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Original Article

USING THE METHODS OF EXPERIMENTAL SOCIAL PSYCHOLOGY TO STUDY CULTURAL EVOLUTION

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Abstract
Cultural psychology, and other social sciences (e.g. cultural anthropology, sociology), seek to document cultural variation, yet have difficulty providing strong empirical tests of explanations for that variation. It is argued here that an effective means of testing hypotheses regarding the origin of, and persistence and change in, cultural variation is by simulating cultural transmission in the lab using certain methods from experimental social psychology. Three experimental methods are reviewed: the transmission chain method, the replacement method, and the constant-group method. Although very few studies have explicitly simulated specific cross-cultural patterns, much potential exists for future investigations. This integration of small-scale experimental simulations and large-scale observational or historical data is facilitated by an evolutionary framework for the study of culture, and has a precedent in the biological sciences, where experiments are used to simulate and explain the processes of biological evolution.

Keywords: Culture, cultural transmission, cultural psychology, cross-cultural psychology, social psychology, cultural evolution, evolutionary psychology, Bartlett, evolutionary synthesis

Introduction

This new forum, the *Journal of Social, Evolutionary and Cultural Psychology*, seems an ideal place to discuss a particular interaction between these three fields that has hitherto received little attention. The central message of this paper is that certain methods of experimental social psychology can usefully inform our understanding of cultural variation and cultural change, by simulating that cultural change under controlled conditions in the psychology lab. These methods can enrich cultural psychology as well as other social sciences such as anthropology and sociology by allowing strong empirical tests of specific hypotheses regarding the origin of cultural variation and the mechanisms underlying the persistence of and change in that variation.

Culture is here defined as the body of information, such as knowledge, beliefs, attitudes, norms, skills, etc., that is passed from individual to individual via social learning/cultural transmission, is stored in brains or artifacts (e.g. books), and may be

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expressed as behavior, language or artifacts (e.g. tools). This is contrasted with information that is passed on genetically in DNA, and information that is recreated or rediscovered independently in each individual (through individual or asocial learning). This culturally transmitted information can vary *spatially*, with different culturally transmitted traditions characterizing different regions or social groups, or *temporally*, wherein cultural information changes over time and may in some cases accumulate successive modifications over multiple generations (Boyd & Richerson's [1996] "cumulative culture" or Tomasello, Kruger, & Ratner's [1993] "ratchet effect"). This paper focuses on spatial (geographic or ethnographic) cultural variation, although temporal cultural change is discussed in the next section as a means of explaining spatial variation.

The study of cultural variation has traditionally been the purview of anthropology and sociology (e.g. Benedict, 1934; Geertz, 1973; Kroeber, 1948; Kroeber & Kluckohn, 1952; Kuper, 1999; Murdock, 1932; Steward, 1955; Tylor, 1871). Specifically, ethnographers have compiled ethnographic databases (e.g. the Ethnographic Atlas: Murdock, 1967; or the Human Relations Area Files: Murdock et al., 1987) that chart enormous cultural variation across many societies world-wide, from means of transportation to premarital sex taboos to social stratification. Similar databases map variation in the almost 7000 languages worldwide (Grimes, 2002). Perhaps more pertinent for this journal, the growing field of cross-cultural psychology[1] (Choi, Nisbett, & Norenzayan, 1999; Heine & Norenzayan, 2006; Lehman, Chiu, & Schaller, 2004; Nisbett, Peng, Choi, & Norenzayan, 2001) has documented cultural variation in numerous psychological characteristics and in various societies world-wide, including aspects of perception (Masuda & Nisbett, 2001; Segall, Campbell, & Herskovits, 1963), economic decision-making (Henrich et al., 2005), and attributions and motivations towards self and others (Choi & Nisbett, 1998; Heine, Lehman, Markus, & Kitayama, 1999).

Anthropology and sociology typically have little interaction with psychology, and when they do it is with cognitive, rather than social, psychology (e.g. D'Andrade, 1995). Cross-cultural psychology also typically has a foundation in cognitive psychology or perception, where individuals' performance on cognitive or perceptual tasks is compared across cultures. However, these disciplines are neglecting another experimental psychology literature - that of a particular tradition within social psychology regarding cultural transmission - that can enrich their fields by explaining the *causes* of cultural variation, by simulating how and why that variation changes or persists over time. First, however, we will examine existing theories and methods that have been used to explain cultural variation.

Explaining Cultural Variation

One problem with the charting of cultural variation within cross-cultural psychology and cultural anthropology is that it tends to be descriptive rather than explanatory. Although the mapping of cultural variation is crucial, an equally important

[1] I refer here to mainstream cross-cultural psychology, rather than the alternative Vygotskyan strand of cultural psychology (e.g. Shweder, 1990; Vygotsky, 1978). This is not to say that the experiments outlined here have no relevance to the latter, merely that constraints on space prevent a more detailed exploration of how they specifically relate to the Vygotskyan sub-field.

next step is to explain how that variation came about and what mechanisms are responsible for its persistence.

Past attempts to explain cultural variation within anthropology and sociology have often been incomplete and unsatisfactory. For example, diffusionists (Graebner, 1905, 1911; Rogers, 1995) attempt to explain all cultural variation in terms of the transmission of traits between different groups, without providing rigorous, empirically supported explanations for why some innovations spread, and others do not spread, from one group to another. Materialists (e.g. Harris, 1989), meanwhile, assume that all cultural variation is functional or adaptive, which fails to explain maladaptive or arbitrary cultural variation (Durham, 1992; Mesoudi, Whiten, & Laland, 2004; Richerson & Boyd, 2005). Similar problems face the argument by some evolutionary psychologists (e.g. Gangestad, Haselton, & Buss, 2006; Tooby & Cosmides, 1992) that cultural variation is generated by biologically evolved responses to immediate environmental variation. This "evoked culture" argument is also weakened by the extensive evidence for the transmission of cultural information independently of genes (Mesoudi, Whiten, & Laland, 2006; Richerson & Boyd, 2005).

It is problematic to assume *a priori* that all cultural variation can be explained with a single, vaguely specified cause, such as cultural transmission/diffusion, individual learning/adaptation or evoked biologically evolved responses to the environment. This is not to say that any of these explanations are incorrect, merely that they are not mutually exclusive. Any single pattern of cultural variation may be the result of any or all of these to differing degrees. What is needed are empirical methods to partition specific patterns of cultural variation according to their underlying causes, as well as explore in more detail the mechanisms of each (e.g. whether cultural transmission is horizontal, oblique or vertical [Cavalli-Sforza & Feldman, 1981], or whether it exhibits conformist, anti-conformist or prestige-based biases [Boyd & Richerson, 1985]).

