUDY

The goal of this document is to describe key factors in a dynamic model of *idea spread* as a matter of intelligence, security, and defense and to outline the ways these factors form the basis of a longer-term, robust research program in the area. As an issue broadly conceived, idea spread (i.e., *memetics*[1] (Dawkins 1976) or *thought contagion* (Lynch 1998)) involves, narrowly, the insertion of critical notions into a defense- or intelligence-relevant social situation so as to promote or counter beliefs in the adversary or some population which must change its world view in order to be sympathetic to another position. More generally, idea spread can be used in a less adversarial context as a way of marketing new ideas for adoption – for promoting everything from out-of-the-box thinking to effective risk communication. In all cases, this action is done to *culturally engineer* attitudes, beliefs, and responses so as to promote a smooth environment for further efforts. Idea spread applies to a wide range of activities, from, for example, general information gathering, to preparatory activities in advance of military action, to activities in a locale after military action.

Idea spread is not new and has caught the attention of the defense community (e.g., “military memetics” (Finkelstein 2008)). The Defense Advanced Research Projects Agency has initiated a seedling program on “Information Propagation, Impact, and Persistence,” focused to date on the scientific observation and measurement of physiological effects. The Air Force Cyberspace and Information Operations Study has an emphasis on influence operations. Decision-makers throughout security, military, and informational activity sectors are beginning to see that an appreciation of the culture of the adversary – as well as the sympathetic but, perhaps, skeptical – is a significant factor

---

1 The companion IDA Document D-3599, *Memetics – Overview and Baseline Models*, introduces and discusses more thoroughly various interpretations of the terminology *memetics*.

in actions. Thus, the *NY Times* (2007) has reported the use of anthropologists in more acceptable ways as the military continues its operations; these cultural specialists have become an essential part of US counterinsurgency methods.

Understood well and executed precisely and efficiently, idea spread has enormous potential as a quiet proactive and preemptive mechanism for laying the groundwork for future successful action, military or otherwise, in the relevant social situation. But doing so requires a clear sense of answers to at least the following basics:

- What ideas are spreadable, how, and by whom?
- How will these ideas be received and by whom?
- What might the consequences of such cultural engineering be for both the spreader and “spreadee”?
- Can we *predict* the effects of a proposed idea spread, not just explain or fit the effects to a model in retrodiction?

In short, can we develop a full research program that takes idea spread as a critical activity and work out both its theoretical and practical aspects?

B. ILLUSTRATION

Suppose we want to introduce into, and spread, the broad idea of Western democracy in a traditional, non-industrial society so as to promote a facilitating environment for other actions. How do we do this in the most effective way with the most foresight?

We should not bluntly introduce Western democracy as a ready-made bundle of ideas. Anthropology shows us that traditional societies are often politically organized analogous to the local family structure with the males in charge. Sometimes the males are surprisingly only nominally leading because traditional societies have complex background networks keyed to extended family relations, where the women are often the informational managers behind the scenes (Gallup 2006). So spreading the idea of *representative democracy* – with non-family members being the representatives of families – would fall on deaf ears. We could predict one thing in such a situation: the attempt would likely fail (compare to the failed attempts in Iraq in this exact style).

We would need to determine democracy's "spreadability." Perhaps Western democracy in a particular traditional society is best spread piecemeal: what we might see as a minor feature could be the best entry point for spread. We have to identify key entry points for the ideas – certain families? women in the background network? men used as ratifiers, not as agents of spread? – and predict uptake (learning) and distribution among the social and cultural networks. We have to have *from the outset* a sense of the long-term hold of the ideas, their maintenance, and their potential modification by the receiving culture: that is, we need a kind of topology of ideas so we can predict those aspects of engineered ideas that will be preserved under transformation. Most critically *we have to be able to know many of these things ahead of time* to plan the proper approach and strategy for *idea maintenance* after the idea spread. Only in rare, unsuccessful experimental cases does a scientist release an agent into a milieu without subsequent interventions to ensure the momentum of the agent (e.g., in biological experiments). Why should cultural engineering not also take these lessons to heart?

In this document, we identify a range of factors to consider in models of idea spread and discuss their relevance to working models and a research program broadly. It is important that we focus on a models not divorced from (real) time. Because rate of spread, for example, will be critical, any model of thought contagion should be sensitive to the temporal parameters involved. For example, models of historical dynamics show that among a populace, a sense of legitimacy – something essential to idea spread – unfolds at a rapid pace while broader and perhaps more structurally essential political and economic factors unfold in a society at a much slower rate (Turchin 2003). Thus we examine the available theories of dynamic modeling for our critical notions.

II. SIX KEY FACTORS IN A DYNAMIC MODEL OF IDEA SPREAD

A. TWO PROCESSES, TWO CURVES

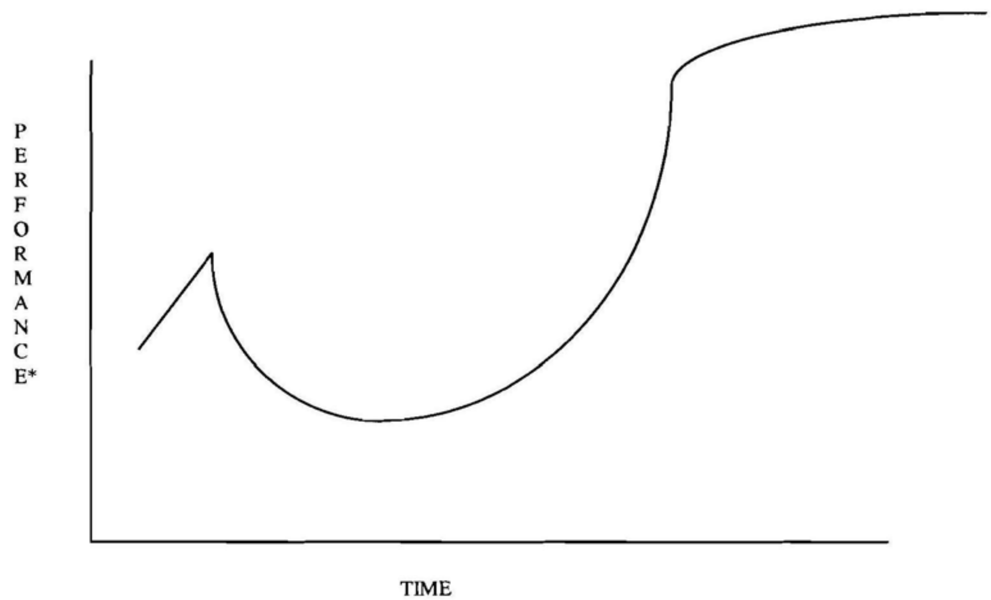
Broadly speaking, engineering idea spread involves two critical processes: *uptake of the input* ideas by the culture and *stability of the ideas, thoughts, and behavior as the output*. Idea spread is a relationship between incremental learning and long-term equilibrium. Much is known about both these processes – uptake and eventual stability. Moreover, since idea spread will take place essentially verbally, we can rely on what is largely known about the incremental learning of linguistic forms and the historical stability of newly introduced forms. After all, learning a language is a variety of idea spread: grammar can be thought of as contagion since everyone in the social group gets it, and it is spread in social networks person to person.[1] To learn new linguistic forms, you have to change your mind and others have to take up the change. It is also well known in linguistics that such changes "run by themselves" when they reach a critical level. All these observations suggest that lessons from work at the convergence of statistics, linguistics, anthropology, and cognitive science would yield much for the theory of idea spread.

1. U-Shaped Learning

Verbal learning, as well as many other sorts of learning, follows a well-known U-shaped curve (Pinker 1994, 1999). As depicted in Figure II-1, learning proceeds with rapid success at first, and falls off in accuracy precipitously; it then recovers and has extended, successful growth, and finally levels off.

---

1 Even though the ruling school of thought in linguistics solves the contagion problem with genetics (i.e., pre-spread ideas), the genetic program is quite narrowly circumscribed to core grammar: there is much in language that is not so determined and is spread via social networks (see, e.g., Culicover and Nowak 2003).



*Performance is measured in a continuous variable, such as probability of success.

Figure II-1. U-Shaped Learning Curve

The reasons for this U-shape are well known. A new form is basically memorized at first and can be used on its own with success. But as it begins to compete for cognitive space with other forms, it is analyzed for its pattern sensitivity, and becomes incorporated into the mental system. Success then falls off rapidly. Here is where real learning takes place because the form is now "in the mental system." Then, as the mental system analyzes and accommodates the new form, reorganization takes place in cognitive space, and success increases: successful growth proceeds markedly as the system regains efficient functionality. With the form fully incorporated, the system ultimately levels off.

As an illustration, consider the verb *go*. A child will initially use the proper past *went*. Then, as the form comes in contact with the rest of the system, he will say *wented*, *goed*, and other incorrect preterits. This is because the learner is analyzing the form and putting it into interaction with the other forms in the mental system. As the irregular *went* settles into the mental organization in its competition with other irregulars (*sang*, *brought*) and regulars (*liked*, *wanted*), success increases and does so rapidly. The child's grammar functionally separates regulars from irregulars (Pinker 1999), and once the mental-computational address of *went* is determined, success proceeds markedly, ultimately leveling off in "normal behavior."

The U-shape is fairly well understood. But note what it would mean for idea spread. If we introduce an idea uniformly and homogenously into a culture, it should first be taken up quickly and well. But we should then expect that its success will drop off. This result should not be a matter of concern, but be taken as natural. Such a point might even be an opportunity for productive intervention by a team specially trained in sustaining idea spread. At the point of drop-off, we could introduce certain critical notions to help the learners sort out the notion in their cognitive space. Then we could move the learning and exponential growth forward with additional assistance until the idea reaches stability.

What the U-shaped learning curve suggests is that cultural engineering can involve a combination of natural, individual learning processes and targeted "instructed learning," which has well known properties and methods. It also suggests that the process likely needs a maintenance contingent to intervene at certain points to push ideas and perhaps change the rate of learning, from solidifying success to combating drop-off. Moreover, a drop in evident success of idea spread is not necessarily to be seen as failure but as natural, presuming it occurs at the expected place in the learning cycle.

Figure II-2 suggests that, for idea spread, there would be certain key points in the uptake process where intervention and maintenance could occur.

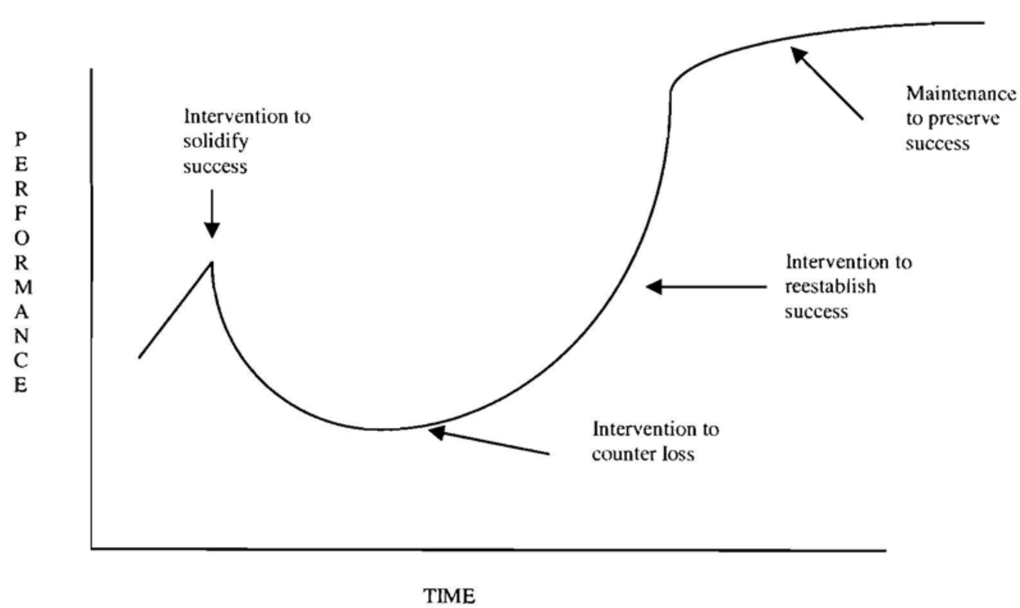


Figure II-2. Critical Places on U-Shaped Curve

It remains to be seen whether these observations and predictions play out in a full, real-world example. But simulations to test the observations would be revealing as an initial move.

2. S-Shaped Results

As an idea spreads, how does it manifest itself in terms of stability in the cultural system? Our goal, of course, is that the idea achieve wide distribution and rapid stability. There is much known about such stability for linguistic forms and other features. Insofar as idea spread must rely on language, the lessons of historical spread of new forms in language and their ultimate stability in use would provide insights to this problem for idea spread. Moreover, in studies of loyalty changes in the populace as an empire advances (Turchin 2003) – work directly related to the examination of idea spread since loyalty shift involves thought change along social networks – results similar to those for language emerge.

Kirby (1999), in his study of the statistical properties of languages under historical change, observes that there is a regular final patterning of a new form in a language. This is the S-shaped curve, or what is known in dynamic systems as a logistic curve. (See Figure II-3.) In such curves, there are rapid, early adopters of a form or idea, the rapid growth of new adopters, and then late adopters who level off.

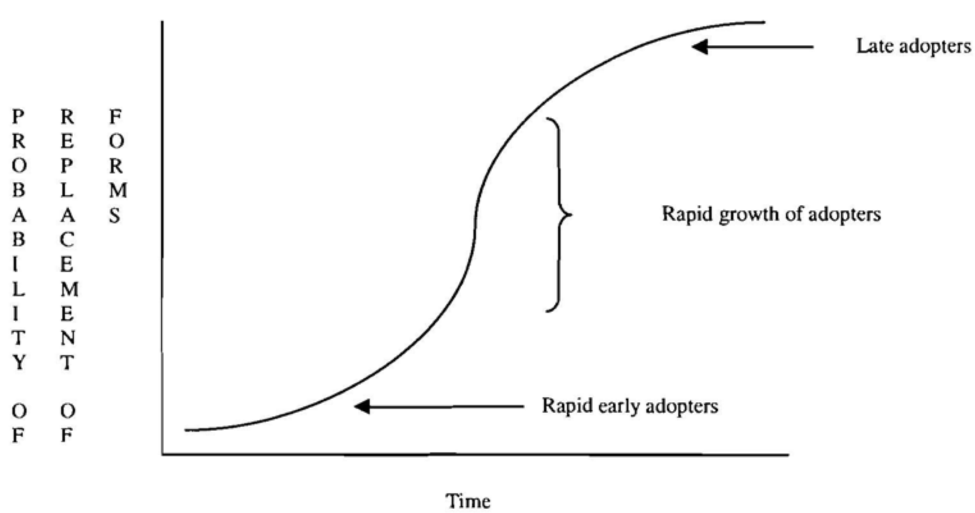


Figure II-3. S-Shaped (Logistical) Output Curve

There is significant evidence for the S-shaped curve in many kinds of groupwide changes. Kroch (1994) has found the pattern in his own studies of the spread of language changes. Shultz (2003: 173-94) finds the S-curve to be predominant in capturing the changes that happen in the stages of human bio-psychological development. Turchin (2003: 94-117) finds the S-curve when he models "ethnosocial change" in situations that pressure individuals to change commitments and loyalties – such as when polities advance in their territorial expansion and encounter new societies at their frontiers whose members must shift loyalties to the new polity and when there is significant religious conversion of peoples from one religion to another. Turchin (2003: 104) observes that the resultant changes are best captured by "S-shaped dynamics."[2] Niyogi (2006), in analyzing the formal structure of language and evolution, also observes the S-curve in language change. But Niyogi has another observation that would be worth pursuing: he says that the S-curve is an artifact of individual learning styles. His work might be a link between the two curves, U and S. (See also Bicchieri (1997), who argues on both game-theoretic and social psychological grounds for the relevance of individual processes in group behavior and for the role of small-group decisions in larger population-level accounts.) But perhaps the strongest argument for an S-curve is Rogers' (1994) work, which indicates that the pattern for the diffusion of all innovations is S-shaped. Thus, while the process of individual learning is U-shaped, the process of the spread of ideas – whether language, ethnosocial, or general cognitive – gets wide distribution and stability across a population.

