Conversation in Cycles: The Dynamics of Culture Sharing

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ABSTRACT

The 'information cycle' as described by H.T. Odum is an evolutionary-ecological model of the processes of information maintenance and change. It is a general model, intended to apply to all forms of information. This paper reports the first behavioral experimental study designed to collect data that can illuminate the dynamics of culture-sharing in information cycles. It is an analysis of conversation among university students in Taiwan. A junior class of 32 students utilized pencil and paper (P&P) diaries to record conversation topics over a three week period. It was expected that some topics of special interest would be shared widely as they were passed among speakers through repeated information cycles. This type of contagious transmission did indeed appear. However, of greater interest, the majority of widely shared topics, it is argued, were initiated by pulses from larger scales of information cycles, specifically from popular media, education and ritual scales, which then triggered a cascade of conversation sharing. This result indicates that the sharing of cultural information is indeed a complex, multi-scaled process that requires a nested model of information cycles as I have proposed elsewhere. This research has important implications for the study of cultural hierarchies, their form, and possible function located within larger human-ecosystems. It is therefore explicitly 'systems' research that attempts to take insights from studies of the organization of complex systems, such as ecosystems, into the realm of the social by re-conceiving cultural information as itself a hierarchy of discontinuous forms of production.

INTRODUCTION

What are people talking about? Do they sometimes repeat topics from one conversation in another, later conversation? Do many conversations spontaneously at times take up the same topic? Are there recognizable patterns to the repeating of topics: a slow run-up and then a surge, a burst of activity and then a quick drop-off, a repeating pulse? We might sense that we have experienced these and other patterns in the course of our conversations. Can these patterns be documented? And can they be explained? Is this the *stuff* of 'culture'? Understanding what is repeated, negotiated, and shared—is that *cultural* knowledge, born or renewed? What are the implications of these patterns? And of greatest significance, what do the patterns and processes of sharing conversational information tell us about the formation and possible function of the information that we commonly refer to as culture?

An anthropological truism is that through conversation people produce, negotiate, and reproduce the fundamental ideas of culture. I have suggested that conversation (discourse, narrative, interpersonal interaction) is the fastest changing, smallest-scale component in a hierarchy of cultural information forms (Abel 2013), and it supplies the building-blocks of all other scales of cultural information (discussed below). Over a given time frame, a great number of conversations are occurring within some spatial expanse. Many conversation topics are highly idiosyncratic, and will not recur. But many conversation topics are repeated or shared, even to the inclusion of specific details. An approaching exam, the scandalous (or not) behavior of some specific professor, the nasty breakup of Jonathan and Katherine, these may be 'contagious' conversation topics that are heard and repeated by a number of discussants in distinct conversation settings.

In this study of student conversation at a small university in Taiwan, topics were indeed shared in this way. But, perhaps surprisingly, the majority of conversation topics that were repeatedly discussed by students were not contagiously shared, but rather were 'initiated' by events at larger scales in the hierarchy of cultural information, e.g., media, ritual, education, law (Abel 2013). These larger scales have properties that are different from discourse. For one, they have cycle times that are longer than discourse. For another, they utilize different intermediate 'carriers' of information within information cycles, which serve to progressively improve the fidelity of transmission. And last, they require more energy in their production. Together, these properties contribute to the ability of information at larger scales to control the occurrence and timing of conversation at smaller scales as will be shown. The issue of timing and control of objects or events located in discontinuous scales of systems, particularly ecosystems, is of great interest to many systems researchers (e.g., (Allen and Holling 2008)), and will be explored below.

Information Cycles

H.T. Odum's 'information cycle' (Odum, 1996) is an evolutionary-ecological model of the processes of information maintenance and change. It is a general model, intended to apply to all forms of information. It has to this point been explored in *emergy* analyses of DNA, discourse, media, and education among others (Abel 2011; Odum 1996). The research presented in this paper is a behavioral, experimental study designed to collect data that can illuminate the dynamics of culture sharing in information cycles.

From Odum's view, information cannot be created once and then copied through time from one individual to another. Information, like any structure, naturally degrades or dissipates, per the Second Law of Thermodynamics, and once lost it must be created anew at great cost. In an information cycle (Figure 1), information is transmitted through time via many copies, i.e., a population of carriers bearing that information. From that population copies are made faster than they are lost or become nonfunctional. Each new entity is then dispersed within the system where it does what it does, always within a larger, dynamic, multi-scaled system of energy and materials. Of those many copies there is later selection for successful entities and their role(s) within that system. At some point the information that defined a selected entity is extracted in some form and used to make new and numerous copies. Those copies then cycle back to their role(s) within the system, and the cycle is complete.