One way of testing potential explanations for cultural variation is by examining the history of that variation, in order to look at its origin and persistence. For example, Nisbett, Peng, Choi and Norenzayan (2001) argued that many of the differences in psychological attributes observed by cross-cultural psychologists between East Asians and Western Europeans can be traced back to differences in systems of thought and social organization between ancient Chinese and ancient Greek societies, the former being collectivist and the latter individualist. These different forms of social organization were in turn linked to differences in subsistence: the ancient Chinese depended upon large-scale agriculture that fostered cooperation, while the ancient Greeks relied on more individualistic hunting and fishing. However, as Nisbett et al. (2001) themselves note, these links are speculative, and many questions remain regarding the mechanisms underlying the persistence of these differences over millennia.

A more rigorous and formal means of testing hypotheses regarding the origin of cultural variation is by using the comparative method with large samples of ethnographic, historical and/or archaeological data, to show when and where cultural variation first arose and how it changed over time. For example, the comparative method can be used to identify specific environmental factors that correlate with a particular cultural variant, as used by Mace and Pagel (1994) to show that camel herding in East Africa was adopted (either culturally acquired or independently invented) only in dry climates. Cladistic methods such as those employed by Mace and Pagel can be used to further identify whether two populations share a particular cultural trait because they both inherited it from a common ancestral population, or whether it was independently invented in each population (for overviews of such work, see Lipo, O'Brien, Collard, & Shennan, 2006; Mace & Holden, 2005).

Historical methods, however, feature several limitations that restrict their usefulness for explaining the origin and persistence of cultural variation (Mesoudi, in press). Historians and archaeologists cannot 're-run' history multiple times to explore the effects of contingency on cultural change; they cannot manipulate variables in different runs to explore the effects of those variables; they cannot assign groups or societies randomly to different experimental and control conditions; and they rarely have access to complete, uninterrupted and unbiased data. Experimental methods allow us to do all of these – they allow multiple replications, the manipulation of variables, the random assignment of groups to different conditions, and the generation of complete datasets. In the next section it is argued that one potentially powerful way of testing hypotheses regarding the origin and persistence of cultural variation is by simulating cultural transmission in the psychology lab, using experimental methods developed within social psychology.

Mathematical models and computer simulations offer many of the same advantages as experimental methods, and have similarly been used to explore and explain historical (Turchin, 2003), archaeological (Henrich, 2004; Kohler & Gumerman, 2000; Neiman, 1995; Shennan & Wilkinson, 2001) and sociological (Bentley, Hahn, & Shennan, 2004; Henrich, 2001) patterns of cultural change and variation, as well as cultural change more generally (Boyd & Richerson, 1985; Cavalli-Sforza & Feldman, 1981). More detailed discussion of mathematical and computer models is beyond the scope of this paper, beyond noting that such methods are perfectly complementary to the experimental methods discussed here. While mathematical and computer models can often be more rigorous and comprehensive than experiments (allowing the manipulation of many more parameters and conditions than is possible with experiments, for example), mathematical models and computer simulations are only ever as good as their assumptions, and experiments provide a useful means of testing those assumptions with real people. Of course, experimental methods feature several limitations of their own, most obviously a lack of external validity compared with observational and historical methods, and these limitations are discussed in the final section. First, however, let us examine these experimental methods in more detail.

Using Social Psychology Methods to Simulate Cultural Transmission

Social psychology has a set of experimental methods that allow researchers interested in cultural variation, such as anthropologists, sociologists and cross-cultural psychologists, to empirically test hypotheses regarding the mechanisms responsible for the origin and persistence of that cultural variation. Essentially, these methods allow researchers to simulate cultural change under controlled conditions in the laboratory. The following sections discuss three of these methods – the transmission chain method, the replacement method, and the constant-group method.

The transmission chain method

This method, originally developed by Bartlett (1932), is similar to the children's games "Chinese Whispers" or "Broken Telephone," and involves passing material (usually written text) relevant to the hypothesis being tested along chains of participants.

The first participant in the chain reads or hears the material and, following a short delay or distracter task, attempts to recall it. The resultant recall is then given to the second participant, who does the same. Their recall is in turn passed to the third participant, and so on along the chain (Figure 1). The changes that occur to the material as it is transmitted along the chain, and/or the different degradation rates of different types of material, can then reveal systematic biases in cultural transmission. Although highly simplified compared with real human culture, the transmission chain method affords a high degree of experimental control and, as will be seen below, has the potential to provide important contributions to the study of cultural transmission and cultural variation. Indeed, it has been described by Plotkin (1995, p. 219) as "close to an experiment tailor-made for those interested in culture."

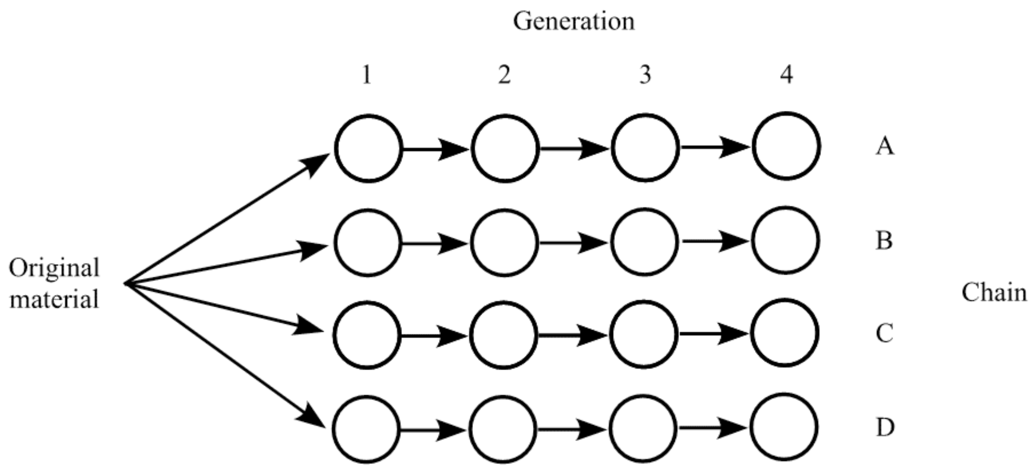

Figure 1 – Experimental design of a typical transmission chain study. The original material relevant to the hypothesis under investigation is given to the first participant (circles indicate participants) in each of four parallel chains (A-D). This material is then passed along four further participants/generations (1-4) in each chain. Changes in accuracy, quantity or content of the material can be assessed in each generation, to test for specific biases in cultural transmission.