S-shaped curves have a number of distinct properties that are relevant to our inquiry into idea spread (Turchin 2003). First, logistic curves are first-order differential models, or single-dimensional, and are of the form $X' = f(X)$, where X' is the rate of change of X, the state variable of the system (what unique state the system is in at a particular time): there is only one structural variable. Single-dimensional models have a number of limitations: for one, they cannot oscillate and so cannot exhibit even one rise and fall. This means that they are at the "low end" of dynamics, but it also means that they are more understandable because they are less complex. Second-order differential models, and higher orders, are generally the meat of dynamic theory because these models can exhibit periodicity, amplitude, and chaos. But these properties make the

---

[2] Turchin also observes that when polities fail, the pattern of their dissolution also follows the logistic curve. Thus we might predict that when our cultural engineering efforts fail, they will manifest the S-shape.

systems more complicated and harder to analyze for results. So the limits on S-curves turn out to be analytical advantages.

As first-order differential models, S-curves are sensitive to feedback in particular ways. For one, fast negative feedbacks cause the curve only to return to its equilibrium states. Negative feedback with delay, however, apparently can promote dynamism (Turchin 2003). Thus, the lesson for idea spread is that delayed intervention may be needed in order to preserve the upward growth of the system in its unstable center. These observations suggest, then, that interventions have to be carefully executed.

In addition, S-curves exhibit unique equilibrial properties. They are metsastable – that is, they can have more than one site of equilibrium,[3] and the S-curve has three. They are stable (because they have non-interactive data) on each end and unstable (because they have interactive data) in the middle. Metastability suggests a variety of intervention strategies for cultural engineering. As with interventions in U-shaped learning, we might also provide explicit, but delayed (per the feedback properties), maintenance at the point of exponential growth to ensure continued movement of the idea spread toward the high end asymptote and to manage the interaction of data in the middle equilibrium. Moreover, because the bounds are non-interactive, we might use this as a way of introducing memorizable or static ideas, those that can stand on their own and not get their power from interaction with other data.

Consider the difference between two culturally engineered ideas:

- The military is going to have a presence in a country for X years.
- The military will be patrolling the country in small groups.

The former is arguably a sheer fact and can be taken (perhaps not happily) as such. But the latter interacts with all sorts of indigenous cultural matters, such as the locales, the activities, the social structure, and so on. The logistic curve can accommodate both kinds of data.

Finally, S-curves are very sensitive to *initial conditions*. Because logistical models are autocatalytic, their growth is a function of the data points already in the model. Turchin (2003) finds this crucial in the S-curve accounting for religious conversion, for example. He observes that conversion is self-sustaining, but it is

---

[3] The term *equilibrium* is being used here in a non-technical sense, as "point of regularity." Perhaps it is best to appreciate this in dynamic terms – that there are three points of attraction, two of which are stable (each end) and one unstable (middle). See Turchin (2003: 12 ff.).

proportional to those already converted. Moreover, in a retrofit of the data, he observes that the pattern of conversion to Islam in Iran and Spain from the 7th to the 10th centuries also follows the S-shape. All but 3 percent of the data fit the logistic curve, unlike, say, a linear model, which misses some 23 percent of the variance (2003:108).

While all ideas spread via particular social groups, the crucial group to pick up an idea is children. When new language learners adopt the new form in their speech, the form achieves rapid spread and integration into to the language (Lightfoot 2006). In the S-curve, this is where the S has its sharp uptake. Mathematically, moreover, it is at that point that the curve allows *interaction of data* (Turchin 2003); at the bounds, there is non-interactive data. Children are the ones to change the language. Hence children should be the ones to change the idea structure in a cultural engineering effort. When they pick up an idea, they "nativize" it. Hence our efforts at idea spread might track how the idea spreads from its introduction into an adult network to the children of the network members. In the end, the use of the form stabilizes and the growth becomes asymptotic. When this is achieved, we can confidently say that the form – idea – has spread.

3. U-Shape to S-Shape

What is the relation of U-shaped learning to S-shaped output? That is, what is the relationship between the properties of learning systems for individuals and the properties of output systems for the populace? How do we get from individual learning to group results? Turchin (2003: 109) asks the question in another way: "what possible mechanisms may underlie the nonlinearity [of the S-shaped curve]"? There seem to be two general approaches here (though see also Niyogi 2006).

The first is to determine mathematically how U-shaped curves for individuals transform into S-shaped curves for groups. In this approach, we would be saying that the system of idea spread takes learning curves as input and transforms them into output curves. Essentially, this is a *black box theory* of idea spread. See Figure II-4.

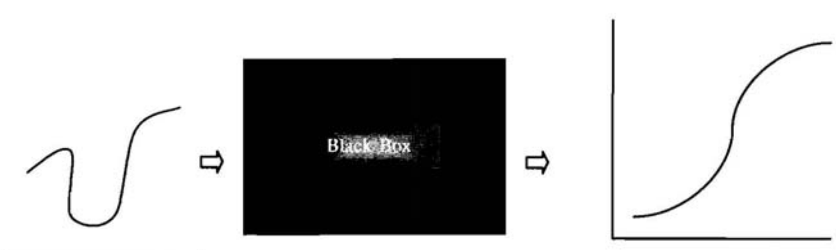


Figure II-4. Transformation of U-Curve into S-Curve

There are likely many ways to capture this transformation, assuming that there are regular processes inside the back box. Such an approach, however, assumes that idea spread is a relation between individual learning and group output mediated by other – largely unknown – processes. This may not be the best approach in the end for several reasons:

- It leaves the instruments of idea spread essentially unstated.
- It is not clear that the learning curve should actually be the input.
- It does not allow explicit statement of the culturally engineered ideas.

To include the above characteristics in the model, we have to turn to a different approach. Another way to capture the relation between learning and output is to say that the learning curve *is* the back box, which accepts pre-engineered ideas as input, transforms them according to the individual learning curve, and then outputs them into the group S-curve. This approach still requires that we transform the U-shape into an S-shape, but locates the processes differently as in Figure II-5

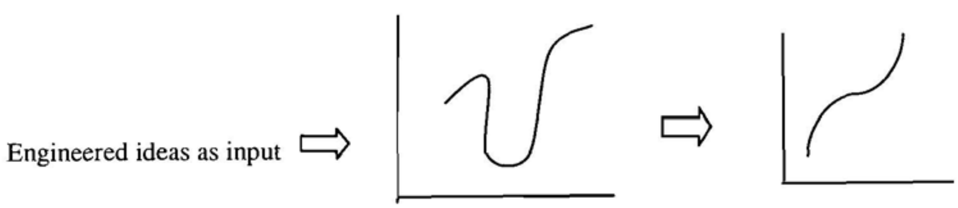


Figure II-5. U-Curve as Black Box

Note the advantages of this approach. We first of all continue to have the mathematics of the relationship between U and S. But whereas in the black box theory the U-curve is literally converted into the S-curve, here the transformations are of the data via the curve. Essentially, this is saying that individuals take ideas as input and learn them according to regular means and the output of multiple individual learning is a group S-curve. This requires a different kind of mathematical approach form the previous, and although mathematical processes may be different from those in the foregoing, the advantage is that we elucidate the black box.

The basic claim in this version of the U/S relationship is that the mechanism for reaching the final curve is the requirement that ideas to be spread have to *pass through the learning cycle as a kind of filter.* In simple terms, ideas have to be learned before they can be output, rather than subjecting learned objects to black-box processes.

Moreover, the model explicitly admits the pre-engineered ideas, and we can see how these factors are subjected to learning processes and how they emerge into the resultant pattern.

It would not be unreasonable to suppose that ideas are output from the learning curve at various points along the S-curve, given their contingencies after learning. Some ideas might be readily learned and so be located at the low-end equilibrium; others might be in the middle unstable region because they are still under processing for various reasons: difficulty, essentiality, competition with other ideas. Still others may be the latest adopted and fall on the high-end equilibrium. These effects would then suggest some further features of idea spread:

- The ideas to be engineered have degrees of acceptability and ought to be selected for such, i.e., not all ideas would achieve the same equilibrium.
- Some key ideas may be under continual processing.
- A full range of ideas to be spread would include all equilibria.

Just as with linguistic, ideological, and religious change, the landscape of engineered ideas appears to require the full curve, not just low-end equilibrium factors. That is, effective idea spread should exhibit natural properties: if not, the populace will eventually see the ideas as artificial. But after all, the robust model is a "full S," not just an asymptote.

In the end, the models that prove to be palatable will be the ones that yield useful results, i.e., tractable cultural engineering solutions that provide informative insights.[4] If Turchin (2003) is right, however, the place where individual U-shaped learning constitutes the black box ought to win out since this actually elucidates the mechanisms underlying the non-linear output curve. For the present, it is important to acknowledge two routes to the relation between learning and output curves.

---

4 Like computer science, cultural engineering might be best understood as a technology rather than a science. Idea spread might use the tools of science, but these do not constitute scientific inquiry themselves. For our purposes, a culturally engineered solution that is not quite "correct" is arguably more valuable than one that is true, but cannot be manipulated to desired ends.

B. ENDOGENOUS VS. EXOGENOUS FACTORS

1. Dynamic Systems

When we consider the kinds of systems we hope to instill by designing ideas and charting and managing their spread, we also have to consider the nature of the variables themselves. Dynamic systems split the variable field into two broad types: endogenous (or intrasystem) variables and exogenous (or extrasystem) variables.

Endogenous variables are factors whose identity and function are entirely within the system under inquiry and are not affected by outside forces. Some examples from a wide range of phenomena are, in their *normal cases*, such things as cell division, DNA recombination, assignment of data to an address in computer memory, learning of universal grammar in language acquisition, and addition. These processes might ordinarily be thought of as intrasystemic. We say *normal* because extrasystem factors could affect these phenomena: e.g., nuclear exposure could affect cell division and DNA. But this is not the typical case. In the usual case, cells divide and DNA recombines *in system-internal ways*. While enzymes may assist the process, enzymes themselves are endogenous. Thus what is needed to account for and model cell division and DNA recombination is a set of variables that remain wholly within these areas of molecular biology.

Consider also the assignment of items to computer memory. The machine's software and hardware do the assignment arbitrarily, putting the data to be stored wherever there is memory space. The computing principle of non-content addressable memory means that the machine does not "consult" factors outside of the machine to determine memory addresses – e.g., the content of what is to be stored. On the contrary, computers put things simply where there is space. Similar endogenous accounts can be given for core grammar (Pinker 1994), where the child makes decisions on universal items as a function of parameters within the biologically given universal grammar itself, not as a function of the external social world (though see Culicover and Nowak 2003 for a slightly different take). The process of addition does not need to reference to factors outside of mathematics to function. 7 + 5 = 12 is analytically true – decidable within the system itself. It is not as if certain 7s work with 5s to make 12, while 7s and 5s, influenced by what there are 7 or 5 of, do not add up to 12 when combined. Addition is autonomous and system-specific.

The foregoing illustrative factors are parts of *closed systems*, those that allow no influences from outside. In contrast, *exogenous variables* are factors that may influence a dynamic system *from without*, but are not affected themselves by any aspects of the system. They thus form part of *open systems*.

Examples of exogenous factors are easy to locate. Turchin (2003), for example, studies how population drop is affected by the physical landscape. The configuration of the land is exogenous with respect to population loss – and note that population drop does not affect the landforms in return. Similarly, many key historical and sociocultural factors are exogenous. For instance, the family as a system has both endogenous and exogenous factors: the latter can be seen in economic and political pressures that the family experiences as it persists as a structural unit. One would not say that a declining stock market is endogenous to the family, yet a declining stock market does affect the family as a unit. The sun is an exogenous factor in the production of Vitamin C in the body: the vitamin does not affect the sun in return. Some linguistic features, such as a bilingual individual's choice of language in a bilingual situation, are exogenously controlled as the speaker assesses the social milieu, not the linguistic system itself, to decide which language to speak.

While the endogenous/exogenous split is easy to grasp in principle, with ideal cases such as illustrated above, in practice the line between the two is not hard because a factor can be either exogenous or endogenous depending on the research questions asked and the system to be modeled. If our goal is to model content-addressable memory in computing, then storage and address become exogenous because they can be developed under parameters that have to take into account factors outside the machine proper (i.e., what the information to be stored is about, what it refers to in the world). Similarly, if our goal is to model the dynamics of family economics, then stock market shifts are internal to the model and different factors would be exogenous (e.g., political factors).

Surely, with these somewhat ready endogenous/exogenous shifts, one asks: *What good would these factors be in general, much less for our project of idea spread, if they can change with perspective?* This is a fair question, but the answer is that even with these shifts, the distinction remains. Moreover, whether a factor is endogenous or exogenous changes the dynamics of the system. Multiple exogenous factors could conflate results; factors that would seem at first blush to be outside the system might in fact be system internal. All these would affect the real-time operation of dynamic models.

A good example of this is in the study of dynamic models of language change, itself a version of idea spread. After all, when languages change over time, the speakers are modifying their conceptual structures and spreading these modifications throughout the social networks that constitute the linguistic community. Culicover and Nowak (2003) observe, in their dynamic modeling of West Germanic languages, that universally unattested word orders may not be ruled out because of the computational system of language (i.e., endogenous factors of the language system per se) but because they are *socially dispreferred* (i.e., exogenous factors). This view that non-appearing linguistic structures result from social organization rather than the formal learnability of the language contrasts with other views of language change that place these gaps in manifestation entirely within the system (Lightfoot 2006). But Culicover and Nowak cogently argue that the social network of users may avoid such word orders, whatever their possible status as intra-system outliers. The point here is that one man's exogeny can be another's endogeny, but this does not compromise the distinction: it makes it more interesting, in fact, because it retains the split but uses it in nuanced, theoretical ways.