In the most familiar example, the information cycle of natural selection requires a reproducing population of organisms to maintain genetic information. Passed singularly, a mutation could end a species line, but transmitted in populations it is protected.

Most genetic information in a reproducing population is 'shared information'. Shared information has special qualities:

An item of information that is shared—held by many units—has the greater emergy that copied and established it in many units, but its territory is now much bigger than any one carrier and its effect is larger, its time constant longer, and thus its rate of depreciation is less than those of any one carrier (Odum 1996:226-7).

In other words, shared information is more difficult to loose. It is in effect insulated from loss because it must be lost from each carrier (over a larger 'territory', which takes more time, i.e., 'it's time constant is longer'). It may even spread to different environments where it occupies a different role, which further insolates it from loss. Information that is shared over a large territory of one or many environments must be functional in each, and thus, in total, 'its effect is larger.'

For this research, I focus on the cycle of shared cultural information within a discourse community, specifically the campus of Tzu Chi University, Taiwan. Specifically, I examine how such conversation cycles are initiated and sustained.



Figure 1. Information Cycle. Information that is useful is repeatedly passed through the information cycle, being selected at each turn, extracted, copied and dispersed (Odum 1996). Information requires a population of carriers to be maintained, and thus the work needed to maintain shared information is great.

Vertical Sharing

The production of cultural information is more accurately depicted as a nested set of information cycles (Abel 2013), each connected within the same complex social-ecological context of human existence and cultural production (Figure). And so, for example, regular discourse that is captured and upgraded through the popular media is more widely dispersed, new energies are applied, and the information will have a longer turnover time than most conversation topics. Information that is further picked up by ritual, education, research, or law has progressively larger dispersal and longer turnover time. Thus we see the function of the upgrading of information within a hierarchy of information scales. Information that is pushed up to higher information scales requires additional energy for its (re)production and maintenance, for which is returned greater fidelity, wider sharing, and longer turnover times.

Conversely, an important focus of this research is that information from larger scales delivers pulses of energy to lower scales that may *initiate* cycles of information transfer at those scales. This is the case, for example, when information from media, ritual, education, etc. influences the production of discourse.

Conversation Topics

The most fundamental stream of cultural information is that of *discourse* or *conversation*. Conversation topics have been previously researched within two fields of study, Communication and Marketing. Within communication, focus has been on friendship (Aries and Johnson 1983; Duck and Miell 1986; Johnson and Aries 1983), gender differences (Bischoping 1993), and more generally about the frequency and topics of conversation (Duck, et al. 1991; Sehuister 2006). In these studies, conversation topics are generally supplied by the researcher and are few in number and simple in form. In marketing studies, research has focused on the spread of *single* topics by word-of-mouth, usually a product line (Abbasi 2008; Dellarocas and Narayan 2006; Goldenberg, et al. 2001; Hill, et al. 2006). These studies give some indication of the nature and duration of 'shared information' in conversation topics, but the single topics come from researchers and nothing is learned of the natural play of conversations among many.



Figure 2. Hierarchy of Information Cycles. This figure depicts a nested hierarchy of information cycles. The value of doing so is to accentuate the fact that each returns objects of information to the same social-ecological context, i.e., the shared information storage, from which any information may be picked up by any cycle. By moving out to larger scales, new energies are applied, information may be shared more widely, and its turnover time is increased. The fate of any piece of information is highly contingent and unknowable, but we should expect that information that is selected will contribute to self-organization at some scale of the social-ecological-informational context.

Research Questions and Objectives

The objective of this study was to investigate the dynamics of recurrent conversations and their explanation (i.e., discourse, the second cycle in Figure 2). The research was designed to elicit detailed and specific conversation topics with open-ended methods. Later categorization of those topics came from qualitative analysis conducted by language community insiders. The goal of diary use was to produce descriptions of conversations that were 'specific enough' to allow insiders to identify the presence of 'shared' topics, i.e., topics that are recurrent in successive conversation events. Over three weeks, in multiple conversations that included the same topic(s), among thirty-two students of a Junior class in the Human Development Department we focused on answering several questions, "How many different conversation topics were discussed?", "How many were shared widely?", "What was the duration of sharing one topic?" and "Are there recognizable patterns of sharing?" The study and the analysis of the data on discourse led the question of "Why we speak", which is considered in a theoretical context, because it cannot be answered directly by the empirical methods and analysis used in this study.

THEORY

Why We Speak?

I wish to make clear how this study relates to the quintessential question in social theory, 'Why we speak?' Does the information cycle answer this *why*-question, supplying explanation or motivation? Or does it contribute something completely different to this age-old conundrum?