Bartlett (1932) reported results for various types of material: two folk tales, "The War of the Ghosts" (from Native American culture) and "The Son Who Tried to Outwit His Father" (from the Congo); passages describing a cricket match, an air raid, and how to play tennis; a joke; two arguments; and a series of pictures. The participants were mostly Cambridge undergraduates, with some undergraduates from India. A general finding was that the material rapidly became considerably shorter in length and lost much of its detail, with only the overall gist being preserved. A second general finding was that participants tended to distort the material to make it more coherent and consistent with their own pre-existing knowledge. "The War of the Ghosts," for example, contained many supernatural elements that were nonsensical to the British participants and were subsequently removed or replaced with more familiar events. These two processes, loss of detail and rationalization, led Bartlett to propose that remembering is primarily a *reconstructive* process and hardly ever a process of exact replication. Only the gist or overall impression of the material is preserved and is rebuilt around pre-existing knowledge structures, or schemas. Bartlett also found that the folk stories were transmitted with greater accuracy than any of the other material, which he explained by arguing that people already possess implicit story schemas that contain the structure of a typical folk tale, thus aiding recall.

In the 30 years following Bartlett's (1932) original studies, several transmission chain studies were carried out which shared Bartlett's general methodology but varied in the material used and participants tested. The transmission of stories was studied using chains of children (Northway, 1936) and adults of different professions (Maxwell, 1936) and nationalities (Talland, 1956). Allport and Postman (1947), Ward (1949), and Hall (1951) studied the transmission of pictorial rather than written stimuli. The results of these studies largely confirmed Bartlett's original findings of a general reduction in the length or complexity of the material, that many of the details are lost, and only the overall gist or impression is preserved.

Although Bartlett's (1932) work was groundbreaking, it can be criticized on a number of grounds, as can many of the subsequent studies listed above. There was little attempt at any quantitative or statistical analyses, the methodology was poorly described and unstandardized, and inferences were often drawn on single chains that are vulnerable to individual idiosyncrasies, making results difficult to generalize and replicate. More recent studies, however, have updated the transmission chain method according to modern standards of experimental psychology, such as the reporting of standardized experimental procedures, the use of statistics, and sample sizes large enough to yield significant results.

For example, Bangerter (2000) used the transmission chain method to test whether participants' gender stereotypes would distort a scientific text describing conception, passing it along twenty replicate chains each containing four participants. It was found firstly that the sperm and ovum described in the text were anthropomorphised, moving from the object to the subject position of sentences, and secondly, the sperm tended to be given an active role and the ovum a passive role, which Bangerter (2000) attributed to gender stereotyping. In a similar study, Kashima (2000) had twelve chains each comprising five generations transmit a single story containing both stereotype-consistent (SC) and stereotype-inconsistent (SI) behaviour. Although the first two generations were more likely to recall SI than SC information, in the final two generations this trend was reversed, with better recall of SC information. This effect was due to the different degradation rates of the two types of material: although SI information was initially recalled more accurately, it then underwent faster degradation than the SC information, so that by the last two generations it had fallen below the SC recall level. Kashima's (2000) study is important because it shows that the transmission chain method can reveal effects in later generations that cannot be predicted by patterns of individual recall (i.e. the first generation), demonstrating the benefit of this methodology over standard single-generation memory studies.

Mesoudi and Whiten (2004) used the transmission chain method to test Schank and Abelson's (1977) hypothesis that people's knowledge of routine events, such as going to a restaurant, is represented in hierarchically organized "action scripts." The overall goal of the script (e.g. to go to a restaurant) constitutes the highest level of this hierarchy. This can be subdivided into a series of constituent subroutines (e.g. enter the restaurant, sit down, order food, eat the food, pay, and leave), each of which can in turn be subdivided into a series of low-level actions (e.g. pick up the menu, read it, decide on the food, and tell the waiter). Mesoudi and Whiten (2004) tested this hypothesis in the context of cultural transmission by passing descriptions of three everyday events (going to a restaurant, getting up, and going shopping) expressed entirely in terms of low-level actions along ten parallel chains each comprising four participants. Consistent with Schank and Abelson's (1977) script hypothesis, the low-level actions were gradually subsumed into their higher-level parent goals as they were transmitted along the chains, demonstrating that the participants were spontaneously imposing a hierarchical structure onto the event knowledge and transforming the events into higher levels of that structure. So, rather than the participants just 'simplifying' the material (Bartlett, 1932), Mesoudi and Whiten (2004) demonstrated that this simplification occurs in a systematic manner according to a hierarchical bias in cultural transmission.

Finally, Mesoudi, Whiten and Dunbar (2006) found that information regarding social relationships and social interactions (e.g. a student having an affair with her professor, or asking for directions) was transmitted with significantly greater accuracy and in significantly greater quantity than information regarding non-social interactions (either an individual interacting with the physical environment or interactions within a physical system). This is consistent with evolutionary hypotheses which argue that primate intelligence evolved to solve social problems (Byrne & Whiten, 1988; Dunbar, 2003; Whiten & Byrne, 1997), with one consequence of this 'Machiavellian intelligence' or 'social brain' hypothesis being that individuals should preferentially attend to, process and transmit social information over non-social information. Mesoudi et al. (2006) therefore argued that this bias for social information represents a biologically evolved bias in cultural transmission.

In summary, Bartlett's (1932) transmission chain method constitutes a simple yet effective means of testing hypotheses regarding cultural transmission under controlled experimental conditions. Although early studies featured a number of methodological shortcomings, more recent studies have demonstrated that the transmission chain method can be updated to meet modern standards of experimental psychology, specifically by the use of multiple parallel chains, quantitative and statistical analyses, and properly standardized and controlled methodology.