How, then, does the endo-exo split affect idea spread? Suppose that we wanted to spread the idea that a local terrorist group is harmful to the local populace so as to have the populace drive out the cell. How should we conceive of this "idea battle"? We could take an entirely exogenous approach and pepper the local community with exogenous counter-ideas: the cell is contrary to the larger military action; the cell is not interested in you but hiding out among you; the cell acts in ways that put you at risk from outside factors; and so on. While this sort of idea spread might be effective, it impacts with a kind of blunt force. Such an action would quickly lead to asymptotic results, with a sharp initial growth of success, or even a loss, and then a rapid leveling off. This is not to say that such action and the attendant modeling are wrong or inappropriate, only that the choice of variables to introduce in designing ideas for cultural engineering affect the outcome and the predictions to be made. Perhaps from an assessment of the situation, the intelligence community must determine that such exogenous action is the right action at the present because it may yield quick success, and so is needed because of other factors. This is fair enough, but the lesson is simply that we need to be prepared for the results of an exogenously driven system.

In contrast, one might choose endogenous factors in the development of the counter-cell actions.[5] In this case, our "designer ideas" would capitalize on such things as the role of the cell in the local populace, the people involved and their relation to the

---

[5] See Epstein 2006 for arguments that wholly endogenous factors are most relevant to idea spread in simulations of organizations.

rest of the local populace, what they have been doing and the effects on local everyday life, and how these actions have been carried out to the detriment of the local cohesion. That is, an endogenous strategy would shift the focus to the factors that are proximal to, and constitutive of, those affected. Such a strategy might not yield immediate successes, precisely because local communities – especially traditional ones – are very circumscribed and often skilled at detecting and rebuffing outsiders (we are seeing this in Iraq and Afghanistan now). Nonetheless, with careful thought and judicious action, it might be possible to introduce ideas such as "the locals who are part of the cell – and they all know who is in the cell – have affected the family structure by taking young men and women off for violent action." This endogenous factor might be especially good to inculcate among a subgroup charged with family maintenance in the local populace.

Endogenous factors might be effective, but our guess is that they would not succeed at first since they would need time to incubate. But they would likely emerge in an S-shaped curve and take hold with exponential growth once they are adopted and compete with each other and other local ideas for cognitive and social space.

2. Correlations and Initial Bias

Thus far we have proceeded as if we had to choose exogenous or endogenous factors in isolation from one another. But this is a hazardous simplification. It is important to appreciate potential correlations across factors. Moreover, initial factor biases or weightings of factors might be operative in a given model and so would have to be built in to the modeling and analysis.

If the factors correlate, their interaction might cause any number of results. Exogenous factors could have a positive correlation with endogenous ones and so enhance fundamentally endogenously driven results, perhaps speeding up adoption and the dominance of socio-cognitive space. But they might also be negatively correlated and so the exogenous factors would temper the endogenous ones and slow down adoption or even block it. Or they might even be independent and thus constitute a kind of double-barreled approach.

The importance of knowing the correlation properties of the factors introduced can be seen in the following. Suppose in the aforementioned situation the strategy for idea spread is to introduce the exogenous idea that the terrorist cell brings outside risk to the local populace and the endogenous factor that the cell affects local family structure by breaking it up. These two ideas together could in principle form a powerful one-two punch, showing that the outside risk really lies in the dissolution of a local social institution. It would thus be up to the cultural engineers to manipulate the informational environment accordingly. In this activity, a simulation would be needed beforehand to predict areas of success and challenge, but the lesson remains that the correlation between external risk and local dissolution of a fundamental structure would likely provide and effective strategy for idea spread.

Such a simulation is behind Cuilcover and Nowak's (2003: 215ff.) dynamic modeling of language change and the correlation of factors therein. Not only has their work shown there are factors that may begin the idea spread as correlated – e.g., the relation between subject pronouns and verb structure – but it has also shown that forms that are independent initially can become *correlated as the process of idea spread unfolds*. Citing socio-cultural work by Abelson (1979) and others, plus mathematical work by Latané (1996), they argue that when ideas that are otherwise independent are spread by the same social network, independent ideas become correlated from this coherence of social attitude. For example, Subject-Object-Verb languages tend to have pre-sentential markers as whole-clause modifiers. This semi-arbitrary tendency emerges as the language system changes, not as a property of the computational system itself. Similar remarks hold for other implicational universals. We are thus left with a kind of guilt by association: when social attitudes (one of which is language) that are otherwise unrelated are transmitted instead by an entire group, the attitudes come to be related to each other.

In a sense, Culicover and Nowak have identified a kind of exogenous correlation: two variables come to be associated because of external factors. The importance of this observation, however, is that it shows that the process of idea spread is more nuanced than the simple introduction of designed ideas. Success may ride on how the ideas associate, temper, or advance other ideas, form a system with one another or ideas not originally associated at all (see section on ontologies), or even be forced to correlate through selective interventions. Cultural engineering thus needs control structures and a sense that idea technologies require specifications, blueprints, and pre-implementation modeling as well as oversight in operation.

In a similar vein, we should observe that ideas may come to the engineering situation readied for a task. That is, they may have initial, intrinsic biases or weightings. It is important to note any initial factors because these biases will push certain data convergences over time. Moreover, it is well known that S-curves for output states are sensitive to initial conditions. Thus, we should be prepared to vet thoroughly any ideas we seek to design or modify. For example, in a Muslim society, the idea that women should vote likely has a negative initial bias. But the idea that men might be the ratifiers of a change in a locale would have a positive initial bias. Now these two ideas are correlated from the start: they both talk about change of view and ratification. We might ask: *Do their initial biases neutralize their effects, promote one over the other, or in some way un-level the playing field? Should they be introduced together since they correlate from the start?* These are questions that can be answered only by a team of experts who know the cultural landscape and the intelligence context.

In the end, the systematic spread of ideas must take into account both intrasystemic and extrasystemic factors and the initial or emergent relationships of engineered ideas to one another and to existing ideas in the system to be manipulated. This is a demanding task that requires that we plan carefully and simulate before implementing.

C. SPEED OF SPREAD

Another factor we need to keep in mind when engineering ideas is the speed at which the ideas spread. While there are many studies of rates of learning in general, it is not clear that there is any systematic work on memetic rate, although there are some interesting findings on cultural change that have been done in a rigorous fashion. Some are not so heartening: Soltis et al. (1995) studied norm change in New Guinea and observed that spread of a new norm took about a millennium. Thus in at least some cases, the rate of spread is quite slow. Still other work shows more rapid adoption if the conditions are right. These latter findings are launch points for an analysis of the time course of idea spread and provide the basis for examining three factors involved in the speed of idea change:

- Actual time vs. rate.
- Adoption and visible payoff.
- Rapid, yet effective, change.

1. Actual Time vs. Rate

We must first distinguish between the actual time frame in which idea change takes place and the rate at which it does so. The time course of cultural and linguistic change can be centuries (Soltis et al. 1995, Turchin 2003, Kirby 199, Culicover and

Nowak 2003); the time course of conceptual change can be moments. Where in this vast spread between moment and century does the time course of engineered ideas fall?

In the end, this is an empirical question, but it is complicated by the fact that the circumstances of idea spread may range themselves from urgent to long-term. Still, it does seem, intuitively at least, that in a cultural engineering context, the ideas to be spread would have a somewhat narrow window for adoption. After all, the purpose of manipulated idea spread is to effect the change within a time period that will advance other goals, and governments do not think, as a rule, in terms of the 100-year window of change.

Alternatively, there may be waves of ideas, with some targeted for rapid adoption, coming in one after the other, and others targeted for long-term maintenance. This at least is an excellent strategy for organizational change, and a culture, as a macro-organization, might be approached in this manner (Shaffer and Ashkenaz 2005). There is also the fact that any kind of cultural change needs to reach only a critical point after which the ideas become self-propagating and hence achieve pervasiveness on their own. Studies of literacy programs, for example, reveal that the social engineering of reading and writing need affect only a portion of the populace before literacy takes off and spreads without external intervention or influence.

We are not aware of a study of any of the foregoing conditions for idea spread generally. Thus a robust research program remains ahead to determine the real-time course of idea change. Pilot experimental studies and simulations would be extremely valuable in this regard.

In addition to the real-time measure, idea spread should be evaluated for rate. How fast do ideas spread within the real-time parameters, whatever the actual time course? This is a question about the slope and the shape of the S-curve or any other output curve.

We can idealize this process by using some notions from control theory, the study of real-time systems and their monitoring processes. In the ideal case, the introduction of an idea into a culture involves engineered ideas that are inserted and play an immediate role in the culture. That is, because of the efforts of cultural engineers, an idea that was not in the culture is suddenly there: the issue is how to control it and determine its rate of spread as a consequence of its introduction. Such a situation is remarkably similar to what in control theory is known as a *step input* (Jagaczinski and Flack 2003: 27ff.).

The step is an instantaneous result: in Figure II-6, we see that there is no time lag between zero and total success. An example might be the turning on of a light switch connected to a series of fluorescent lights. The actual flipping of the switch is a step input because this immediate change then generates various outputs (lights going on). These outputs have well known rates of appearance – *lags*, which are the "gradual approach to a steady state following a step input" (Jagaczinski and Flack 2002: 29). Lags are a function of feedback and forward loops – technically, the integral of error.

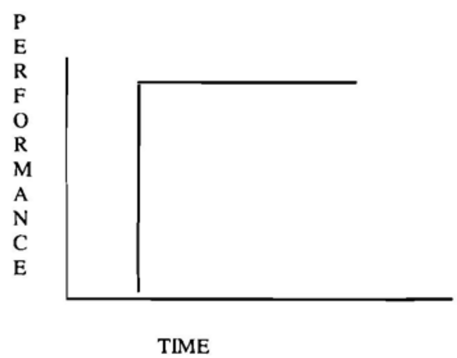


Figure II-6. Step Input in a Control System

What is important about this idealization is that we know much about the time course of change from step inputs: "first order lag predicts time history" of output (Jagaczinski and Flach 2002: 31). More specifically, in one unit of time (as defined within the system under examination), and knowing the gain factor from the integral of error, we will see that the first-order output from step input will achieve 63 percent of its steady state. This is an important result because it means that we can introduce ideas quickly and achieve 2/3 stability quickly – if we know the error and gain from forward loops.[6]

Additional orders of lag can be determined, depending on how many levels of error there are for feedback. But the important point here is that one does not have to go on a hunch about the actual time course of an idea on the basis of history and intuitions – *Voting rights for women? That should take 3 months*. It appears that it might be possible to calculate a time course and simulate the spread in a laboratory. And if we can get 2/3

6 It must be acknowledged that these results have been shown for motor behavior in humans. It is not clear whether they can generalize to idea spread, but, prima facie, there seems to be no reason to preclude the analogy.

of the stability of the system from the first time unit of spread, then we know we can introduce ideas rapidly to a proportion that might then allow them to spread on their own.

2. Rapid, yet Effective, Change

How can we engineer quick change plus ensure its effectiveness? We could certainly pepper the community with ideas and induce some step-like change, but these ideas would likely not persist in the ways we desire. How do we manage the tradeoff between the need for rapid change and the need for long-term hold in the populace? In some cases, there will be no tradeoff, but these will likely be few. Research on the spread of norms, the restructuring of ideas, and the benefits of idea interactions suggests some strategies and approaches for further studies.

Boyd and Richerson (2002) observe that from the standpoint of group selection in sociobiology, beneficial norms can spread rapidly when certain conditions are met, namely if:

- The adopting group sees that the payoff of adopting is highly visible.
- The initial group in which the spread occurs is small.
- Neighboring groups to whom the norm is to be spread intersect with the initial group in an optimal way.

As to the first, it is important that any advantage that might accrue to adopting a norm be explicit and demonstrable. This seems obvious: why should there be multiple adoption of an uncertain idea? Doing so would be to ask the adopters also to accept risk, thus violating well-established, game theoretic explanations. As to the second, there is obvious advantage in limited network involvement simply from the standpoint of quantity – and the possibility of interference or change of the idea as it spreads through a large network increases as the network itself increases (the truth about networks may be more complex than this: density, not size, may matter – see the material on landing sites). Third, and perhaps most crucially, the initial group and the next group to adopt and hence propagate the idea must overlap in part – a phenomenon Boyd and Richerson call *mixing* – and do so optimally: not too much, not too little. What is the optimal mix?

Boyd and Richerson (2002) have something to say on this matter of mix, and they formalize the interactions between the idea-holding group and the adopters. Certainly their formulas will be very useful, especially since they allow for non-optimal adoption by members of the adopting group who, depending on their individual choices, might take a more conservative tack. But overall, the difficulty with the Boyd and Richerson answer to the mixing question is as follows: *what numbers do we put into the formulas?* Here we need some *field memetics* to tell us the value ranges for adoption choice, group size, and so forth.

Still, there appear to be two important features of Boyd and Richerson's notion of optimal mixing. First, the differences between the two groups are not enforced, and, thus, the adopters do not experience barriers to norm spread. This is another way of saying that the transaction costs between the two groups are quite low (see Young 1996) and so the groups can afford to mix. Second, members of the adopting group imitate the successes of the initial group. Thus, the adopting group functions as kind of a thoughtless user of a neighbor's triumphs in the context of easy commerce between the two groups.

While this approach may be appropriate in the ideal, in actual fact the situation of adoption is much more complicated. No matter how thoughtlessly imitative, the adopting group will have a history that pressures for and against adoption (Young 1996) and will be located at what we later will refer to as *the frontier* (see the following section), where competition and individual, not group, computation hold sway. That is, there is no mindless imitation at the frontier (Epstein 2006: 236). Furthermore, the Boyd and Richerson parameters interact: for example, thoughtless adoption is a function of mixing and mixing is a function of the size of the group.

Even with these challenges, however, at least the Boyd and Richerson model, for all its drawbacks, lays out some of the essential parameters. To summarize their view of rate and effective adoption: explicit benefit in small optimally interactive groups where there is no punishment for difference will lead to rapid norm spread.

If Boyd and Richerson are correct, then to determine rate of idea spread we should limit our focus to certain ideas and to certain social networks. There are separate sections in the present report on each of these activities, so we leave further discussion of the rapidity of norm spread to those inquiries. But we do note that if we could quantify the visible benefit, the optimal group size, and mix – if we could assign values to the variables in the Boyd and Richerson formulas – we could make some predictions about where and how to engineer ideas.