Two scales of explanation have been offered to answer this question in the past, system scale explanations, and individual scale explanations. In *systems scale explanations*, if conversation is *useful* in some way to the conversation community or larger it is expected to occur and recur. Such explanations are difficult to demonstrate empirically. Furthermore, they are often tautological, as for example when related to maximizing energy intake to a system: (1) systems that prevail maximize power (the inflow of energy), (2) the system exists, therefore (3) the system, with this information, is maximizing power. This theoretical and methodological difficulty does not *disprove* the assertion of usefulness to a community or system, and systems researchers have applied a range of methods to demonstrate system functions, particularly in the field of ecosystems ecology (Allen and Holling 2008; Gunderson and Holling 2002; Odum 2007; Schmitz 2010; Waltner-Toews, et al. 2008). Systems-thinking draws attention to the energy-attracting value of information, which is an essential requirement for any system in the universe.

Individual-scale explanations are today the more commonly preferred approach. For their reduced scale, mechanistic design, and experimental ease, they are the ideal of scientific analysis (Holling 1998). Certainly for some anthropologists the question of why we speak can be answered by looking no further than individual volition and 'cultural' uniqueness. I will briefly introduce here a number of alternate views that represent a range of micro- and meso-scale explanations.

Early scientific explanations for human action including human speech focused on the satisfaction of basic needs and drives (Maslow 1943). The result has been rational choice models that emphasize material causality, sometimes with multiple scales of repercussions (Harris 1979).

From the sociological study of 'interaction rituals' it has been argued that human interaction is motivation in itself (Collins 1993). We participate in interaction rituals because we receive emotional rewards. Our desire to engage in interaction rituals motivates behavior in many domains, including our participation in work, religion, and countless other social rituals.

A number of quite sophisticated explanatory models have more recently been proposed from the burgeoning field of evolutionary psychology (Barkow, et al. 1992). They attempt to explain behavior in terms of innate psychological mechanisms that improve reproductive fitness, and may be grouped under topics such as mate selection, cooperation, or parenting. It might be argued in general that conversation that accords with the narratives associated with each of these fields would ultimately increase fitness, and thus be explained (but see discussion of motivation below). An attempt to do so was made in this study (Appendix B), though a number of objections may be easily raised related especially to 'intention' and the context of cultural meanings.

Two other related approaches from evolutionary psychology that more specifically address the topic of speech and human interaction are Dessales (2008) and Gilbert (2000). In Gilbert's theory of social attention-holding potential, humans compete with each other to be attended to and valued by others in the group. This explains the human-unique nature of cooperation and dominance. Speech is a central component of attention-holding among people. In a similar fashion, Dessales argues that speech evolved because it is an exceptional tool for achieving joint attention, which has significant fitness advantages. People compete among each other to use language to draw attention to socially meaningful, unexpected, or emotionally charged information, with obvious fitness advantages.

Finally, a great deal of social research in the last 40 years has been directed to the meso-scales of *fields* of political-economic contest (Bourdieu 1989; Foucault 1980; Gramsci and Buttigieg 1992). The result has been a range of sophisticated constructivist models of power, hegemony, discourse, and contest. Within such approaches, speech has the critical role of contestation, negotiation, and the

production of discursive formations. Explanations of speech, why we talk, therefore must be related to those contests.

How can these various and distinct approaches be reconciled? D'Andrade and Strauss (1992) propose that motivation is in fact a hierarchy (Figure 3). Master motives include food, security, love, sex, shelter, and play, which ultimately instigate action. In the middle range are schemas for things like marriage, work, etc. These schemas are not fully autonomous since one's marriage, or one's job is a means to more ultimate goals like love or food or sex or security. Finally, low-level schemas are explicit, conscious motivations for specific actions. These acts contribute to the satisfaction of middle schemas, and ultimately master motives. The collected 'topics' of this experiment are low-level schemas.



Figure 3. Hierarchy in Schemas. Graphic representation of D'Andrade's hierarchy of schemas related to motivations (D'Andrade and Strauss 1992).

Low-level schemas are potentially vast in number and highly idiosyncratic and situation specific and culturally diverse. Middle-level schemas apply perhaps to what Bourdieu called *fields*, structured social spaces with their own rules, schemes of domination, legitimate opinions and so on (e.g., marriage or work). Fields are culture specific and continuously negotiated, dynamically structured structures. They are also potentially great in number, and except for a few instances in space and time, have never been catalogued in any satisfactory way.