Bartlett (1932) was also aware of the wider implications of the transmission chain method, stating that "elements of culture, or cultural complexes, pass from person to person within a group, or from group to group, and, eventually reaching a thoroughly conventionalized form, may take an established place in the general mass of culture possessed by a specific group" (Bartlett 1932, p. 118). Hence Bartlett argued, as is argued here, that the results of these small-scale laboratory studies regarding memory biases along linear chains of a few individuals can potentially be extrapolated up to explain certain large-scale patterns in cultural variation. Although this has yet to be tested formally, we can speculate that the kinds of information that are preserved well in the experimental simulations, such as folk tales (Bartlett, 1932) or information regarding social relationships (Mesoudi, Whiten, & Dunbar, 2006), should be more stable over time and more prevalent than certain other types of information. Indeed, we might informally note that folk tales have indeed been preserved over many generations precisely because of their schema-like properties (Rubin, 1995), while the popular mass media tends to favor social gossip over non-social factual information (Mesoudi, 2005), although more systematic tests are needed to investigate such links more fully.

The replacement method

One limitation of the transmission chain method lies in the linearity of the one-to-one chains. Actual cultural transmission may frequently involve more than one model and more than one receiver, and a slightly different method is needed to study these more group-based aspects of transmission. The replacement method, originally proposed by Gerard, Kluckhohn and Rapoport (1956), involves establishing a norm or bias in a group of participants, and one by one replacing the participants with new, untrained participants (Figure 2). Each replacement represents one cultural "generation." The degree to which the norm remains in the population during successive replacements/generations represents a measure of its successful transmission to the new members.

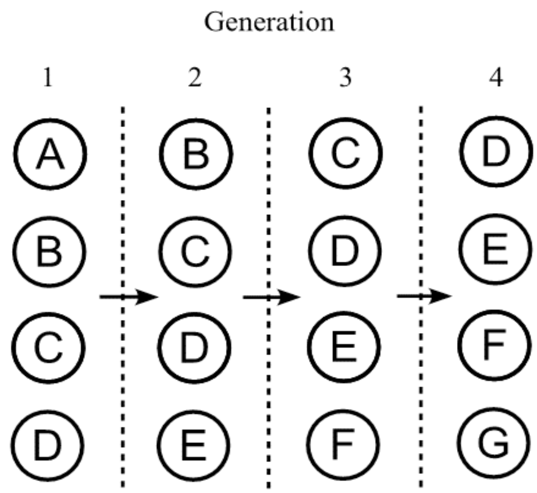

Figure 2 – Experimental design of a typical replacement method study. Each generation (1-4) comprises a four-member group, who typically must perform some task or solve a problem. After each generation, one member of the group is replaced with a new participant (e.g. in generation 2, A is removed and E is added). The degree to which norms or strategies persist despite replacement represents a measure of cultural transmission.

Jacobs and Campbell (1961) used the replacement method to study the persistence due to conformity of an artificially exaggerated perceptual judgment of the "auto-kinetic effect," a perceptual illusion in which a stationary point of light is perceived as constantly moving slightly when viewed in an otherwise pitch-black room. In earlier work by Sherif (1936), groups of participants were shown this illusion and the group members asked one by one to estimate publicly how much they thought the light was moving. Each group was, in fact, composed of only one genuine participant, the rest being confederates of the experimenter who had been instructed to give unrealistically exaggerated estimates of the light's movement. Sherif's (1936) now-classic finding was that most of his participants gave estimates similar to those of the confederates despite that estimate being obviously false, illustrating the powerful effect of conformity in group settings. Jacobs and Campbell (1961) repeated Sherif's (1936) experiment with the addition that, after each round of estimating, one group member was replaced with a new, naïve participant. Significant evidence of the inculcated norm was found for about four or five generations after the replacement of all of the confederates, after which the perceptual judgment returned to that exhibited by naïve control groups. This demonstrates some degree of transmission but no long-term persistence.

Weick and Gilfillan (1971) used the replacement method to study the persistence of problem-solving strategies. Participants in a group had to individually call out numbers, without being able to hear the other members' numbers, so that the sum total of all group members' numbers equaled a specified target value. Groups were taught either hard or easy strategies for coordinating their responses, and group members were periodically replaced with new participants. It was found that the easy strategies persisted for about eight generations after the last trained member had been replaced, while the difficult strategies were hardly transmitted at all, demonstrating that high fidelity transmission of problem-solving strategies is possible when the strategy is both effective and easy to implement.

More recently, Baum, Richerson, Efferson and Paciotti (2004) used the replacement method to study cultural transmission in an anagram-solving task. Groups of participants could choose to solve an anagram printed on either red or blue card. The red anagrams gave a small but immediate payoff, whereas the blue anagrams gave a larger payoff but were followed by a "time-out," during which no anagrams could be solved. By manipulating the length of this time-out, the experimenters were able to determine which of the two anagrams gave the highest overall payoff; when the blue time-out was short, blue was optimal, and when the blue time-out was long, red was optimal. Every 12 minutes one member of the group was replaced with a new participant. It was found that the optimal choice of anagram type tended to emerge in the groups, and was transmitted through successive generations, with existing group members instructing new members in the optimal choice by transmitting either accurate or inaccurate information about payoffs, or (less frequently) through coercion.

Most relevant to the present discussion, however, is a set of studies by Insko et al. (1980; 1982; 1983), which used the replacement method to simulate the trading of goods between groups, with the aim of testing competing anthropological theories regarding the emergence of particular forms of social organization in traditional societies. In the most relevant study, Insko et al. (1983) tested two alternative theories regarding the origin of "chiefdoms," which are collections of small bands or villages that engage in mutual trade. Service (1975) argued, based on archaeological and ethnographic data, that chiefdoms emerge when three conditions are present: (i) inequality of resources, such that different villages produce different products for trade; (ii) geographic centrality, such that one village occupies a position of economic superiority (i.e. it does not depend on the other groups for the production of viable goods) and communicative superiority (i.e. all trade must be conducted through that dominant group); and (iii) geographic circumscription, such that it is more advantageous for villages to trade with each other than to relocate. An alternative theory proposed by Carneiro (1970) argued that chiefdoms emerge instead when conditions (i) and (iii) exist but additionally where one village has a military or coercive advantage over other villages, such that it can confiscate goods without voluntary trade.