A second factor in the rapid and effective change of ideas is restructuring of the conceptual network into which a new idea is inserted for spread. While we will again look at this idea in detail in another section, it is worth observing here that rapidity of change and hence knowledge about rate of spread may come not from idea trading –

mere passing an idea from one group to another, as Boyd and Richerson (2002) argue – but from the internal restructuring of ideas in the encounter with a new idea. Idea trading by itself may have large transaction costs: note that Boyd and Richerson eliminate this variable by having easy commerce between groups. But the time course of idea spread might be via measured inside the group adopting the ideas and might focus on the ways in which the group's conceptual restructuring occurs. This would be a kind of idea spread via collateral activities, whether benefit or damage.

Epstein (2006) has made progress in simulating this matter of trading. He modeled organizational adaptation and examined the role of endogenous factors in structural change. He notes: "individual agents endogenously generate internal organizational structures that adapt optimally to dynamic environments" (2006: 309). In particular he showed that when there is a need for human capital reallocation, there are two possibilities: trade capital from one subgroup of the organization to another, or rehierarchize groups on their own. Epstein finds, overall, that rehierarchization (i.e., conceptual restructuring) functions more effectively than mere trading and, more to our immediate purposes, that *trading is slower than rehierarchization*, at least in intelligent simulations (2006: 323). These findings are not only traceable to transaction costs but to properties of an organization in general. Trading of capital requires local decisions and hence territorialism, unlike rehierarchization, which can be done by executive order.

Now, let us make the following assumption: the structure of society is a macro-version of the structure of an organization. Ideas are part of the organzation's capital and function as units in a network of conceptual information just as personnel function as nodes in the network of human capital in a firm. In other words, the structure of organizations reflects the structure of society (e.g., this is well known and axiomatic, especially in cross-cultural work on business). Thus, when we change ideas, we may have two broad strategies with respect to the network structure: merely trade ideas across subnetworks, as Boyd and Richerson have argued above, and rehierarchize inside the networks (or both).[7] If we choose the latter, according to Epstein's work, the rate of change is more rapid. But it brings with it certain commitments. Let us look at an example.

Suppose that for some reason, we would like the US populace to better grasp the attitudes of those who promulgated the 9/11 atrocities. That is, we want to spread the

---

7 We assume that there is equivalence between ideas as nodes in conceptual networks and personnel as nodes in human capital networks.

idea of the characteristics of those who support the 9/11 attacks. As recent Gallup (2006) inquiries show, there is a widespread belief in the US that 9/11 was carried out by fanatics who held great religiosity and were relatively impoverished: i.e., poor religious extremists. We might capture this belief in an *ontology* (a network or labeled nodes connected by labeled, directed graphs). In the diagram below, which is a very small portion of what would normally be a much larger diagram, the concepts are nodes in the network and are bordered; their relationships are indicated in capitals and are taken from the received set of conceptual linkages that relational modelers use (Evens 1988).

Figure II-7 is to be read as follows: terrorists *cause* 9/11 *and* terrorists *have* the properties of poverty and extreme religion. While this network represents (a very small part of the knowledge structure surrounding) received views of the 9/11 terrorists, in point of fact, it is wrong: those who caused 9/11 held rather different beliefs from what the US has assumed. From a survey of radicals and moderates in the Mideast, Gallup concludes (2006: 2):

> The two groups had no statistical difference in religiosity as measured by the frequency of religious service attendance and the affirmation that religion is an important part of their daily life. In addition, political radicals were, on average, *more* educated and *more* affluent than the moderate masses, signaling that the root cause of extremism may not be about a manipulation of the ignorant by religious superstition or promises of economic assistance. What was different, however, was the political radicals' sense of being dominated, even occupied by the West – an unfulfilled desire for self-determination.

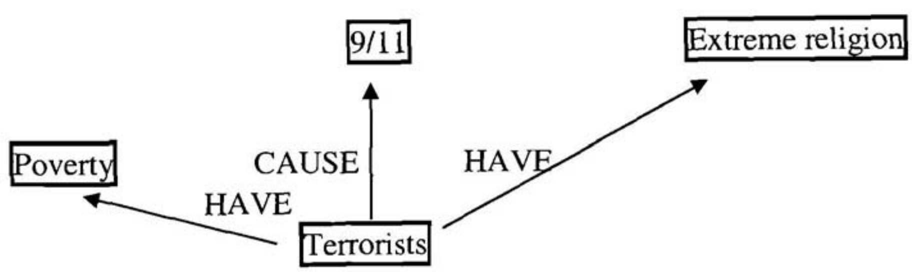


Figure II-7. Small Ontology for *Terrorist*

How do we represent the foregoing? Or, more to our task, how do we get from Figure II-7 to one that is more accurate with respect to the Gallup results?

The ontology must be restructured to include modest religious beliefs, that the inculcators were from the middle and upper classes, and that they were driven by the belief that the West was controlling the Middle East. How do we change the operative ontology in Figure II-7 so as to promulgate idea spread? There are two broad ways.

First, we might simply engineer the insertion of the new ideas and then manipulate the Boyd/Richerson parameters to ensure that there is visible payoff visible to neighboring networks, and hence provoke idea trading across neighboring groups as those groups see that the idea is worth having (the top figure below is an intermediate stage where the ontology sustains contradictory ideas; it will be reorganized for coherence subsequently):

In Figure II-8, the notations are self-evident except for PAT, which means *patient* or undergoer of the event: hence the terrorists are the undergoers – *PATients* – of Western control. But it is clear from Figure II-8 that already the transaction costs are high. The initiating network must first incorporate contradictory beliefs, not exactly the kind of thing that networks sustain. What relationship do "poverty" and "middle class" now bear to each other? Moreover, these new ideas have to be imbued with explicit return and thus imitated by the receiving network. While such a situation is not impossible, it is unclear how this all will happen.

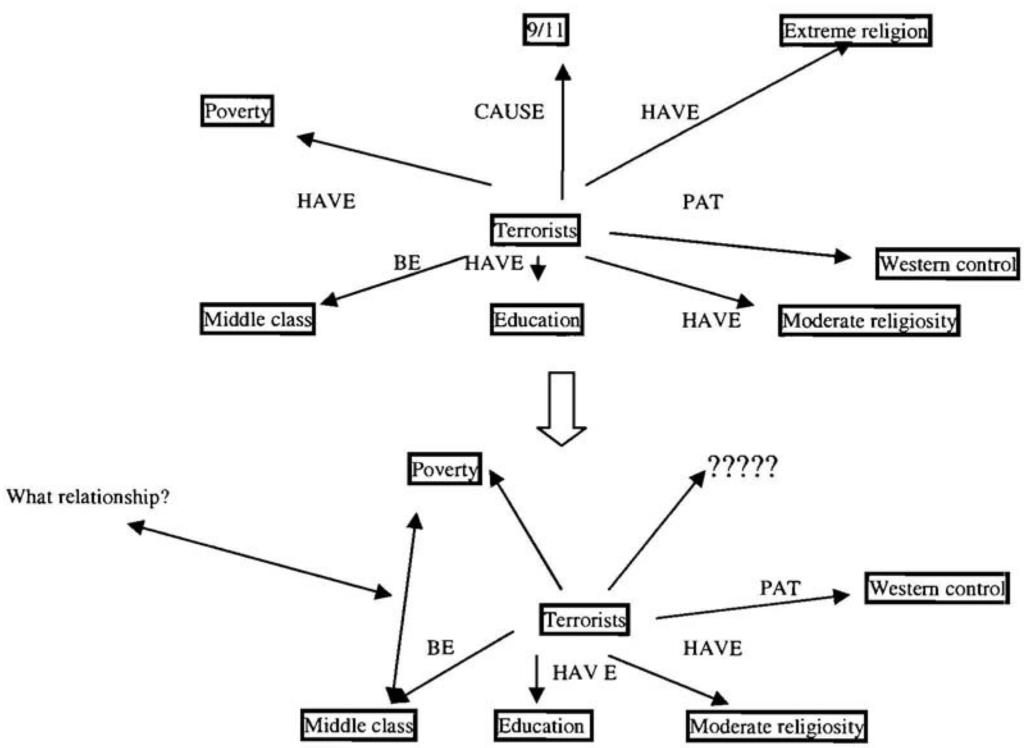


Figure II-8. Idea Trading from one Network to Another

The second way is to integrate the new ideas into the original network – and create a new, restructured ontology – and then let the spread go from there, as a kind of collateral benefit.

What is most apparent from these changes is that the ontology has undergone radical reorganization. These changes are not just additive – with new ideas simply inserted – but pervasive. The core concept, "terrorists," no longer *causes* 9/11 but is the *agent* (AGT) of it. The *cause* now lies in "Western control." Moreover, the ideas that once held direct attributive relation to the core concept are, now, *caused by* education and those concepts are seen in opposition (*ANTonym*) to formerly held attributes of extreme religion and poverty.

Restructuring is more complex on its face than idea trading, and it likely has more upfront costs, but what is does is to reset the ontology and make it more accurate and hence more amenable to visible payoff. Idea trading is kludgy while restructuring is subtle. What is the best strategy?

If speed is what is wanted, restructuring is the way to go, according to Epstein. It would seem, in any case, that this restructuring is an obligatory phase in idea trading itself. That is, there may be no such thing as bare idea trading. It may be that cultural engineering has to restructure the ontologies first and then trigger idea trades. But this is in the end an empirical question. This result would affect the rate of spread, but it would also allow rapid restructuring of ideas in key networks to begin with.

This discussion of ontologies and idea spread from and by of these networks raises four more issues that deserve serious research under the aegis of rate and effectiveness. First, some ideas may have intrinsic times and rates and come with initial time-weightings. Turchin (2003), e.g., argues that "legitimacy" spreads rapidly through a population because an idea can be accepted before it is fully understood. This is an important fact to know because it would give cultural engineers leeway to work on filling out already accepted ideas. As we have previously remarked, norm change could take millennia. Thus an attempt to change a rule of behavior might be tempered with caution about the time course of payoff. What we might do in the future is inventory ideas to be engineered to see if we can determine any intrinsic time courses they may have: some ideas may just be implementable in the short term, while others may survive only over the long term, with varying degrees of implementability in between.

Second, any idea spread and rate thereof depends on the properties of the receiving network. In particular, what is the carrying capacity of a receiving network?

We will look at this idea in a later section, but for now it is important to raise it as part of the discussion of rates and effectiveness. If a neighboring network, for example, is to expand along the lines of a restructured initiating network (as in Figure II-9), then we have to ask about the representational capacities of that receiving network. In principle, all networks are infinite, but in practice, ontologies are activated only in relevant parts. What is the maximum activatable part of ontology with respect to speed of idea spread? The answer to this question is not known, nor has the question even been asked before.

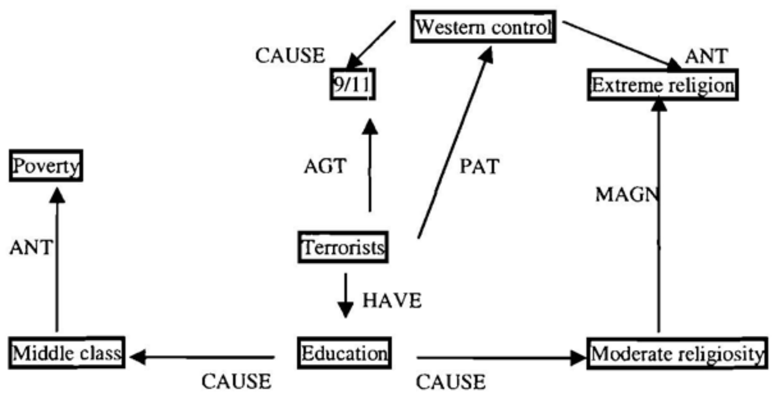


Figure II-9. Restructured Ontology

Third, we need to judge the tradeoff between small changes and big effects. What is the minimum change needed to implement a large idea change? The answer to this is unknown at present, but it is the right question to ask. Dynamic systems are known for their small change/large effect characteristics, and we would want to try to inventory kinds of optimal, minimum changes that might allow networks to take up the spread on their own. In Figure II-9, we introduced three conceptual changes, but these induced a dozen other changes in the network. How do small changes produce such large effects, and can we predict and manage these small/large tradeoffs?

Fourth, there is the notion of idea competition. While we can effect rapid change by simply inserting ideas into ontologies, we have no guarantee of the sustainability of the change: for ideas to persist, they must enter into competition with other ideas. But this slows down the rate of change. So what is the tradeoff between success and time? Again, the answer to this research question remains open because the question has never been asked.

D. TERRITORY GAIN AND FRONTIERS

Those who study quantitatively how polities advance (e.g., Turchin 2003, Epstein 2006) have observed the ways and means by which societies spread by territory gain. Growth and empire are positive factors, if inevitable in any state, since they enhance the position of polities, promote stabilization as the polity grows, and allow for the spread of values and norms outward on the frontier of growth. Indeed, few polities have not advanced over the course of history and when they have not, they have generally dissolved or been absorbed by advancing states. Although formal models predict dissolution of the state as it grows and overreaches, empirical observation suggests this is not what really happens. Usually hidden factors hold the expansion together, such as exogenous variables not accounted for in the model or endogenous factors that might arise as polity expansion proceeds. Thus, we see that spread, at least for polities, can mean "territory capture."

Moreover, in polity growth, the *frontier*, where one polity meets another, plays a crucial, dynamic role. At the frontier, what typically happens is substantial interaction, perhaps even adversarial, as two polities negotiate the ground of their respective advances. A number of factors come into play at the frontier:

- Group beneficial actions on each side of the frontier which have been part and parcel of the polity's solidarity give way to more individual computation (Epstein 2006) because the group as a whole is being challenged.
- The advancing group is "pressing at the subsistence limit" (Turchin 2002: 52); hence intragroup competition may arise.
- The boundary is both destructive and constructive: it will be the site of clash but also the site of resolution through competition.

The issue for idea spread then becomes: how can we use the lessons of quantitative history directly in the general project of mapping, predicting, and effecting idea spread? We have seen the benefits of using some of these ideas in the foregoing, but here we have a straight on and full test of the analogy. While idea spread is like quantitative history in sharing the S-curve or in matters of rate estimation and actual time course, can we now take the idea of territory gain part and parcel into the project of cultural engineering?

As an idea propagates, it restructures individuals' ontologies and arguably the ontologies and norms of the others in the groups to which these individuals belong. We would argue that we can chart the territorial advance of this kind of idea gain and map and predict ontological change and expansion. There is certainly "conceptual network gain" in the ontology in Figure II-9. And there is certainly something like conceptual territory gain as idea trading and norm advance (Young 1996) occur. The conceptual landscape thus becomes territory and gain is a measure of success. Cultural engineering is a kind of empire building, where more is better.