Master motives, however, are arguably few in number. Many lists have been proposed, which should include Maslow and Harris, but should also include the innate psychological mechanisms proposed by evolutionary psychologists. How, specifically, these motives are expressed in cultural behavior, however, may not be obvious. If D'Andrade is right, they are shaped by the middle scales of fields or discursive formations. They are ultimately encoded into the low-level schemas that we experience. Can these be reliably related to master motives? Again, an attempt was made to do so (Appendix B), but these results are less than satisfying. Demonstrating causal-chains between master motive and observed behavior is perhaps ultimately impossible, a product of the hierarchical nature of complex systems (Holling 1998). This does not mean that the attempt should not be made; I argue that

it should, but a simple scientific result will not appear. It is for this reason that systems research with its graphs and general results, as in this paper, may be the most effective solution for answering questions of such complexity. The information cycles (Figure 2) examined in this study cannot answer, in specific instances or at the individual scale, the *why*-question—why we speak, but the results of the study will be interpreted within this theoretical treatment of that question. Perhaps answers to the "why" question must be sought only in the motivations of individuals, as just described.

METHODS

Study Design

Much of social research is concerned with life as it is lived. Methods of study include naturalistic and laboratory observation, electronically activated recording (EAR) for the sampling of speech (Mehl, et al. 2001), questionnaires, and self-report instruments (diaries, log books). The first two methods provide objective data, while the second two record subjective accounts. The EAR and self-reporting methods provide naturalistic and real-time or close to real-time data. Self-reporting is technically referred to in the psychological literature as experience sampling (ES) or momentary assessment (MA). The term momentary assessment highlights that fact that the research participant will report on events close in time to the moment of experience. Minimizing the time lag between an event and its reporting effectively bypasses memory-related problems of standard questionnaires (Csikszentmihalyi and Larson 1987). Self-report instruments may be diaries, log books, or even electronic Personal Digital Assistant (PDA) devices that can be programmed to notify subjects when they are to record some facet of their experience.

Momentary assessment has a number of advantages and some disadvantages (Bolger, et al. 2003). The chief advantage is that MA permits the reporting of events in their natural, spontaneous context. It minimizes the amount of time between the experience and its reporting, and therefore the likelihood of forgetting and omission. And it results in a record of event dynamics that is not achievable with standard deferred questionnaires. Diaries, however, do require a high level of commitment and dedication from participants. Demands on participants are typically reduced by requiring short entries that take only several minutes to complete. This can limit diaries to less in-depth reporting than achieved by other methods. In addition, the act of diary completion may affect participants and their responses in some ways. Gleason, et al. (2001) observed a short-lived spike in negative emotion related to self-reporting that dissipated in two to three days. Litt, et al. (1998) reported that participants were aware of the monitored behavior but this did not change their experience or behavior. Participants may develop habitual response styles such as skimming over sections of a diary questionnaire that rarely apply to them. Also, the participants understanding of the surveyed domain may become more complex over the duration of the study or their conceptualization of the domain may become entrained to fit the issues measured in the diary (Bolger, et al. 2003). These limitations may be minimized by understanding their origins. In the current study some of these issues were avoided by requiring only short responses for each entry. Furthermore, the subjects did not complete a short questionnaire when reporting, but rather followed a single simple instruction discussed below.

Diaries are commonly used to discover central tendencies of the typical person as well as the range of variability between persons. They may be used to determine how subjects change over time or other temporal dynamics, an important advantage over other study designs that lack the fidelity of temporal reporting. Diaries may be used to discover within-person psychological processes that have antecedents, correlates, and consequences in daily experiences (Bolger, et al. 2003). In this study, the focus of the analysis was placed on central tendencies, variability, and the temporal dynamics of events as reported by the students, and although the student's psychological processes may have been evident, they were not of interest.

Three popular diary types are used, time-based designs with either fixed or variable schedules, and event-based designs (Bolger, et al. 2003). With time-based designs, subjects are required to record

ongoing events or emotions at times selected by the researcher. These reporting events may be on fixed or randomized schedules. With event-based designs, subjects are instructed to make diary entries following an event of interest. Examples of events might be interpersonal conflicts (arguments, verbal or physical abuse) or experiences of strong emotions. Difficulties arise with the ambiguity associated with identifying some events. For the current study, event-based reporting is used, and ambiguity is not an issue because events are unmistakable, as they are conversation events.

Diary Technology

This study utilized the earliest and most commonly used technology of paper and pencil (P&P) diaries. Advantages of this method include the low cost and simple format for participants. Since the study design was event-based and not time-based there was no worry with regard to missing reporting times and thus no need for electronic reminders, which have gained great popularity for time-based studies. It has been recommended that P&P diaries be easily portable, pocket-sized and bound into a single piece (Bolger, et al. 2003). Our diaries met each of these suggestions (Figure 4). Also, Bolger et al. (2003) recommended that responses be collected at several points during the length of a study. For this project, three diaries were used for each subject, collected and replaced at the end of each three week period. As also recommended (Bolger, et al. 2003), a pilot test of the diaries was performed and it was decided to reduce the number of pages (and replace the diaries after each week). In addition, changes were made to clarify diary instructions and demonstration procedures.