Insko et al. (1983) simulated these different scenarios for state formation in the social psychology lab using the replacement method. Three groups each comprising four participants were taught to produce different paper models, for which they could earn money. Earnings were maximized if paper models from different groups were combined, encouraging trade. In the "Service" condition, one group was placed in a position of economic and communicative superiority by making its products more valuable than those of the other two groups, and forcing all trade to be conducted through it. The other groups, however, retained control over their products and were free to withhold them or negotiate their trade value. In the "Carneiro" condition, the dominant group was allowed to freely confiscate and redistribute the other groups' products as it saw fit. In both conditions one member of each group was replaced with a new participant after each round of trading, with a total of nine replacements/generations, in order to simulate the overlapping generations and intergenerational cultural transmission of traditions observed in traditional societies. It was found that there was significantly less production and lower earnings in the Carneiro condition than in the Service condition for all groups, both subordinate and dominant. In addition, significantly more social unrest was observed in the Carneiro groups: the subordinate groups were less accepting of the dominant group's authority, less motivated, and more frequently attempted strikes, slowdowns and sabotage. Although not explicitly acknowledged by Insko et al. (1983), we can predict on the basis of these findings that voluntaristic Service-style societies would out-compete and outlast the less productive and more unstable coercive, Carneiro-style societies, through a process of cultural group selection[2] (Boyd & Richerson, 1985; Richerson & Boyd, 2005). Hence the simulations support Service's (1975) explanation for the origin of hierarchically organized chiefdoms, although as Insko et al. (1983) note, further simulations varying many other parameters and conditions are needed to fully resolve this debate.

In summary, the replacement method offers a useful complement to the transmission chain method. Whereas the transmission chain method has been mainly used to study the transmission of verbal material along one-to-one chains, the replacement method has been used to study the emergence and persistence of group-wide behavioral traditions that may persist despite changes in the composition of groups. This is a likely situation in business organizations and traditional societies, making it ideally suited to simulating certain economic, sociological or ethnographic data. Indeed, this is demonstrated by Insko et al. (1983), who tested a specific anthropological hypothesis regarding the emergence of hierarchically organized chiefdoms.

The constant-group method

A third and final method looks at cultural transmission within groups of participants with no replacement, where group membership is constant. Here, individuals within a group perform some task or play a game, and are given the option of copying one or more other group members (Figure 3). This method can be used to test claims about when people choose to copy others as opposed to learn on their own, and who they choose to copy. A large body of theoretical work suggests that such factors can significantly affect large-scale cultural dynamics and play a major role in generating different patterns of cultural variation. For example, copying other individuals at random

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[2] The theory of "cultural group selection" derives from group selection theory in evolutionary biology (e.g. Wynne Edwards, 1962), popular in the first half of the 20th century, which holds that biological evolution occurs through competition between different groups of individuals, such as flocks of birds or even entire species. This competition leads to the differential survival and reproduction of successful groups, and the spread of group-beneficial traits such as in-group altruism. Group selectionist arguments have been largely discredited within biology as being extremely unlikely because groups rarely persist for long enough to be subject to selection, do not reproduce with high fidelity, and are vulnerable to exploitation by selfish individuals, or free-riders, moving between groups. Natural selection is now predominantly seen as occurring at the level of the gene (Hamilton, 1964; Dawkins, 1976), favouring the spread of traits that are beneficial to genes, such as kin-based altruism. Richerson and Boyd (2005), however, have argued that group selection is a viable theory in cultural, rather than biological, evolution, where different social groups compete and differentially reproduce, because of social mechanisms like conformity, which reduces within-group variation and keeps groups from breaking up, and cultural transmission, which allows groups to "reproduce" their values and beliefs through time.

has been shown theoretically to result in a distinct "power law frequency distribution," which features a small number of very popular traits and a large number of relatively uncommon traits (Bentley, Hahn, & Shennan, 2004). Conformity (copying the group majority) can lead to cultural group selection and in-group altruism towards non-kin (Boyd & Richerson, 1985; Richerson & Boyd, 2005; see also note 2), while copying successful or prestigious individuals can lead to the "runaway selection" (i.e. extreme exaggeration in size, form or number) of those cultural traits that act as markers of prestige, such as tattoos, hairstyles or number of publications (Boyd & Richerson, 1985). Finally, with purely individual learning and no social learning, then culture would not exist, while with purely social learning and no individual learning, culturally transmitted information would become out-dated in changing environments. The constant-group method can be used to verify, under controlled conditions, these and other theoretically predicted cultural dynamics in groups of actual people, and explore the conditions under which these different learning rules are employed. In practical terms, the constant-group method requires fewer participants and is less time consuming than the replacement method, which requires a steady stream of new participants to introduce into the group[3].

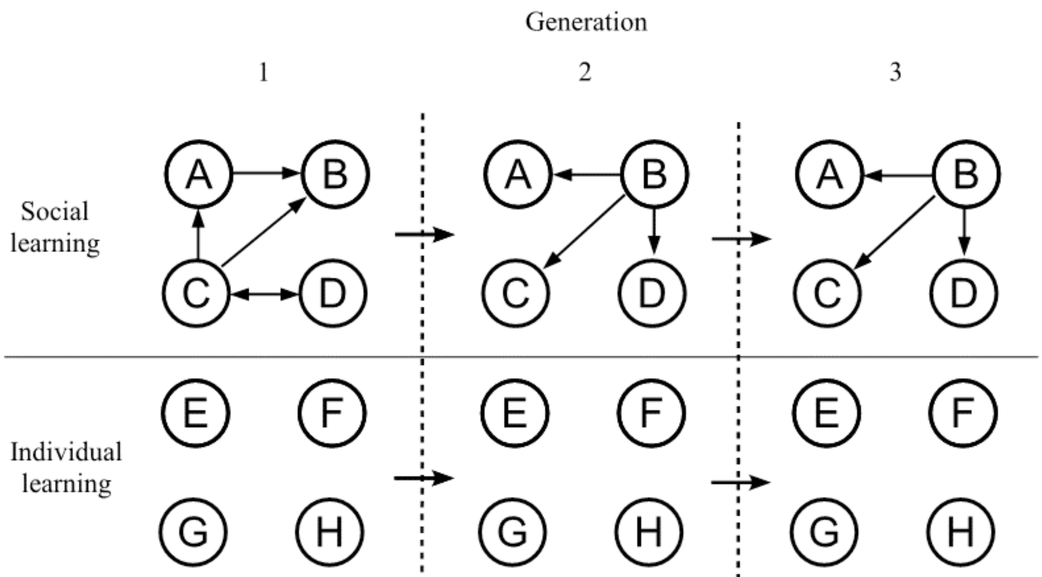

Figure 3 – Experimental design of a typical constant-group study. A group of four participants, A-D, performs three trials/generations (1-3) of a task. In the social learning condition, participants can copy each other, and arrows indicate the flow of information or the direction of social influence. In generation 1, A learns from C, B learns from both A and C, and C and D learn from each other. In generations 2 and 3, participants A, C and D all copy participant B, who might be particularly successful, prestigious or powerful. The individual learning condition provides a baseline control, where participants E-H learn on their own and do not interact.