To follow through on the empire analogy, however, cultural engineering will also be subject to the same pressures on dissolution and challenge as any empire is. We will need to look at how ideas gain "cognitive and social territory," whether they can overspread, how hidden exogenous factors might hold spreading ideas in place, and the idea frontier. So the extent and stability change among the populace as the network empire advances must be made explicit and measured, as must the interactions at the "idea DMZ," where individual computation overtakes group computation. How do we do this?

1. Measuring Conceptual Territory Gain

As said in the previous section, idea spread would seem to involve two basic processes:

- *Idea change*: the restructuring of ontologies to make ideas to be spread or restructuring of those which are in receipt of ideas that have been spread.
- *Idea trade*: the spread itself and the restructuring of ontologies as a result, either at the front end from engineered introduction of an idea or at the back end on the receiving side from an already restructured ontology.

The second process – determining if and how restructured ontologies actually propagate, and hence the specification of a measure of idea trade – is a much harder problem than the first (it requires simulation, e.g., even to begin to be unpacked). We have only a limited amount to say about this here and leave it to further research. We concentrate only on ontological restructuring.

There would seem to be three major factors at play in the task of capturing in explicit ways the conceptual gains (losses) in ontological restructuring:

- Determination of the kinds of changes that occur in ontology modification and quantification thereof.
- Determination of the actual node and relation changes and quantification thereof.
- Appropriate sampling to test the foregoing.

When an ontology changes, whether via internal re-hierarchization or from inheriting information in an idea trade and spread, four classes of change can occur:

- Nodes and relations can be eliminated.
- Nodes and relations can be rewritten but stay within the same conceptual field.
- Nodes and relations can be radically rewritten.
- Nodes and relations can be added.

Of course, nodes and relations can stay the same, but this is a distinction without a difference.

To begin to use the categories as the basis of measurement of idea spread, we can put these on a scale of effect. The least consequential is rewriting within the same conceptual field. When a relation is changed, for example, from CAUSE to AGENT, the modification is simply a narrowing of scope within the same conceptual field because agents are the enactors of causing. In the same vein, when a relationship changes to its opposite, the introduction of ANTONYMY is a change within the same conceptual field: no two items can be opposites unless they share a property or coincide in some way. *Life* is the opposite of *death* and vice versa on the property of living. *Up* is the opposite of *down* on the scale of verticality; and so on. Opposites are thus not as radical a change as some others might be.

Rewriting nodes and relations radically – outside the conceptual field – is the next most consequential. This process leaves the formal structure in place but re-labels it. It does not induce formal gain or loss – no territory as such is gained – but it does change the navigation. Thus a relation change such as a shift from CAUSE to MAGN (increase), which would mean a shift from active causal relations to growth and attributivization, would seem to be a radical rewrite.

The two most consequential changes are elimination and adding. These affect the quantitative structure of the ontology itself. Cutting nodes and relations lessens the conceptual territory, and while it might seem to be a counter to the idea that gain is all there is in the advance of ontological empire, the elimination of nodes can be an important strategy because it makes space for new nodes, revises the ontology for accuracy, and keeps the ontology within manageable proportions. In short, idea spread, like territory spread, is not just acquisition.

Similarly, adding nodes and relations is a significant move. For obvious reasons, increasing the network constitutes territory gain. But we might want to consider, as we investigate these measures more closely, the tradeoffs between loss and gain. There might be a separate measure of the difference between loss and gain, and perhaps there is an ideal target for cultural engineering in this regard. This matter remains to be investigated.

These foregoing kinds of changes to ontologies can be assigned values. For the time being, we can quantify these simply, as follows:[8]

- Rewrite within same conceptual field = 1.
- Radical rewrite = 2.
- Eliminate = 3.
- Add new = 4.

Assigning these values to changes would yield an index of conceptual territory gain. Let us see how this quantification fares with our previous examples, reproduced below.

The top ontology in Figure II-10 is the same as Figure II-7 and provides the baseline ontology; the lower ontology is the same as Figure II-9 and provides the output ontology.

In the movement from the small network that captures the original belief system to the newly engineered one that tempers the beliefs and makes the ontology more accurate, there are four node changes and eleven relation changes. These are listed in Table II-1 by kind and numerical assignment.

The value of the changes induced in the original ontology is 55, and the average change in a value is 3.7. It is not clear at present whether these are large numbers or small ones, though they look to be high, especially considering that the mode is 4 and the range is 3. But these changes may appear high from the initial conditions: we began with a small network and added, increasing its size. A more empirically accurate initial point, where the ontology likely already contained such things as "Western control," would

---

8 It is not clear whether we should make a distinction between nodes and relations in the assignment of values. For the time being, we would keep them equal, but a case could be made for nodes carrying more weight than relations: without a new node you do not need a new relation, so relations depend on nodes, but, perhaps, not vice versa. It is also not entirely clear if we should differentiate by value elimination from addition: arguably the zeroing of information is as critical as the increase, but since we are seeking a measure of territory gain, we differentiate them by 1, assigning loss a lower value.

have resulted in a lower number. Thus we need to see the above as illustrative rather than definitive.

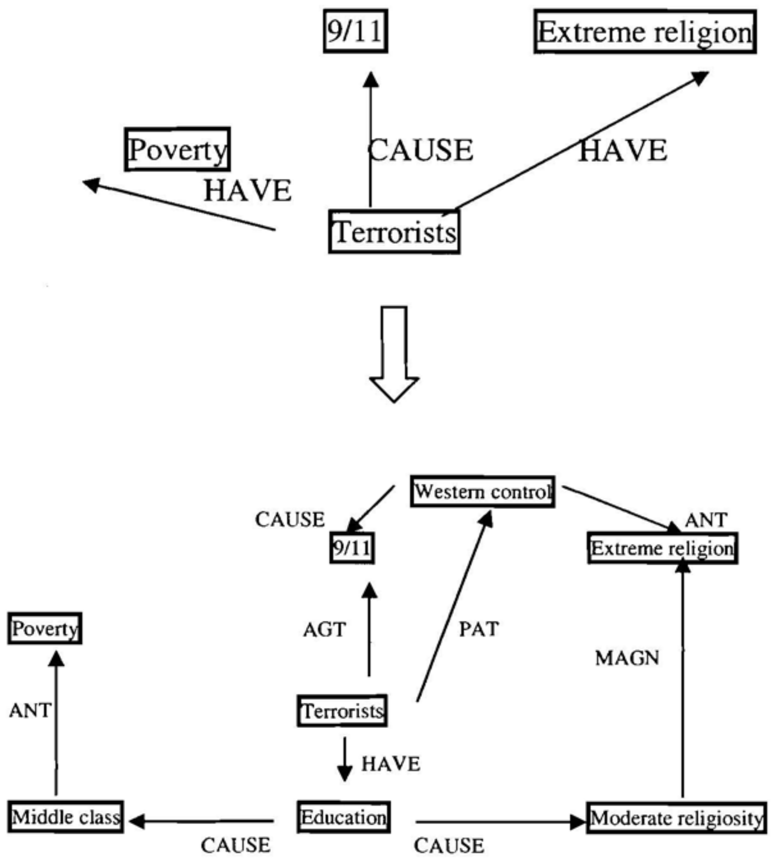


Figure II-10. Ontological Changes After Idea Spread

Table II-1. Summary of Changes in Ontology

Part of Ontology	Kind of Change	Value	Comment
NODE			
Middle class	Add new	4	"Middle class" has been added to function as the opposite of "poverty."
Education	Add new	4	"Education" has been added as a brand new node and it is unrelated to any existing nodes.

Part of Ontology	Kind of Change	Value	Comment
Moderate religiosity	Add new	4	“Moderate religiosity” is added as a new node and will be related to “Extreme religiosity” as a lesser version, but it is a new node.
Western control	Add new	4	”Western control” has been added.
Relations			
CAUSE (3)	Add new	12	Three new instances of CAUSE appear, two in the relation of “Education” to its neighbors and one in the relation of “Western control” to “9/11.”
PATIENT	Add new	4	“Terrorists” is related to “Western control” via Patient, or undergoing.
MAGNIFY	Add new	4	“Extreme religiosity” and “Moderate religion” are now linked by the relation of magnification, which scales one idea into another.
ANTONYMY (2)	Add new	8	“Middle class” and “Poverty” are related in a new way, not via a modification of an existing node, and “Western control” has been added as an opposite of a newly an existing node, “Extreme religiosity,” so the instances of ANTONYMY are additions.
HAVE (2)	Elimination	6	Two instances of HAVE have been eliminated; “Terrorists” now links indirectly to its former linked nodes.
HAVE	Add new	4	“Terrorists” now HAVE “Education.”
AGENT	Rewrite in similar conceptual field	1	The connection between “Terrorists” and “9/11” has been modified from CAUSED to AGENT and so merely narrows the scope.
TOTALS		55	

What is clear, however, is that we can quantify the gains. Moreover, it is also clear that we have made, in the end, some rather limited changes in terms of ontological modification: the semantic net has not been that much radically redrawn. But in doing so, we generate what seems to be a numerically high index. This is perhaps a good instance of small changes for large effects.

In terms of the qualitative changes, we have significantly modified the causal and antonymic structure of the ontology. These would seem to be consequential qualitatively because they reposition the nodes (i.e., concepts) in relation to their results and antagonists. It would be as if we modified some of the driving forces of the ontology. If this ontology were to spread, it would arguably induce significant conceptual changes in a populace because they would come to see that the agents of actions and the effects of these actions have to be viewed in light different from before.

Putting together these quantitative and qualitative observations, we might ask whether it is best to have a high gain index, a low one, or some moderate figure. Arguably causal changes are more consequential than, say, attributive ones. Perhaps we should *weight the changes by kind* or establish an *effective gain index*. All these ideas remain to be explored.

Now, how do we know whether these changes have taken place and are spreading? We have to sample the populace in appropriate ways to see if these ontologies have taken hold. The first order of business will be to do some cognitive anthropological fieldwork and gather conceptual data, organizing it into ontologies; these could then be tested on a sample of the populace for accuracy. After ideas have begun to spread, another wave of testing would have to occur, or several waves, to monitor progress.

In this respect we should use the standard sampling techniques, but we would offer a few cautions. We have learned from the sampling for linguistic changes that subjects are very self-conscious and often do not tell the truth. So we must plan these samples in critical ways that also meet our other needs. We should do both randomized cross-sectional and longitudinal studies to see the hold on the populace as well as shifts overt time. Gender, age, education level, socioeconomic status all need to be dependent variables, as well as some sample-specific factors that would depend on the culture undergoing the engineering efforts, such as the social network to which the individuals belong, the effects of patriarchy on idea uptake and spread, and perception of subject of how changes are happening more broadly and to others (group measures).

2. The Frontier

The foregoing applies mostly to the canonical population, those in the mainstream that have been subjected to engineered ideas and who have let their barriers down to overlap with other groups' ontologies (see Young 1996 again on this).

What about the limits? How do we manage and sample at the margins, where idea spread is arguably the most critical. First off, we need to determine where the frontier is. We know from formal studies (Epstein 2006) that there will be heavy emphasis on individual cognition, but *frontier* is a relative term: one man's DMZ is another's main street. What is a frontier?

We would argue that a frontier is an area of potential conceptual gain where *counter forces exist,* whether *explicit or implicit*. Change inside a social group or even across social groups who overlap (per Young's observation) is not frontier work, but part of the normal encroachment of new ideas – no less important, but less adversarial nonetheless. Changes across oppositional areas are true frontiers.

Take Iraq as an example. Idea spread among the Sunnis or Shiites is one thing; idea spread across these two groups (and various subgroups of each) is a real frontier. Would it be possible to induce the idea that, say, the US military has a supportive role across the line between Baghdad and Sadr City? It might be easier to do this wholly within Sadr City than across its boundaries. Baghdad and Sadr City thus form a true frontier.

It should also be noted that frontiers do not always occur in such dramatic socio-cultural situations as Iraq. There can be idea frontiers within organization, as long as there is a directly oppositional force. For example, how do we induce intelligence officers to adopt new points of view, new hypotheses, and new analytical techniques when the culture of intelligence gathering has its own inertia? The same frontier factors hold in such a case. Can we spread ideas among organizational members who otherwise might oppose change to induce changes in their thinking? The same question holds in more "everyday" contexts. Can we rapidly induce thought change through effective risk communication in, say, a national disaster so that the populace understands quickly and well the facts and consequences?

The first order of the day is how to determine a frontier. This will require some sampling ahead of time and the determination of existing ontologies. Then, after inducement and cultural engineering, we would need to sample the frontier populace highly individually – not just quantitatively, but also qualitatively to secure more detailed information about the individual cognition and decision-making.

The frontier is therefore a complex site for idea spread. It requires significant thought and work ahead of time, different sampling techniques, and more detailed analysis (and perhaps some simulation ahead of time). In such a situation, a very low gain index might be a significant finding.

Let us consider an example to close. The Department of Homeland Security (DHS) has a strong interest in being able to convey to the populace, in times of national urgency, that matters are under control and that the populace needs to listen to, believe, and closely follow DHS messages with respect to the urgency and appropriate behavior thereafter. If a bridge collapses in Minnesota, it may *not* be because al-Qaeda has come to the Heartland and blown it up, but because of engineering failures. Thus DHS has both a message problem – what to say and how – and a meta-message problem – what people believe about this message and the DHS itself.

Now, the US is not Singapore, where messages from the government seem to be taken at face value and responded to in an orderly way. On the contrary, part and parcel of American identity, born as it was in rational enlightenment thought, is skepticism for authority and moves to grassroots democracy. Indeed, there are many populist groups on the left and right, even the moderate left and right, that essentially reject much of the authenticity of the government and so would see DHS messages as mere conspiracy. This strain of thought also runs quietly in mainstream America, precisely because healthy skepticism is part of the rational foundations of our independence: we are taught so in civics classes, and this is reaffirmed by the media self-appointed role as monitor. What a task for DHS! The odds are against it. In short, believability is a frontier idea for DHS, and the frontier is remarkably close to home.

Tempering DHS messages with knowledge of how they will meet structured ontologies at the frontier is an important task ahead of DHS. An interesting research project would be a review of DHS public messages and their effectiveness to see how they have fared at the frontier and in less adversarial contexts. But that work is outside the scope of the present document.

E. DESIGNER IDEAS: ONTOLOGICAL CHANGES AND CONTROL IN A DYNAMIC ENVIRONMENT

Our overall goal is to develop a theory and practice of thought creation and spread. In many ways we are engaged in what might be seen as making of designer ideas, *ideas for a purpose*, marketed for wide and successful uptake. What is the best design of engineered ideas? What do they look like and how do we construct and implement them for the most effective spread?