Diary Instructions

Diaries were carried by students for three weeks. Students were asked to record in quiet or private moments the conversation topics that they had just discussed. They were instructed to record topics in their own long or short phrases, in everyday terms. Dates, times, and conversation participants were also recorded. This was necessary to identify identical conversation events reported by different participants from the study, and thus avoid over-counting conversation events. For three weeks on every Friday, the students reported to my assistant to receive their new diary and a payment installment. Participants were expected to record conversation topic descriptions in the provided diary (Bernard 2006; Duck, et al. 1991; Harrison 2000):293-4. This required no supervision, and students recorded their information at times of their discretion. At the end of each week the diaries were collected and transcribed into Word documents, retaining the temporal order of topics, as well the dates of the conversations.



Figure 4. P&P Diary.

Subject Recruitment

All students in the Department of Human Development were invited to participate in an orientation meeting. In the meeting, my assistant and I described the research and the participant's responsibilities in detail. We invited all students in the department to participate in the study and each student participating signed a letter of consent and was paid the equivalent of \$30 in weekly installments, as is the standard procedure for campus experiments at this university. Since we achieved 100% participation, no statistical sampling methods were required.

Diary Data Analysis

Qualitative, subjective methods patterned after 'cultural models' studies (Li 2002, Quinn 2005) were later applied to the analysis of log books by independent judges (from the sophomore class). Log books were transcribed into Word files and all identifiers were removed.

Judges were divided into two groups of 4 and 2 for two sequential tasks. In the first task, the log book Word documents were divided among the 4 judges. They were asked to use their native language intuition and insider understandings to identify identical topics of conversation. Identifications had to be specific, i.e., not just 'basketball', but 'the play of Kobe Bryant in last night's Lakers game'.

When each student judge completed their stack, the stacks were shuffled, which occurred four times. Each judge therefore saw each of the log book documents. Extensive notes were made and judges endeavored to match conversation topics within a log book and between them. Judges were allowed to discuss among themselves during and after this process. The process was slow and deliberate, requiring over six hours, and numerous breaks were given and taken.

In the second round of evaluations, two different students reviewed all of the 'repeatedly shared' topics (39) that were identified by the first group, approximately 500 entries. Their task was to agree with the groupings and to choose a topic description, either from among the log book entries, or by identifying a new one. Open discussion of topics needed to lead to agreement on 'shared' topics. If no agreement could be reached, then the topic was separated into two, each with its own description name. All accepted topics were eventually given an agreed topic name. This process required ten hours over two sessions, with much of that effort, by the choice of the judges, applied to separating topics into meaningfully precise sub-topics. The next step was to assign each of the conversation topics to likely scales of influence as in Figure 2. For most cases this was relatively easy, though these are all admittedly subjective assignments (Appendix A).

RESULTS AND DISCUSSION

From over 4000 conversations topics, only 39 were found to be recurrent defined by a requirement of 5 references or more (Figure 5). One event, the Japan tsunami that happened to occur during the study period, elicited 99 distinct conversations.

Of the recurrent 39 topics, only three were judged to be contagious, meaning that the information shared in one conversation most likely resulted in similar discussion in a later conversation. An example is a conversation about restaurant food. As seen in Table 1, an initial conversation about the high quality of roast duck at Xiao Guang-Dong restaurant takes place between AM and BG. Two days later BG promotes the restaurant to AX. One day later AX promotes the duck to AL and AH, perhaps while enjoying it at dinner.

If contagious cycling within information cycles is not the explanation for the many other observed instances of recurrent conversation topics, what is?



Figure 5. Recurrent Conversation Topics

Table 1. Contagious Example.					
Names	Topic	Day	Time		
AM, BG	Roast duck rice of Xiao Guang-Dong is really tasty	14	5:00pm		
AM, BG	My roast duck has a lot of bones	14	5:30pm		
BG, AX	Xiao Guang-Dong's business is good; customers have to order in advance	16	1:20pm		
AX, AL	Roast duck rice of Xiao Guang-Dong is tasty	17	5::30pm		
AX, AH	Food of Xiao Guang-Dong is not expensive	17	5:45pm		

Patterns of Sharing

When conversation topics are recurrent there appear to be two general patterns that were often found. The next two figures are examples of these patterns. One is a quick pulse and a gradual rundown (Figure 6), and the second is a gradual build-up, followed by a steep drop-off (Figure 7).



Japan Earthquake and Tsunami

Figure 6. Quick Pulse and Gradual Run-Down.



Singing All Night Till Dawn at Karaoke TV

Figure 7. Gradual Build-Up and Steep Drop-Off.