For example, Kameda and Nakanishi (2002) explored experimentally the adaptiveness of individual and social learning within groups of six participants. Participants played a simple computer game in which they had to locate a rabbit in one of

[3] Indeed, Insko et al. (1983) note that "each run of the nine-generation procedure required 36 subjects, 6 experimental assistants, 9 rooms, and approximately 4½ hours" (p. 981); there were 12 runs in total.

two possible locations. To help them decide, participants could engage in either costly individual learning or free social learning. In the latter, the past choices of three randomly selected group members could be seen. In accordance with the predictions of the authors' mathematical simulations, polymorphic equilibria emerged in which individual learners ("information producers") and social learners ("information scroungers") coexisted. Increasing the cost of individual learning increased the frequency of social learning. A follow-up study (Kameda & Nakanishi, 2003) found that groups in which social learning was permitted outperformed groups in which only individual learning was allowed, suggesting that social learning is adaptive when individuals can selectively switch between individual and social learning.

McElreath et al. (2005), meanwhile, had groups of 6-10 participants repeatedly play a computer-based task in which they had to choose which of two kinds of crops to plant, where one crop gave a higher yield. This choice was made either (i) with no social learning (an individual-learning baseline), (ii) with the opportunity to view the previous choice of one randomly selected group member (allowing random copying), or (iii) with the opportunity to view the previous choices of all group members (allowing conformity). Although some participants engaged in social learning, most did not, even when mathematical models predicted that social learning would have been optimal. Of those who did, social information was more likely to have been used when individual learning was relatively inaccurate and when the environment (i.e. which crop was optimal) did not change, in line with theoretical predictions. Although the models indicated that conformity was the optimal strategy under all conditions, it was used only when the environment fluctuated.

Finally, Mesoudi and O'Brien (in press) simulated specific population-level patterns observed in the archaeological record, in order to elucidate the underlying transmission biases potentially responsible for those patterns. The archaeological patterns simulated by Mesoudi and O'Brien were reported by Bettinger and Eerkens (1999), who studied projectile points (i.e. the stone tips of projectile weaponry such as arrows or spears) found in the Great Basin region of the south-western United States, and manufactured by inhabitants of that region around A.D. 300–600. Bettinger and Eerkens observed that projectile points found in two specific regions of the Great Basin differ in the degree to which their attributes, such as weight, width, and length, correlate with each other, and explained these differences by appealing to the manner in which prehistoric people of the two regions acquired and transmitted projectile-point technology. Specifically, the attributes of points found in eastern California were found to be poorly correlated with each other, which Bettinger and Eerkens argued was because point designs in this region originally spread as a result of "guided variation," where each attribute was copied from a model but then subject to separate individual trial-and-error experimentation, causing them to vary independently. In contrast, projectile points of the same material and from around the same period found in central Nevada featured uniform designs with highly correlated attributes. Bettinger and Eerkens argued that points in this region originally spread as a result of "indirect bias," with all individuals copying wholesale the design of a single successful model.

Mesoudi and O'Brien (in press) simulated these different transmission biases in groups of six participants. Each participant played a simple computer game in which they had to design their own "virtual projectile points." Participants entered the attributes (e.g. width, weight) of their points and tested them in a "virtual hunting environment." The closer the participant's point design was to a hidden optimal design, the higher was their feedback score. Different phases of the experiment then simulated either indirectly biased cultural transmission or guided variation (similar to the two conditions shown in Figure 3). In the indirect bias condition, every participant's score was publicly known, and participants could copy the point design of another player (typically the single player with the highest score). In the guided variation condition, there was no access to other players' designs, and participants had to improve their points through individual trial and error learning. Mesoudi and O'Brien found that periods of indirectly biased cultural transmission were associated with high attribute correlations and low variation (because everyone was copying the same successful player), while periods of guided variation were associated with low attribute correlations and high variation (because of idiosyncratic individual trial and error). Hence these two conditions successfully recreated the patterns observed by Bettinger and Eerkens (1999) in Nevada (low variation) and California (high variation) respectively, and support Bettinger and Eerkens' "learning rule" explanation for the origin of these differences (i.e. indirect bias in Nevada, and guided variation in California). Mesoudi and O'Brien also found that indirectly biased cultural transmission was significantly more adaptive than individual learning, and especially when individual learning was costly. This latter result provides a potential explanation for the differences between the two archaeological samples, and we can speculate that the prehistoric Nevadan environment was harsher in some respect than the prehistoric Californian environment, hence making cultural transmission relatively more effective and more frequent in the former than in the latter.

In summary, the constant-group method has been used to look at the relative effectiveness of individual versus social learning, and the effects of various biases in cultural transmission. As demonstrated by Mesoudi and O'Brien (in press), learning within the group can be manipulated in order to test specific hypotheses from anthropology, just as Insko et al. (1983) used the replacement method to test between alternative anthropological hypotheses.

Evolutionary Interactions

Evolutionary psychology

We have not yet considered the third field mentioned in the introduction, that of evolutionary psychology. As commonly conceived (e.g. Barkow, Cosmides, & Tooby, 1992; Pinker, 1997), the field of evolutionary psychology concerns supposed biologically evolved, genetically inherited aspects of mental processes. One respect in which this may affect the work outlined above is in providing hypotheses concerning *biologically evolved biases in cultural transmission*, the operation of which can be tested using the above experimental methods. Specifically, if cultural transmission can be seen as the successive filtering and transformation of information through multiple individuals' cognition, and if that cognition has been shaped by biological evolution to more easily process certain biologically-relevant kinds of information or better deal with certain biologically-relevant tasks, then we should find that biologically-relevant information to be preferentially transmitted. The transmission chain method, in which information is passed through successive minds, is ideally suited to testing such hypotheses. Indeed, the social bias observed by Mesoudi et al. (2006), which was argued to represent a legacy of past biological selection pressures on primate cognitive evolution, is one possible example of a biologically evolved bias in cultural transmission. Evolutionary psychology provides a wealth of other potential biases regarding mate choice (Buss, 1994), cheater detection (Cosmides, 1989), folk biology (Atran, 1998), supernatural/religious concepts (Boyer, 2002) and many others, all of which can be studied in a controlled, quantitative manner using the methods discussed above. An interesting possibility is to systematically vary one or more of these factors within the same material, and measure the relative strength of each.