The selection of ideas for propagation is a relative matter and depends on the context into which the ideas will be inserted. This obvious point – that ideas must match their context – is not always so obviously followed. Spreading the idea that women should vote in a patriarchal society requires some judiciousness; telling the populace that the latest disaster is not a terrorist attack requires a sense of the receiving group's view on the believability of government issued communiqués. Determining the content of idea spread requires the close, mutual work of a team of researchers that includes military and intelligence personnel, field cognitive anthropologists and linguists, cognitive and computer scientists and statisticians. They must work in concert on at least the following six factors:

- Identify the area of idea need and propagation.
- Sample the current cultural state and determine the current idea structures.
- Revise and verify: test on sample of receivers; re-represent the ideas and fine tune; test again on sample or simulate. [This step is optional; it depends on the accuracy of the results from Step 2.]
- Determine points of adoption and spread in existing idea networks.
- Implement: choose right form and right media.
- Monitor and control implementation and spread; engage in interventions as needed.

We will briefly look at these in turn.[9]

---

9 In what follows, the illustrations focus on a small number of ideas. This narrowing of discussion is not an indication of cost-benefit ratios: i.e., that much effort needs to be expended on a few ideas. While cost-benefit considerations have to be appreciated, the processes below can and should apply to large pieces of ontologies; one project might in fact be the estimate of costs of idea spread. Here we just provide some illustrations of the processes for explanatory purposes.

1. Identify the Area of Idea Need and Propagation

What are the key ideas to be spread and why? Not an easy question. The answer depends on the strategic goals of the spread (e.g., to change thought on the whole playing field vs. to change thought for short-term positive purpose), the idea itself (e.g., not all ideas to be spread need be dramatic ones), the physical and cultural environment (e.g., a closed social network and difficult physical terrain may limit spread), and the expectations of the cultural engineers as to speed and rate of spread and consequence (e.g., is a small change enough?).

Gallup's (2006) ongoing world poll in the Mideast has revealed that one thing Muslims resent the most about American presence in Iraq and Afghanistan is not military action so much as the humiliation and shame that the American actions have caused. When it comes to Arabic-speaking social networks in the region, it is well known among linguists and anthropologists that the concepts of humiliation and shame vary significantly by Mideast area and by dialect of Arabic. But in all cases, there is a common core of concepts of sexual humiliation of individuals, shame engendered by desecration of religious sites, and shame induced by the mere parading of guilty individuals in public spheres (Al-Jallad 2000).

Many Muslim Arabs saw the horror of Abu Ghraib not in terms of the violence that occurred, but in terms of (to them) the appalling sexual humiliation. Also many saw Saddam Hussein as guilty, but, even so, they were humiliated by his public trial. The public display of the dead face of al-Zarqawi in a Western framed picture by one of our generals had a reverse effect. Knowledge of the ontology surrounding "shame" and "humiliation," their spread, and their sustainability over the culture is essential to understanding and acting on behavior in the Muslim Arab world.

So here we have a case where American sense of shame is non-operative and gives way to bragging while what ensued was an Arabic sense of shame, which also involves forms that entail that the holder of the emotion retaliate – clearly a foreign notion to us. (We have no word that means "now that I have been humiliated I am going to engage in retaliatory behavior." But Modern Standard Arabic (MSA) has *9ar*, which, according to al-Jallad 2000, means this). This, then, is a case ripe for idea change: Americans, perhaps specifically the military for now, must come to understand that Arabs (at least, speakers of MSA) have such an emotional structure and vice versa.

A military leader knowledgeable of the essential cultural ideas and their influence in areas of occupation will be much more effective – more intelligently managing fighters and aware of the limits of public display of captured enemy in certain regions. Similarly, a populace in an area of military action which understands the core beliefs of the soldiers will arguably be more tolerant of actions by those individuals. This is a situation that cries out for intelligent, socially preemptive action.

2. Sample the Current Cultural State and Determine the Current Idea Structures

How is this action carried out? The next step is to survey the two populaces in the standard ways of social, behavioral, and cognitive sciences to get a picture of the key variables. (The specific work on MSA and English emotions has been done by al-Jallad in his 2000 dissertation, on which we rely heavily here.) Then it is necessary to represent the information gathered in a useful and strategically implementable way. For our purposes, this will be a relational network.

Al-Jallad (2000) argues that while English has 12 "shame" words/concepts, MSA has many more. See Table II-2.

Table II-2. "Shame" Words in Modern Standard Arabic

xajal	dana?a
Haya?	sitrah
mahana	9ar
9eb	xizyah
xissa	Hishmah
isa?a	istihzaa
istihjaan	inHitaaT
fadiiHa	Harraj
waqaaHa	

These forms all signal some aspect of the semantic field of "shame" and "embarrassment." But they differ from American English in some significant ways, not only quantitatively but also in areas of conceptual coverage. We can see some of these differences if illustrative forms are rendered in a network to capture the ontology. The diagrams below are cognitive architectures for small parts of the conceptual space of emotion in the two languages/cultures. Nodes stand for the words/concepts linked by labeled directed arcs, which represent the semantic-conceptual relations across the concepts; the relations come from standard sets that are found in the semantic-conceptual literature (see Evens 1988, Mel'čuk 1986, Frawley 1992).

Figure II-11 shows the causal structure surrounding the concept of "shame" in American English. Much of this is reasonably self-evident – shame CAUSES anger, it CAUSES its own shame, it is the ANTONYM of pride, and so forth. Others are less obvious: the EXPERIENCER of shame (the "subject," A) has certain PROPERTIES, for example, being insecure, wanting to be invisible.

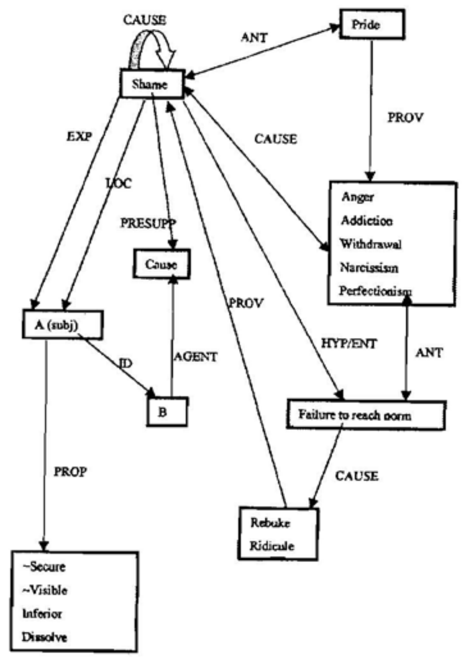


Figure II-11. Causal Ontology for Shame in English

Now the point here is less to argue the structure of "shame" than to illustrate the difference between the English ontology and the MSA one. Figure II-12 displays a partial semantic network for *9ar*, the Arabic word which has a concept of "shame" that involves retaliation.

Notice that *9ar* comes from (PROVENANCE) religious rules, and it is a member of the class of (HYPONYMY/ENTAILMENT) norm violations, which in this case are the same as (ID) religious rules; *9ar* may CAUSE retaliation, and has a SYNONYM in *fadiHaa*, which is like *9ar* in CAUSing withdrawal behavior but differs on retaliation.

If nothing else, these ontologies, grounded in fieldwork and behavioral testing, show that English and MSA differ markedly in their conceptions of "shame." How do these differences then feed into the project of cultural engineering?

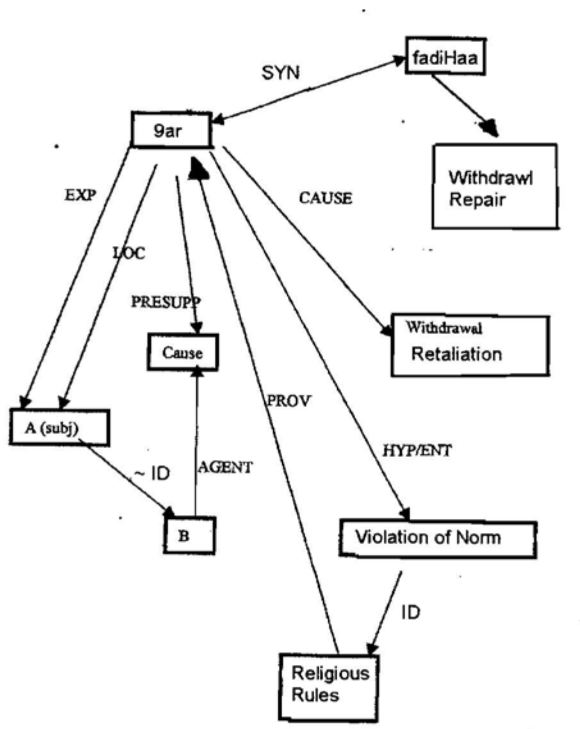


Figure II-12. Partial Ontology of Arabic *9ar*

3. (Optionally) Revise and Verify: Test on Sample of Receivers; Re-represent the Ideas and Fine Tune; Test Again on Sample or Simulate

After the ontologies have been determined from initial fieldwork and testing, it is important to retest and revise as much as possible in order to ensure that the proper nodes and relations are captured. While there are obviously cost-benefit tradeoffs to be determined here – just how much testing is needed for the benefit of the idea spread planned? – it is important to have robust and highly accurate information from the outset.

Additional sampling of the populace can help us see if the ontology is properly constructed. But one could also do some quick simulation or computer-assisted actions to test the fidelity of the ontology. One such action could be a parse of local text using the ontologies as the backend knowledge base. If the knowledge bases can be used to "understand" texts in the way that AI systems do, then we might have some assurance that the ontologies are properly constructed. In concert with one of the many existing MSA grammatical parsers, the system should be able to drive summarization of input text in the relevant area.

Note that if this simulation exercise is successful, the development of ontologies for idea spread has spin-off benefits, and so resources expended on the project of "designer ideas" can be a way to reduce costs elsewhere in the intelligence, security, and defense efforts. These ontologies could be shared across agencies and used more broadly in efforts for automatic text and discourse processing, or quick summary, say from recording or other silent data-gathering situations. Thus, this phase of idea spread has benefits beyond itself.

4. Determine Points of Adoption and Spread in Existing Idea Networks

Where are the opportunities and vulnerabilities in the ontologies? If the purpose of this entire effort is to modify ontologies so that informational actions can be carried out more effectively, then we have to identify places in the knowledge structures where such key changes can happen (or "structural holes": see Burt 1992). One simply does not add a node and relation to a structure and assume that the idea spreads will work on its own. The ontologies are structures, and so we must be sensitive to the right placement of new ideas in established networks.

In general, new ideas emerge in areas of similarity to old ideas. That is, it is rare for a radical redrawing to occur initially, at least if the lessons of PDP and self-adjusting neural nets are to be taken seriously. Thus, it will likely be necessary to build incrementally, from more basic entry points of similarity across ideas to more elaborate and radical results than simply to thrust all new ideas into the target ontology.

Figure II-13 is the revised ontology from Figure II-10, which shows the insertion of new ideas about "religiosity" and "Western control." It is emended with an indication, by shading and numbering, of sequencing of changes to occur:

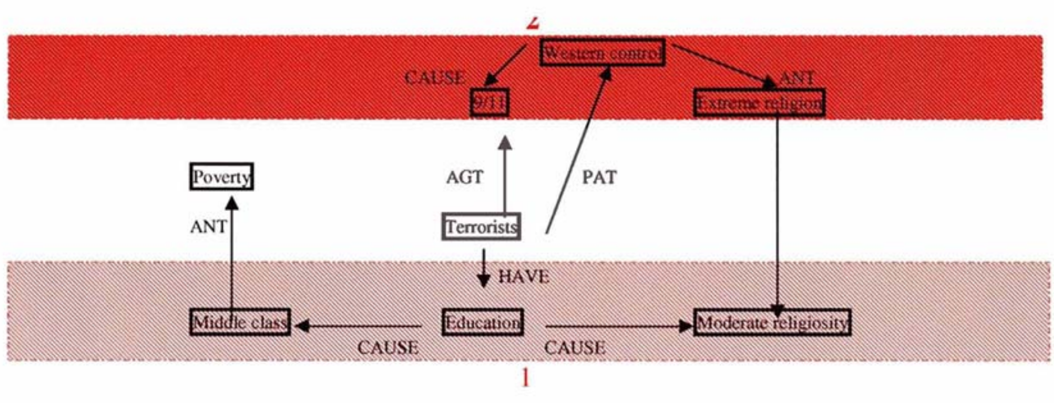


Figure II-13. Ontology Emended for Sequencing of Spread

It would seem appropriate to begin idea changes in this ontology with indications that the terrorists HAVE certain properties which are different from what is normally expected and then move on to the more complex changes of ideas of "Western control" and "extreme religiosity." For one, this couches the terrorists as real people, like the American populace. For another, it lays the groundwork to move from moderation to extreme. Thus an idea spread effort using these points as entries into the ontological changes would likely begin with discussions or public representation of the terrorists as real people with certain middle class properties, such as education. This would ease the recipients into the more radical ideas to follow.

Let us consider a more complex case, the change of MSA "shame" ontology to include knowledge of English shame, so that the local populace can appreciate better the belief system of the military. Figure II-14 is the ontology for *9ar*, emended with possible entry points:

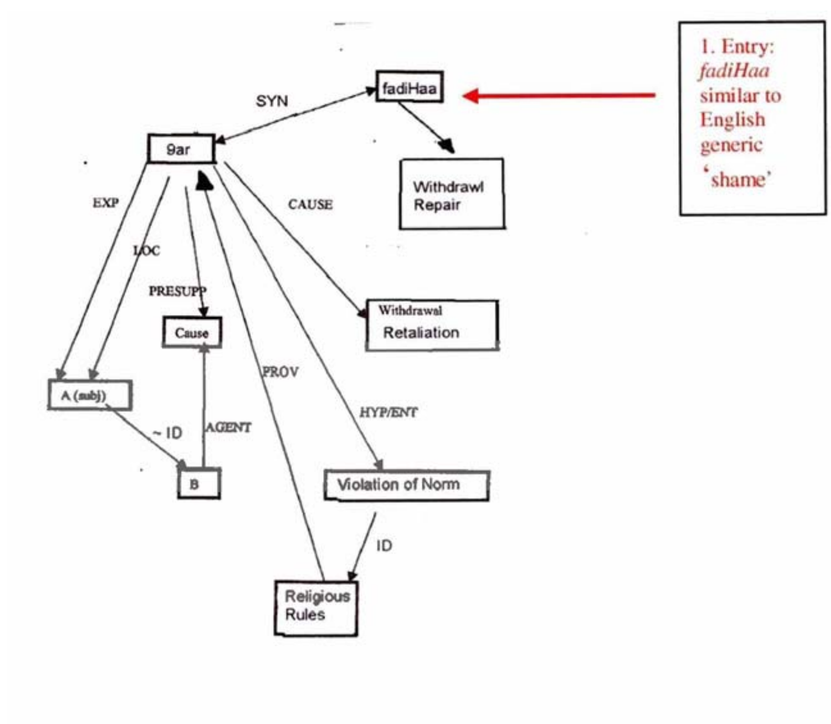


Figure II-14. Ontology of *9ar*, Emended for Entry Point

Reasonably we can begin with *fadiHaa* because a full "frontal attack" on *9ar* would likely fail: *9ar* is both very different from English "shame" terms and pretty well encased in its own ontology. After all, what *9ar* means is something like "a person who has to be other than yourself religiously shames you such that you can retaliate." In that sense, it is like "humiliation with retribution." Changing *9ar* itself risks retaliation! Thus these changes have to be insinuated into the network and done in a quite subtle way (see below on the form of change).