I became curious about the regularity of these patterns and so turned to the simulation practices pioneered by Odum (Odum and Odum 2000). The two observed patterns can be generated in simple simulations called mini-models. There are a few mini-models that generate these curves independently, but there is one model that generates them both. That model is a predator-prey or oscillating model.

Oscillating Model

Recall that there are two principles associated with Figure 2 above: (1) information may be more widely shared by upgrading it to higher scales, and (2) information pulses from higher scales may initiate information production at lower scales. After much consideration, a unifying proposal was made. Both curves are the result of an oscillating system in which the timing of pulses comes from

larger scales (Figure 8). In the simulation diagram, the larger scale is represented by the second 'storage' symbol. When this model is used to simulate predator-prey oscillations, the second storage represents the predator, which comes appropriately from a larger/higher consumer trophic level or 'scale'.

Thus, within the media scale, the Japan earthquake and tsunami (as reported in the TV news) could represent the down pulse of an oscillating system in which the up pulse is the gathering of news story information by the network and is therefore not visible in this window of campus conversation (Figure 9).

These two patterns could be observed in roughly 50% of the cases of recurrent topics. This realization led to a more careful consideration of the content and subject matter of all the recurrent conversations. When doing so, it became obvious that many conversation topics were not completed in the time period of the study. Similarly, many had clearly been initiated prior to the study period window of three weeks. This can be represented in the following diagram (Figure 10). The flow of conversation is a cacophony of topics with durations that are highly variable. My study window was dropped essentially into the middle of that flow.



Figure 8. Oscillating System. The predator is represented by the 'storage' Q2, while the prey is Q1. The prey storage grows until at some point the predator's population expands to consume the prey.



Figure 9. Earthquake Communication as Oscillating Model.



Figure 10. Study Window in the Flow of Talk. Conversation is continuously produced in any speech community. Some conversation topics began before the 3 week window, some clearly would continue after the window.

Looking Outside the Window

At the scale of ritual influence, the semester basketball tournament supplies the timing and focus of regular practice and planning (Figure 11). The tournament itself is outside of the three week window, and it can be predicted that a run-up of conversation will precede it. It can also be anticipated that much conversation will follow the tournament, thus forming the down pulse of discussion.

With careful reading it was discovered that all nine of the twelve ritual influenced conversation topics that did not complete within the window of observation could indeed be attributed to upcoming events. In similar fashion, at the media scale, the three topics that did not complete within the window could all be attributed to prior events, such as the announcement of product price reductions ('sales') or, in the case of repeated conversations about two movies, *The King's Speech* and *Black Swan*, the Academy Awards show that occurred only a few days prior to the window.

For the ritual events that *did* complete within the window, down pulse conversation was indeed observed, though it required a more careful reading of the topic entries and reported chronology of these to identify conversations that indeed *followed* the event (Figure 12). Recall that both date and time were recorded by the student for each conversation. It was therefore possible to identify conversations that, while on the day of the event, actually occurred after. Those conversations occurred as a *result* of the build-up and staging of the event, and thus in a sense are a second flourish of conversation in response to or 'consumption' of the event.



Figure 11. Basketball Tournament as Oscillating Model.



Figure 12. Lecture as Oscillating Model. By attending to specific topics and the chronology of conversation it was observed that a number of conversations on the day of the lecture event actually occurred after the event, and are therefore included in the down pulse.

Cycles within Cycles for Greater Influence at Larger Scales

In Abel (2013) it is argued that the cycle time of the ritual cycle is in fact the larger time scale of the *planning* of a ritual season. Rituals are planned events that draw on past experiences of successful ritual events. They are repetitive at some cycle time, which varies between and within cultures. It is argued therefore, that the cycle time of any one ritual is actually the time between successive occurrences of that specific ritual. Furthermore, there may be an explicit planning event for the ritual season as a whole, which is common for universities, but also for sporting event seasons, and other ritual organizations. Thus a ritual season may be depicted as in Figure 13.



Figure 13. Ritual Cycle within Larger Scale of Ritual Season Planning.



Qualitative Research Class

Figure 14. Qualitative Research Class as an Oscillating Model. Again after careful reading it was discovered that conversations in the post event down pulses (light shading) were also present on event days. It may appear that cycling at this scale (education) is completed with each pulse, but in fact this oscillating pattern is the product of the larger education scale which has been argued in Abel (2013) to span the length of an academic semester. That semester unit is the conceptual whole of education delivery, subject to addition or deletion (selection) as a unit, and which makes possible the relatively accurate transmission of a complex body of information through repetition and review, structured content, and presentation by motivated and engaged instructors (Woolfolk 2001).

Rules Conflict in Applying for Dorm Rooms



Figure 15. Conflict over Dorm Assignments. A conflict over dormitory assignments for Hualien resident students would need to be resolved in policy committee meetings (outside the window), which would undoubtedly generate more conversation. Again, this scale of cycling should be expected to be nested within larger scales of campus legal code production.