The transmission chain method can also be used to explore issues of cross-cultural universality and the evoked culture arguments mentioned in the introduction. By simulating the biases listed above in multiple replicate chains, we can test the claims that cultural variation should predictably converge on specific biologically-predisposed patterns (Sperber, 1996; Sperber & Hirschfeld, 2004), or whether an element of contingency or randomness exists in the transmission process. By manipulating the conditions experienced by different chains we can also measure when these patterns are most likely to emerge. For example, Atran and Norenzayan (2005) draw on ethnographic evidence to argue that religious beliefs are "minimally counterfactual," violating certain rules of folk physics, folk biology and folk psychology but not excessively so. Different chains of participants transmitting information that systematically varies in "counterfactualness" might reveal exactly how counterfactual such beliefs need to be to persist culturally and whether this trend is observed universally in all chains, as well as explore the conditions that favor such a bias (e.g. environmental uncertainty, or in the presence of a conformity-driven social norm).

Cultural evolution

As well as using theories from evolutionary psychology to inform the study of cultural transmission, we can also look to theories of *cultural evolution*, where culture is seen as an evolutionary process that operates in parallel to gene-based biological evolution. The theory of cultural evolution is supported by evidence that cultural change exhibits the same underlying principles – variation, selection and inheritance – as does biological evolution[4] (Campbell, 1960; Cavalli-Sforza & Feldman, 1981; Mesoudi et al., 2004; Plotkin, 1995; Richerson & Boyd, 2005). Although evolutionary theory in the human sciences is currently dominated by a particular brand of evolutionary psychology that exclusively focuses on biological (gene-based) evolution and tends to ignore culture in explanations of human behaviour (e.g. Barkow et al., 1992; Pinker, 1997), the existing and potential work discussed above can be seen as part of an evolutionary psychology that is more broadly conceived (e.g. Barrett, Dunbar, & Lycett, 2002; Heyes, 2000; Plotkin, 1997), one that acknowledges that culture can play a significant role in determining human behaviour.

In fact, the integration suggested here of the experimental or micro-scale on the one hand, and the observational/historical or macro-scale on the other, has a precedent in the biological sciences. The "evolutionary synthesis" (Huxley, 1942; Mayr & Provine, 1980) occurred within biology in the 1930s and 1940s and represented the integration of the hitherto separate sciences of biological microevolution and biological macroevolution. Biological *microevolution* describes the processes that affect changes in

[4] This is not to say that biological and cultural evolution are identical in every respect, merely that the parallel is sufficiently close to warrant the use of (suitably modified) evolutionary methods, tools and theories in the study of culture (Mesoudi et al., 2006).

gene frequencies *within* populations (below the species-level), such as natural selection, sexual selection, drift, sexual vs. asexual reproduction, etc., and which are studied using field experiments, lab experiments and mathematical models. Biological *macroevolution* describes large-scale, long-term patterns or trends in space or time that occur *at* or *above* the population or species level, as studied by paleobiologists (through time) and biogeographers (through space). Examples of macroevolutionary patterns or trends include adaptation (a species gradually exhibiting an increasing fit with its environment), speciation (the emergence of new species) and punctuated equilibria (long periods of stasis punctuated with short periods of rapid change). During the synthesis, biologists explicitly recognized for the first time that the small-scale processes of microevolution, when extrapolated up in time or space, can explain specific macroevolutionary patterns. In other words, both microevolutionary biologists and macroevolutionary biologists were studying the same phenomena, but at different temporal or spatial scales. It was only when this link was made that biology became unified within a single synthetic framework, and became the enormously successful discipline that it is today (Mayr, 1982; Mayr & Provine, 1980).

Adopting an evolutionary framework to the study of culture allows a similar unification of the social sciences and an integration of cultural microevolution and cultural macroevolution[5] (Mesoudi, Whiten, & Laland, 2006). Hence the experimental methods discussed above can be used to experimentally simulate in the psychology lab the small scale microevolutionary mechanisms of cultural evolution, such as the sources of cultural innovation, different modes of cultural transmission, and forms of cultural selection, and explicitly link these mechanisms to specific temporal and spatial patterns of cultural macroevolution, as documented by cultural psychologists, cultural anthropologists, sociologists, archaeologists and historians.

The potential value of such an endeavour is highlighted by the fact that experimental laboratory studies have made major contributions to progress in evolutionary biology by uncovering the fundamental principles of biological inheritance and selection, from Mendel's (1866) pea-plant studies, which established that inheritance is particulate, to Morgan's (1932) and Dobzhansky's (1937) experiments of selection and mutation in *Drosophila*, through to present-day experimental population genetics. Recent studies have experimentally simulated long-term biological macroevolution using micro-organisms (Cooper, Rozen, & Lenski, 2003; Elena & Lenski, 2003; Lenski & Travisano, 1994), tackling issues regarding macroevolution that previously only the fossil record and/or theoretical models could address, such as punctuated equilibria (Lenski & Travisano, 1994), long-term adaptation in multimodal fitness landscapes[6] (Colegrave &

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[5] One might argue that the distinction between cultural microevolution and cultural macroevolution is less clear than that between biological microevolution and biological macroevolution, because it is less clear what the equivalent of a "species" is in culture, and hence what "above the species level" or "at or below the species level" might mean for cultural evolution. However, even within biology the species concept has been, and still is, quite controversial and subject to extensive disagreement and debate (Mayr, 1996; Pigliucci, 2003). In spite of this, the evolutionary synthesis in biology still had the stimulating and productive effect described in the text. Perhaps this problem should be considered a challenge for future work rather than an obstacle to evolutionary approaches to culture or to a similar evolutionary synthesis for the social sciences.