In the end, we want a kind of hybrid ontology such as in Figure II-15.

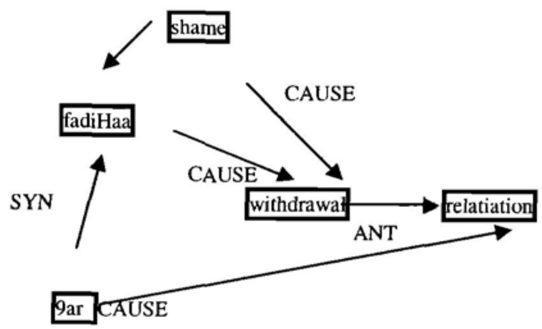


Figure II-15. Ontology with "Shame" Entry Point

This ontology shows that "shame" resonates with *fadiHaa*, but that there are stark oppositions in the CAUSal and ANTonymic structures surrounding these notions. In particular, *9ar* causes retaliation but it is the opposite of what "shame" causes. Note also that we achieve this conceptual opposition not directly, but via the results of what these ideas cause. Thus an entry point into the opposition of "shame" notions across English and MSA is via the larger network of the ontology: you do not have to induce idea change by direct counter of existing ideas. This result in turn suggests ways of implementing the changes.

5. Implement: Choose Right Form and Right Media

Given all this preparatory work, how do we actually begin to implement the idea change and spread? Should we just march in and state the changes? The effects of a kind of blunt force introduction of new ideas is not to be underestimated, as successful Psyops efforts in the past have shown. Nonetheless, discretion may be the better part of valor here, depending on the nature of the ideas to be spread and the context.

Two factors seem to loom large in the implementation of idea spread itself: the overt form of the ideas and the media in which the spread takes place. As to the former, much is to be learned from memetics, or the study of relatively fixed forms which carry routinized messages reproduced virtually as is throughout a population. The point about memetics is a key one: memes are automatically taken on and reproduced. The assumption behind this is that humans are routine processors, not an idea that everyone agrees with, at least on surface. There remains much controversy over whether the human processor is equipped with symbolic processing beyond surface pattern recognition. Suffice it to say that there are results for both the routine message structure and the abstract symbolic system (see Frawley 1997).

From the memetic standpoint, a slogan such as “Just Do It!” evokes Nike products and services in a fixed and contagious way. In the same vein, linguistic corpus studies and statistical linguistics have shown much of language, on its surface at least, exhibits collocational regularities, or relatively fixed sequences that recur in predictable order and context. One “touches base with another,” not “step on base with another”; you “give someone a kiss,” not “make them a kiss”; and so forth (Mel’čuk, 1986 et al).

So a memetic or collocational approach to idea spread would be the first recommendation for form of implementation. In essence what we are talking about here is everyday linguistic and conceptual marketing. How can we encase an idea we want spread in a spreadable form? FEMA has an opportunity to remediate its risk communication strategies at the moment as hurricane Dolly comes down on Texas. The first thing it should do memetically is develop a series of phrases to be marketed out as indicators of how FEMA has rebounded and is now responding in a timely and forward-looking way to disasters. This is a difficult situation that has been met with much counterforce, given FEMA and Katrina, but it is a classic frontier, where individual computation will hold sway. The energy of idea exchange at this frontier would offer much promise for FEMA to reshape its image.

Since we are actually engineering these ideas, we must also give some thought to the instruments of implementation. Again, judiciousness is the order of the day. It is not clear that a blanketing of available media is the right strategy since that is as much a blunt force as just stating the ideas blankly. Some memes are best left to certain media. For example those with a highly phonetic routine should be spread in verbal media; those with visual memetics should be in the print media; those requiring imagistic manipulation should perhaps be in electronic media. For FEMA, if it is to be trusted again, it must spread its image in the visual media, showing routinized examples of how the disasters are not only dealt with but predicted and headed off in some way. A similar frontier holds for DHS, which is gradually getting the reputation among the population as a wide-spending albatross: this is a frontier opportunity for DHS to communicate out in a culturally engineered and streamlined way its mission and accomplishments.

Ultimately, these decisions have to be made by the community at the implementing end, but the decision-making team should include those who have developed the ontologies because certain ideas and knowledge routines suggest in themselves certain formats for propagation. One need only look at marketing failures to see this. The product marketers at “Head On,” the roll-on analgesic for headaches, ultimately scientifically proven ineffective, produced an annoying memetic structure of a voice repeating “Head On!” It was remembered well – as a bad thing! The Chevy Nova debacle in Latin America is another case in point: “no va” means “it does not go.”

6. Monitor and Control Implementation and Spread; Engage in Interventions as Needed

After the ideas are implemented in the appropriate format and medium, it will be important to monitor progress and make changes where necessary. It seems highly unlikely that a program of culturally engineered ideas could be loosed on a population with no intervention along the way to ensure full and proper uptake. Of course, such an intervention is tricky and could bias results. In the same way, however, that instructed language learning and languages for special purposes are sustained by intelligent intervention, so, too, might the work in designed ideas also be assisted.

Two areas of work come readily to mind. The first is to follow the lessons of the earlier phase in of the ideas and randomly sample among the population and/or run simulations and AI-like text understanding. This will allow us to see how the ideas are flowing through the population. We might also keep a list of key concepts and chart their frequency and “embeddedness” in the local idea structure in the way that information management professionals or knowledge engineers track ides for their currency. This way we can get a real-time measure of the progress or loss of the ideas spread.

The second is to engage in follow-on activities. It would be advisable to develop several waves of ideas so that new ideas can build on those that have taken a foothold in the populace. An incremental and orchestrated series of designed ideas, following one on the other, would have substantial effect and go a long way toward anchoring the designed ideas in the local ontologies.

F. LANDING SITES: SOCIAL NETWORKS, THOUGHTLESSNESS, AND SOCIAL CONFORMISM

The final factor we consider is the one that has perhaps received the most attention in the intelligence community of late: these are the social networks through which ideas propagate. There can be no thought contagion unless there is a linked group of people who have loyalty and hence cohesion and whose social structure and social distance promote idea spread.

There has been a fair amount of work on social networks because distributed adversaries, such as loose links of cells, have an advantage accorded them by their format. It is hard to track information through distributed networks, and they degrade softly under duress and so can persist. But social networks are also the site for idea change and idea engineering because there has to be a network for the thought contagion to traverse. What do we know about networks? Here we examine both the structure of the social networks and their function as mechanisms of the thoughtless spread of ideas.

1. The Structure of Social Networks

We will examine eight key features of social networks:

- Size.
- Density.
- Distance (quantitative).
- Distance (social).
- Composition (structure and organization).
- Role in community.
- Performance (speed of information travel).
- Carrying capacity (amount of information able to hold).

A network, as we already know, is a set of nodes connected by arcs and hence is a directed, labeled graph. Ontologies are networks of concepts and semantic relations; social networks use individuals and their social roles in the network. Figure II-16 is, for illustration, a partial social network of one of the authors' (WF) family:

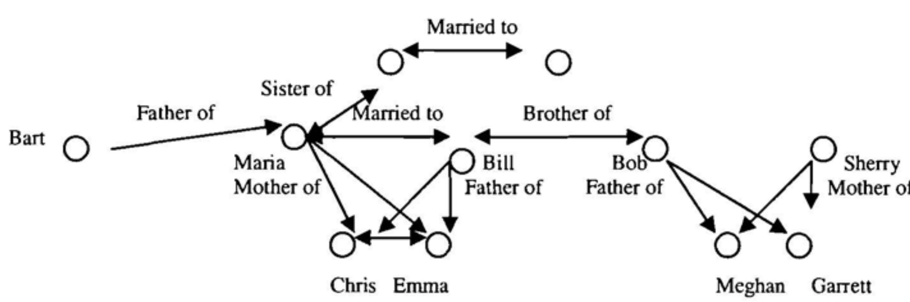


Figure II-16. Partial Social Network

Note that some relations are symmetric, and some are not. Note also that there can be recursion: if X is the mother of Y, then Y can be the mother of Z, and so on. The choice of labels for nodes and arcs is not arbitrary, but there is much leeway, as long as the system of knowledge and relations is captured. Occam's razor, however, would constrain unnecessary labeling.

The first property we need to examine is *size* of the network. That is, how many nodes and relations are there? This count gives a rough estimate of the network's manageability, carrying capacity, and performance. It also constrains the quantitative distance of the operations of the network. But mere size of the network does not necessarily predict performance. Certainly, the larger the network is, the more likely the spread of an idea is to have greater effect. But size alone is not key. Much depends how the network is traversed as the ideas are spread. Some networks, because of other properties, such as density or structure, may have intrinsic barriers to contagion. Indeed, the size of the network may be a mitigating factor. We need ultimately to measure relative tradeoffs of size and other properties.

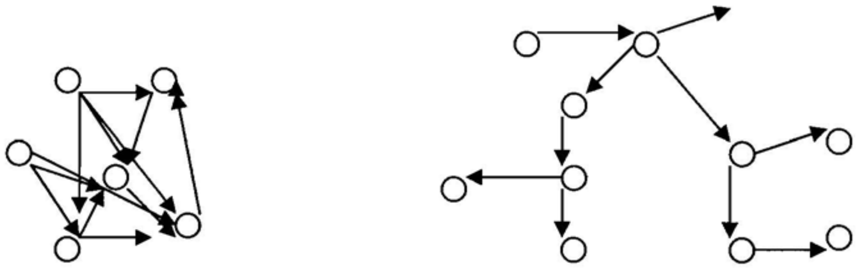
Still, sheer size does matter at a base level, and we can assign a number to network for their size. In the partial network above, counting tokens, there are 11 nodes and 15 relations, yielding a token value of 26. As to types, there are still 11 nodes (no node stands for a type, like "father": they are all individuals) and 5 relational types, yielding a type number of 16. Its type/token ratio is 1.6. It is not clear whether these numbers are meaningful in any broad sense: we would have to survey familial networks and get an understanding of the mean size for a particular context.

Thus, much depends on how you count. It will be important to assign meaningful numbers to these networks for size, especially because there are size/density tradeoffs that have been discovered in social network analysis.

The second property we will examine is *density*. By this term, we mean the relative interconnectedness of the social network. In Figure II-17, the network depicted on the left is denser though smaller than the network depicted on the right.[10]

---

[10] Burt (1992) calls (22a) a *clique* and (22b) a *core-periphery*.



Small, Dense Network **Large Network Lacking Density**

Figure II-17. Network Density

Density is a matter of the convergence of relations on nodes: the more convergences on a single node, the greater the density. Thus, if we were to assign a point value to each convergence, with single convergences at 1, double convergences at 2, triple convergences at 4, quadruple convergences at 8, and so on, we would see that the leftmost network in Figure II-17, at a convergence rate of 18, is more dense than the rightmost network in Figure II-17, with a score of 10.[11]

Density of the network is a useful measure because it interacts with size, distance, and other parameters of social networks in important ways. Essentially density is a measure of the cohesion and compression of the network while size is a measure of extent. A highly dense network which is small may be a better candidate for idea contagion than one that is large and loose, depending on the functionality of the network and the social and quantitative distance therein.

The third feature of social networks is *distance*, and this comes in two forms: *social distance* and *quantitative distance*. *Quantitative distance* refers to the number of nodes between a node and another and can be quantified simply by adding up the nodes from one to another. It is a grosser measure than social distance but it is also numerically determinable. Because quantitative distance is abstract and just a counting procedure, it may or may not signal an affinal or consanguineal relationship. In Figure II-16, for example, one might argue that the relationship "father of" is socially closer than the relationship "married to," even though both might have the same quantitative distance between nodes. Conversely, the relationships "X brother of Y father of Z" (= "X uncle of

---

[11] One of the motivations for this increase in value comes from the lessons of natural and artificial neural nets, which rely on convergences in weighting node transitions: the more convergences, the more important the node.

Z”) are socially closer than the relationships “X sister-in-law of Y, X aunt of Z” even though both have the same quantitative distance.

Social distance refers to the nature of the relationship across nodes; it cannot be easily quantified because a direct descendant is socially closer than one either more removed by consanguineal relations or by affinal ones (i.e., a son is closer than a nephew or a sister-in-law), and arguably consanguineal relations trump affinal ones in any network (sons > sisters-in law). In essence, social distance is a measure of closeness of family.

What is the relationship between density and distance? Both density and distance mark cohesion and dispersion, and so it would be useful to use them in relation to each other to make some predictions. Fortunately, in at least one case this relationship has been tested.

Culicover and Nowak (2003) studied the connection between distance and density in the development of new languages, via simulation of interaction of speakers of languages using parameters of language change to construct new languages. That is, as speakers interacted, how many new languages did they develop? This simulation is relevant to our work because an increase in languages over time as a function of density or distance of the social network would correspond to an increase in idea spread: the parameters of language change would have to spread throughout the social network to create more languages. What did their simulations show?

They remark:

> We can compute the tradeoffs in the simulation model between interaction distance [= quantitative distance in this case, WF] and interaction partners [= density, WF]. The number of languages that persist as individuals interact declines dramatically as the interaction distance increases, particularly from 1 to 2 (from one no nodes intervening to one). When the interaction distance is small, the number of languages declines slightly as the number of interactive partners increases, but when the interaction distance is larger, the number of languages grows as the number of partners increases.

In other words, density ultimately trumps distance. As the interaction distance alone increases (quantitatively, from 1 to 2), there will be dramatically fewer languages as the sort out of parameters unfolds. But when there is larger distance, this has an effect only insofar as density increases. This would stand to reason as the interconnectedness of the network can overtake sheer quantitative spread, because connectedness is in principle more powerful than sheer number. So Culicover and Nowak (2003) have shown that, all things considered, density determines the final output of language spread.

What we do not know is anything more subtle than this finding, however. What are the detailed parameters of density? Does density drop off ultimately as a determining factor? Are there subtler relationships between distance and density? These are questions that remain for future research.

The fifth characteristic we should consider is what we have called *composition*, or what exactly goes into the network in terms of nodes and arcs. First off, most obviously, the information must be relevant to the domain at hand. Epstein (2006: 99-101), for example, has a nice exposition of how to model historical and social data with respect to the Anasazi culture. He shows how basic demographic data must be enhanced by data such as physical locale in order to get the right simulation results for the social network. We want, in the end, to have our networks endogenous since we could introduce all sorts of arbitrary exogenous variables to get the task of interaction done. Moreover, individuals' actions are the site of the strength of the network, and we want individual behavior to be the contributing factor to the overall macro-stability of the network in context (Epstein 2006: 309). But what is relevant within the domain itself?