In like fashion, education events (Figure 14) occur in similar nested cycles. Weekly classes nested within semesters, which themselves cycle yearly or bi-yearly. As in the ritual cycle, semester classes are selected in planning events that are yearly. Larger review periods may be five years or more. For these reasons it is argued that the formal education scale is larger still than the ritual scale (Figure 2) in space and time (Abel 2013).

Finally, at the scale of Legal Codes it can only be expected that a larger pulse of policy meetings exist outside of the window (Figure 15), and again that they are nested within larger scales of campus rule making events.

Returning to Figure 2 and 5, note that I have not reported any conversation production at the scale of academic research. This is not surprising, for the participants in this experiment are students and not their professors. A wider study would include professors and others.

Two Linked Oscillations

In sum, for each scale, we should ask, what is represented by the two halves of a paired oscillation? Figure 16 gives a brief description by which scales may be compared. In this experiment, the darker text was observed and the lighter text inferred.

With detailed reading of the diary data, it was ultimately found that all *widely shared* conversation topics, save one 'online gaming', fit this oscillating pattern.

Data Issues

Not surprisingly perhaps, there is evidence that not all conversation topics were recorded. While making diary recording ease was a priority, as discussed under *Methods*, the use of diaries still asks



Figure 16. Oscillation Signification.

much of participants. A simple check is to identify how often each of the participants did *not* record the same topics in the same conversation. With the time and participants of conversations recorded, it was fairly easy to identify same topic events (and thus avoid double counting). But this also makes it possible to identify when students failed to record topic events. In fact, the failure to record identical topics occurred in over 60% of cases. This is perhaps an important result for judging the method of P&P diary experience sampling in the many other experiments where it has been applied.

Why is that not a problem for this study? It should be clear that the outcome of this research has been to identify trends of contagious sharing and patterns of topic production. This has been successfully achieved. If there were indeed more cases in some or all categories the outcome would arguably be similar, although more demonstrations may have given greater resolution of the oscillation patterns. The principle results of this research are not dependent upon precise quantitative distributions. Instead, they are qualitative demonstrations of the dynamics and perhaps causality of topic production.

It was an original design decision to set the cut-off for 'shared topics' at 5 conversation events. This was rather arbitrary, and an equally good cut-off might have been 3, or even 2. It can be reasonably argued that this decision particularly impacts data for the media scale. Media cycles are fast in duration. That is their nature, as explained in Abel (2013). Therefore, this could give participants less opportunity to engage in conversation about a topic, as new topics are rapidly replacing the old in the cycles of news broadcasting and in the lives of the students.

Implications for the Information Cycle

Returning to the 'information cycle,' what does that conceptual model add to all this? We know that one conversation within any scale is one cycle, and useful information is re-cycled in contagious cycling. Three cases of evidence for contagious cycling were found, one each initiated at the media, ritual and education scales. Contagious information may therefore be said to occur at anytime under the influence of any scale, though it is arguably most important to a system when it occurs on the large-scale pulses.

Why was contagious conversation not observed more often? It may be that conversation is the least prone scale to contagious transmission. As discussed in Abel (2013) regarding conversation, the intermediate carriers (brains) are individuals and unique, and it is recognized by cognitive scientists (Atran 2001) that communication between individuals is often 'transformation not transmission', because of the interpretation that is required by receivers of speech. Rather than a high fidelity exchange, conversation is an effective means of transmission because learning is statistical (Saffran 2003), the product of *many* conversation events that accrue over time and approximate some meaningful form.

In contrast, for the scales of media, ritual, education, etc, the 'intermediate carriers' between information production and human mind are much better – paper, electronic storage, textbooks, published standards, journal articles, etc. Elements of larger scale information cycles, these carriers greatly improve the fidelity of transmission. At these scales, contagious spreading is probably more common. Examples are well known: a breaking news story picked up by other networks, a successful course copied by other universities, an academic result accepted and built upon. These are the big pulses at each scale.

The Oscillation Model and the Information Cycle

How does the information cycle (Figure 1) relate to the oscillating model? As has been explained, one conversation, one news story, one ritual event, etc. is one pass through the information cycle. Contagious information has multiple cycles that carry the same information. But what is often ignored in the information cycle is the process labeled 'Sense Contribution.' This process is said to be located at larger scales, and to control the process of information 'selection'. In ecosystems, that scale may be a top carnivore, which is consuming those *not* selected. Or it may be mineral cycles, choosing plant species that can survive and additionally contribute to the uptake and holding of nutrients within the mineral cycle.

In the case of information cycles, the role of selection, as has been discussed in this paper, is the coming event, or particularly, the larger temporal cycle event by which a year or season of events is structured. Figure 17 makes the point that the relationship between the information cycle and the oscillating model is intimate.

In Figure 17, we see that the larger scale selects conversation topics, i.e., the coming event will determine what is being talked about. And perhaps of greater importance, it is the presence of the coming event that is setting the timing of conversation.

The Role of Information Cycles

What then is the role of the information cycle in the production of conversation? The information cycle may help to unravel the contributions that cultural information in its many forms makes to the necessities of self-organization of the larger human-ecosystem. Information cycles at greater scales may provide the pulses of energy that *initiate* specific instances of conversation, and that determine their duration and timing.



Figure 17. Information Cycle as Oscillation Model.

In fact, it may be that the 'institutions' that we refer to as ritual, media, education, etc. have selforganized *because* they function to motivate people. They provide in pulses the emotional energy that instigates the many types of activity that constitute complex societies. They motivate through a complex hierarchy of schemas, fields, and master motives. They are effective because they interact with basic human psychological and emotional needs. It may be, therefore, that information cycles provide a key portion of a systems explanation for why we speak.

What is first necessary for such an argument is the recognition and demonstration of the hierarchy of cultural information forms and their interactions. That is perhaps the most significant outcome of this research. Ecosystems are widely recognized to be hierarchical entities, composed of many scales, including various producers and consumers (Allen and Holling 2008; Odum 2007). But human culture has never been conceived in a similarly hierarchical form (Abel 2013). The result of doing so, and the demonstration of that hierarchy, provides a key contribution to systems thinking generally, and specifically to the study of human-ecosystems. Function and process at the scale of ecosystems has been studied for decades by ecosystems ecologists and others. A truly integrated human-cultural component in that study should be of great benefit to ecology, and to the centuries-old study of the nature of culture.

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APPENDICES

Appendix A: Information Scales and Topic A	Assignments
TV News, Entertainment, and Marketing Medi	a
TV News	
10K Run accident	Price increases, food and gas
Taipei Floral Expo	Japan Tsunami
Free phone calls	Visiting Warships
Entertainment Media	
Fierce Wife	KTV all night
Good movies	-
Marketing Media	
Beauty Masks	KTV all night
Taipei Floral Expo	Malaysia vacation
Free phone calls	Online games
Good movies	Passport photos
Grad trip prep	
Internet Scale	
Online games	
Ritual Cycle	
Basketball practices	Professor buys dinner
Basketball tourney	Malaysia vacation
Children's Play	Passport photos
Gidden's speech	Weight loss contest
Grad exam study group	Yearly play rehearsal
Grad trip prep	
Education Cycle	
Career planning	Class - World
Class - Behavioral Science	Class - Yoga
Class - Forensic Anthropology	Dance club
Class - Oral present and discord	Grad exam study group
Class - Quantitative Research	Interview Malaysia exchange student
Class - Social Psychology	Yearly play rehearsal
Class - Special Ed	
Legal Codes Scale	
Living in Dorms	Visiting Warships
Student meeting	
Enculturation, Lifecycle Scale	
Career planning	Passport photos
Grad exam study group	Tutoring
Grad trip prep	Visiting Warships
Interview Malaysia exchange student	

Mate Selection				
Physical appearance maintenance				
Weight loss contest	Beauty Masks			
Reputation maintenance and managing	; threats			
Career planning	Log books			
Class - Oral present and discord	Romantic triangle			
Class - Forensic Anthropology	Student meeting			
Fierce Wife				
Status striving, men - showing off				
10K Run	Dance club			
Basketball practices	Grad exam study group			
Basketball tourney	KTV all night			
Career planning	Tutoring			
Class - Yoga				
Status striving, women - supporting gro	oup goals			
10K Run	Grad exam study group			
Beauty Masks	KTV all night			
Career planning	Tutoring			
Class - Yoga	Weight loss contest			
Dance club				
Rites of passage				
10K Run	Passport photos			
Career planning				
Cooperation and Coalition Formation				
Reciprocal altruism, costly signaling an	d coalition allegiance			
Basketball practices	KTV all night			
Basketball tourney	Student meeting			
Dance club	Tsunami relief organizing			
Grad exam study group	Weight loss contest			
Specialization or original input				
Career planning	Roast duck			
Reputation maintenance - avoiding defe	ecting, cowardice, cheating			
Career planning	Log books			
Class - Oral present and discord	Student meeting			
Class - Forensic Anthropology	Tsunami relief efforts			
Fierce Wife				
Parenting and Parental Investment				
Cheater detection				
Fierce Wife	Romantic triangle			
Sexual jealousy				
Fierce Wife	Romantic triangle			

Appendix B: Possible Explanations from Evolutionary Psychology Mote Selection