Essentially following the line between endogenous and exogenous variables can help guide choice (and physical locale is an endogenous variable for the Anasazi, as above). For example, in the relationship "father of," we would want to further distinguish "biological father of" from "step father of" as endogenous variables, making all consanguineal and affinal relationships endogenous variables.

But what about the idea that fathers as a whole have more influence on their children than on their children's children? How is this captured? Is this endogenous or exogenous? Note that network distance is not enough. There is the same distance between "father of" and "child of child of" as there is between "brother of" and "child of brother of," but arguably there is more influence by the father on the grand children than on the nephews and nieces. How do we capture this qualitative information in the network since it affects the run-time and spread?

These questions lead to another larger issue for composition. We must understand that simply diagramming nodes and arcs is not sufficient as an account because all sorts of hidden assumptions lie underneath those. For example, in a dense network, how does a receiving node sort out multiple convergences? The usual way is to make the influences additive, but arguably a convergence of three is qualitatively more than a convergence of two. How do we represent the information in the most robust and accurate way? These questions and others like them are unanswered at present.

Perhaps the most useful exposition in regard to representation comes from agent-based modeling (Epstein 2006). In this kind of simulation, nodes and arcs are defined as computational objects, which themselves are blocks of memory that function as a unit and consist of data – properties of the node (the agent) – and functions that the agent carries out, or rules of interaction. In addition, agents as nodes can be equipped with tracking mechanisms or other functions that show how far they traverse a network and how many interactions they can sustain. Furthermore, networks themselves can become objects and so recursively we might then have whole networks as the interactive partners (see Epstein 2006: 170-73). This is the essence of thought contagion.

So the lesson here is that a social network can be manifested in many ways, just as long as the proper information is captured. Our guess is that object-oriented programming will accord us two benefits: it will force us to make the information about nodes and arcs explicit and at the same time produce the backend of a simulation.

The last three properties – *role in the community*, *performance*, and *carrying capacity* – are discussed together because they relate to one another and because we know so little about them. They raise more questions than answers.

What function does a social network have in the larger community? That is, what influence does a particular network as a whole have in relation to other networks? For one thing, we know that we can make networks the objects of other networks, according to the above, and so represent influence, but then the same old questions arise. What is the extent of influence of one network on another, and can this be captured by things other than distance? Density is always a sign of influence but there are many cases where single convergences have more influence than other single convergences. Note in this respect what the Gallup poll (2006) has revealed about the Mideast – that women's networks may have as much behind-the-scenes influence as men's do overtly. How do we capture this role of the network in our representations?

Similar issues arise for performance and carrying capacity. How fast does information travel? How efficiently? That is, are all arcs equal econometrically? And what is the overall sustainability of the network? What information load can it carry, whatever its structure of performance? Turchin (2003) has much to say about carrying capacity and population dynamics, but do we know how the idea of carrying capacity might apply to social networks? Answers to these questions may depend on the role of the networks in the community more than on structural factors. Nonetheless, they are important but not known.

So, much remains ahead of us in terms of the properties of networks. If we can formalize much of this, we might be able to make some mathematically based predictions about where and how ideas spread.

2. Thoughtlessness and Social Conformism

Whatever the structure and organization of the networks, what we want from them, to put it bluntly, is *blind adherence*. Idea spread, memetics, thought contagion – they are all predicated on the belief that humans will make many decisions essentially without thinking, in thoughtless conformism, by imitating across their social relations. Epstein (2006: 22) puts it nicely:

> Often the aim is not to equip target populations with the data and analytical tools needed to make rational choices; rather one just displays exemplars and then presses for mindless imitation…The manipulation of uncritical initiative impulses may be more effective in getting to a desired macro equilibrium than policies based on individual rationality.

While the PDP literature is full of illustrations of how blind or near-blind imitation can function in a learning environment – especially on the basis of analogy (whatever that is) – there is less on the subject in the formal social network literature. Here we look at two factors, *rationality* and *tolerance*.

Young (1996) observes that imitation has long been thought of as a non-rational process. On the one hand, social agents make economic decisions based on cost-benefit analyses of the situation and make and seek the greatest benefit for least cost. On the other, humans sometimes (often?) display group-oriented loyalty that violates the cost-benefit analysis and so looks irrational. Why, for example, would someone choose to decorate their house in a certain way when it is quite expensive but nonetheless looks like others' in the neighborhood or social network? The answer can only be one that refers to non-rational behavior – loyalty to the neighborhood or social group.

Young (1996) crucially observes that such a decision is in fact rational. Individuals can be seen as characterizing the cost-benefit tradeoffs of staying in the network. Said otherwise, loyalty has a price and payout. There is a cost to removing oneself from the social network, and this is understood by the agents in the network. Thus, while "self-enforcing social regularities … [allow us to] conform without thinking about it" (Epstein 2006: 228), and in the ideal, "individual thought is inversely related to the strength of a social norm" (Epstein 2006: 229), it appears that we do think about it and assign cost-benefit figures to the activity of going against the grain. Imitation and thought contagion are rational.

Our question now is: *how can we influence the social network such that accepting ideas* wholesale *in idea spread has an economic pay off?* Can we engineer norms to allow rational calculation of payoff? One measure of success here would be a decrease in individualized action as a function of the calculation of the costs of separating form the group. To this end, Young's (1996) formulas might help in the formalization of the solution.

The second factor is tolerance. This is a formal notion that is found in the simulation of social behavior by agent-based systems. But it appears relevant to human networks. The issue is: what *is the largest radius within which you will allow imitation?* How far can you go? This result is known as *tolerance*.

In simulations, we see, as Epstein (2006) notes, that social agents are lazy statisticians. They know that a larger sample for imitation will be more reliable, but they prefer closer-to-home sampling. This makes for a constant reduction of tolerance of difference. If there is no difference – or no need to check for difference – at the higher level, check lower, and so on. (Bicchieri (1997), citing Skyrms (1990), who uses memorylesss, or Markov, strategies, has similar results in looking at game-theoretic accounts of cooperation.)

But what is the average tolerance for a social agent? According to Epstein (2006: 233-34), "the average radius will stabilize around different values from run to run, depending on the number of different norms that emerge." So, again, individual thinking is inversely proportional to the strength of social norms, but this does not mean that the thinking is not cost-benefit driven or non-rational.

III. CONCLUSION: 15 NEW IDEAS FOR THE STUDY OF NEW IDEAS

In this document, we have outlined a program of research for idea spread and linked it, as we are able, to defense, security, and intelligence issues. Relying heavily on dynamic models, we have tried to show that there are six key factors in a program of work on idea spread. These factors generate some 15 important research questions for future work.

1. What is the process of going from U-shape to S-Shape (both mathematically and cognitive-behaviorally)? Can we extend Niyogi's (2006) work on the relation of the individual to the macro equilibrium and Young's work on the relation of individual cost-benefit analysis to operation within leveling social norms? That is, is there natural learning in idea spread? Can we determine actual times, rates, and extents of spread? Can we predict them?
2. What are the differences between endogenous and exogenous variables in idea engineering? What role does each play? What is the precise line between the two?
3. What are the factors that induce rapid and efficient idea change? Can these factors be correlated? How do these results relate to more standard econometric models of competition, decisions, and change? Can we use such well known human facts such as avoidance of the negative and the calculation of estimates over probability to assist rapid change?
4. What are the minimum and maximum activatable parts of an ontology or social network for effective idea spread?
5. How do factors such as the frontier, legitimacy promotion, and loyalty shifts play into rate and extent of spread? What is a frontier?
6. Can we quantify more precisely and more subtly the measure of conceptual territory gain? Are there ideal ratios of loss to gain?
7. What more can we do with the structure and organization of ontologies? Where are ontologies vulnerable to spread?
8. What is the most efficient form for an idea to be spread? What are the proper measures, overall, of effective idea spread? Can we identify an inventory of new ideas and areas for cultural engineering?
9. What kinds of practical interventions can we perform to ensure idea spread? How does this relate to effective control processes?

10. What more can we learn about the structure and organization of social networks? Where are they vulnerable for idea spread (structural holes)? What is the more nuanced picture of density and the connection between density and distance? How much does size matter? What is the connection between network composition and density? Can we make more precise the ideas of performance, role in community, and carrying capacity?
11. Are there reliable and accurate measures of social conformism?
12. Who would use these results and why? Are there special applications to the military, the intelligence, or security communities?
13. Are there practical programs for engineered ideas? With a predictive model of idea propagation and networks of core ideas in culture, can we develop training programs to assist in the making of the expert serviceman/servicewoman or analyst?
14. What would computer modeling of idea spread and social networks look like? Can we develop automatic summarizers, simulations of cultural landscapes for virtual battle, and related ideas and projects?
15. BONUS QUESTION: What does a cost-benefit analysis of all the foregoing give us?

REFERENCES

Abelson, Robert. 1979. Social clusters and opinion clusters. *Perspectives on Social Network Research*, P. Holland and S. Reinhardt, eds. NY: Academic Press.

al-Jallad, N. 2001. *Shame in English, Arabic, and Javanese: A Comparative Lexical Study*. Ph.D. Dissertation (Linguistics), University of Delaware.

Bicchieri, Cristina. 1997. Learning to cooperate. *The Dynamics of Norms*, C. Bicchieri et al., eds. 17-46. Cambridge: Cambridge University Press.

Boyd, Robert and Peter Richerson. 2002. Group Beneficial Norms Can Spread Rapidly in a Structured Population. *Journal of Theoretical Biology* 215. 287-296.

Burt, Ronald. 1992. *Structural Holes: The Social Structural of Competition*. Cambridge, MA: Harvard University Press.

Culicover, Peter and Andrzej Nowak. 2003. *Dynamical Grammar*. Oxford: Oxford University Press.

Dawkins, Richard. 1976. *The Selfish Gene*. Oxford: Oxford University Press.

Epstein, Joshua. 2006. *Generative Social Science: Studies in Agent-Based Computational Modeling*. Princeton: Princeton University Press.

Evens, Martha, ed. 1988. *Relational Models of the Lexicon*. Cambridge: Cambridge University Press.

Finkelstein, Robert. 2008. Information Propagation, Impact, and Persistence (InfoPIP): Defining Memes. Presentation to DARPA Workshop on Military Memetics.

Frawley, William. 1992. *Linguistic Semantics*. Hillsdale, NJ: LEA.

Frawley, William. 1997. *Vygotsky and Cognitive Science: Language and the Unification of the Social and Computational Mind*. Cambridge: Harvard University Press.

Gallup Organization. 2006 *The Gallup World Poll – Muslim Women*.

Jagacinski, Richard and John Flach. 2003. *Control Theory for Humans: Quantitative Approaches to Modeling Performance*. Mahwah, NJ: LEA.

Kirby, Simon. 1999. *Function, Selection, and Innateness*. Oxford: Oxford University Press.

Kroch, Anthony. 1994. Morphosyntactic variation. *CLS* 30. 180-201.

Latané, B. 1996. The Emergence of Clustering and Correlation from Social Interaction. *Modelle Sozialer Dynamiken: Ordnung, Chaos, und Komplexita*, A Hegselmann and H. Peitgen, eds. Vienna: H-P-T.

Lightfoot, David. 2006. *How New Languages Emerge*. Cambridge: Cambridge University Press.

Lynch, Aaron. 1998. *Thought Contagion: How Belief Spreads through Society*. NY: Perseus.

Mel'čuk, Igor. 1986. Dictionnaire explicatif et combinatoire du français contemporain. Montreal: University of Montreal Press.

New York Times. 2007. Army Enlists Anthropology in War Zones. October 5.

Niyogi, Partha. 2006. *The Computational Nature of Language Learning and Evolution*. Cambridge: MIT Press.

Pinker, Steven. 1994. *The Language Instinct: How the Mind Creates Language*. NY: HarperCollins.

Pinker, Steven. 1999. *Words and Rules: The Ingredients of Language.* NY: Basic Books.

Rogers, Everett. 1994. *Diffusion of Innovations*. NY: Free Press.

Shulz, Thomas. 2003. *Computational Developmental Psychology*. Cambridge: MIT Press.

Shaffer, Robert and Ron Ashkenaz 2005. *Rapid Results: How 100-Day Projects Build the Capacity for Large-Scale Change.* San Francisco: Jossey-Bass.

Skyrms, Brian. 1990. *The Dynamics of Rational Deliberation*. Cambridge: Harvard University Press.

Soltis, et al. 1995. Can Group Functional Behaviors Evolve by Cultural Group Selection? An Empirical Test. *Current Anthropology* 36. 473–494.

Turchin, Peter. 2003. *Historical Dynamics: Why States Rise and Fall*. Princeton: Princeton University Press.

Young, H. Peyton. 1996. The Economics of Convention. *The Journal of Economic Perspectives* 10. 105-122.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)* 31-10-2008	**2. REPORT TYPE** IAD Draft Final	**3. DATES COVERED** *(From - To)* March 2008 – August 2008

4. TITLE AND SUBTITLE

Idea Spread: Toward a Research Program in Socio-Cultural Modeling and Cultural Engineering for Security, Defense, and Intelligence

5a. CONTRACT NUMBER DASW01-04-C-0003

5b. GRANT NUMBER — — —

5c. PROGRAM ELEMENT NUMBER — — —

6. AUTHOR(S)

Frawley, William; Fries, Arthur

5d. PROJECT NUMBER — — —

5e. TASK NUMBER C5504

5f. WORK UNIT NUMBER — — —

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Institute for Defense Analyses
4850 Mark Center Drive
Alexandria, Virginia 22311-1882

8. PERFORMING ORGANIZATION REPORT NUMBER

D-3601
H08-001219

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

IDA Contracting Officers' Representative (COR)
Mr. Jay S. Minsky
4850 Mark Center Drive
Suite 9601
Alexandria, Virginia 22311-1882

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

— — —

12. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for public release; distribution unlimited. Enterprise Information and OSD Studies, OUSD(AT&L)/ARA/FFRDC, 03-11-2008

13. SUPPLEMENTARY NOTES

— — —

14. ABSTRACT

This document describes key factors in a dynamic model of idea spread as a matter of intelligence, security, and defense and to outline the ways these factors form the basis of a longer-term, robust research program in the area.

15. SUBJECT TERMS

Meme, memetics, meme engineering, memplex, terrorist meme, idea spread

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
a. REPORT Unclassified	**b. ABSTRACT** Unclassified	**c. THIS PAGE** Unclassified	Unlimited	72	Arthur Fries **19b. TELEPHONE NUMBER** *(include area code)* 703-845-2364