[6] Wright's (1932) concept of a multimodal fitness landscape describes the design space of all possible fitness combinations of several phenotypic characters, where the height of the landscape represents the fitness of an individual or a population, given their combination of character values. Peaks in the landscape represent phenotypes that have high fitness, whereas valleys represent regions of low fitness. Natural selection causes individuals or populations to move upwards in the landscape (i.e. increase in fitness).

Buckling, 2005; Elena & Lenski, 2003), and the evolution of sexual reproduction (Colegrave, 2002; Xu, 2004).

As an example, Lenski and Travisano (1994) describe one such study in which an initially genetically identical population of *E. coli* was allowed to breed in an unchanging environment. Mean cell size was found to increase rapidly during the first 2,000 generations before stabilizing over the next 8,000 generations. Lenski and Travisano argued that this pattern of rapid change followed by lengthy stasis resembles the punctuated equilibria seen in the fossil record (Gould & Eldredge, 1977). Although punctuated equilibria are sometimes attributed to the incompleteness of the fossil record, the fact that punctuated equilibria were observed in Lenski and Travisano's data, which were sampled regularly and hence not vulnerable to sampling error, suggests instead that punctuated equilibria may constitute a genuine pattern of macroevolutionary change. Lenski and Travisano repeated the experiment using twelve replicate populations, all initially genetically identical (both within and between populations) and evolving under identical environmental conditions. A similar pattern of change in cell size was found in all populations - a rapid increase, followed by stasis - ruling out random drift as an explanation for the observed change in cell size. Lenski and Travisano's study hence demonstrates the value of experimental simulations, in allowing history to be rerun in replicate chains and by generating complete data. As mentioned above (see also Mesoudi, in press), the same advantages also apply to experimental simulations of cultural evolution, and indeed are demonstrated by Mesoudi and O'Brien's (in press) simulations of patterns in the archaeological record.

Conclusions

Above, it was argued that explanations for cultural variation and cultural change are often lacking in empirical support, and that experimental simulations of cultural change can provide one means of investigating such issues. We then examined three different methods for simulating cultural change in the social psychology lab. First, the transmission chain method is probably most appropriate for studying content biases, i.e. what kinds of information are transmitted best due to biases in cognition, perception, attention and memory. There exist tentative links between transmission chain studies and actual cultural variation and persistence, specifically Bartlett's (1932) finding that folk tales show greater persistence and fidelity than other material, consistent with the persistence of folk tales in oral societies across several generations (Rubin, 1995), and Mesoudi et al.'s (2006) finding that social information is transmitted better than non-social information, consistent with a socially-oriented mass media. Second, the replacement method appears most appropriate for studying norms and how they persist over multiple overlapping generations, and allows group dynamics like conformity and coercion to be examined. Importantly, Insko et al.'s (1983) work constitutes an experimental test of a specific anthropological theory regarding the emergence of a chiefdom-based social organization. Third, the constant-group method is a less time- and participant-consuming means of studying the relationship between individual and social learning and the relative efficacy of different rules and biases in cultural transmission. In another explicit simulation of an anthropological case, Mesoudi and O'Brien (in press) tested a specific hypothesis regarding patterns of variation in Great Basin projectile points.

There is much potential here to more explicitly link experimental simulations such as these to actual data on cultural variation and cultural change, as so far only Insko et al. (1983) and Mesoudi and O'Brien (in press) have attempted. Furthermore, hypotheses regarding data from cultural psychology, rather than cultural anthropology and archaeology, have yet to be tested. Given that cultural psychologists study variation in psychological attributes, these are likely to be most amenable to simulation in the social psychology lab. As noted in the section on evolutionary interactions, evolutionary psychology provides a number of potential biologically evolved biases in cultural transmission that, when simulated, might provide explanations for certain cultural trends or differences. Another possibility is to adapt Insko et al.'s (1983) simulation of inter-group trading to test Nisbett et al.'s (2001) hypothesis regarding the origin of Western European and East Asian patterns of thought. Different experimental conditions might simulate an individualistic "hunting/fishing" scenario and another simulate a cooperative "agriculture" scenario, to see whether these lead to differences in psychological characteristics corresponding to those observed in Western Europeans and East Asians respectively, and importantly, examine how long such differences persist in the absence of the original conditions. As well as replacing individuals based on seniority, as in Insko et al. (1980; 1983), we might also replace individuals/groups on the basis of success (or "fitness"), in order to more explicitly simulate cultural group selection[7]. Such studies could be performed with East Asian and Western European participants, to explore the interaction between those participants' enculturation during childhood and the immediate demands of the experimental task.

It is essential to emphasize not only the potential benefits of experimental methods in simulating cultural change, but also to recognize their limitations. The utility of the experimental methods described above crucially depends on their ability to successfully recreate aspects of real-life cultural change. This is necessarily limited by the many differences between the cultural change we seek to simulate and the typical psychology experiment. Whereas real-life cultural change typically occurs over long periods of time, in diverse social and ecological environments, and in multiple generations and large populations of diverse groups of people, experiments are typically performed over a few hours at most, in a university laboratory setting, and use small groups of participants who are typically affluent, literate, middle-class, Western, unrelated, well-educated, anonymous, and participating for course credit or petty cash. Any or all of these differences may reduce the validity of experimental simulations of cultural phenomena. And even if the demographics of the participants perfectly matched those of the cultural progenitors, there is still the problem that every laboratory setting is artificial to some degree. As noted by Shweder (1990), the psychology lab is far from a culture-free or culture-neutral environment. Participants may bring to the experiments a specific set of social norms and expectations regarding science, psychology, experiments, and the roles of experimenters and participants, which may cause their behavior to diverge from that under "natural" conditions.

However, despite these limitations, the fact remains that experiments offer unique advantages which cannot be offered by other methods available to study culture. As noted above, such advantages include the manipulation of variables, the ability to re-run history multiple times, the random assignment of participants into experimental and

[7] An alternative method employed by Gurerk, Irlenbusch and Rockenbach (2006) measured inter-group competition by allowing participants to voluntarily move between groups, and may prove equally useful.

control groups, and the generation of complete datasets. Barring the invention of a time machine, we cannot go back and directly study the ancestral populations within which much cultural variation originated, and experiments offer a unique means of recreating and exploring those past events in a controlled and systematic manner. There is a trade-off here, as with all experimental methods, between the control afforded by experiments (i.e. their internal validity) and the degree to which they reflect those aspects of reality that we wish to investigate (i.e. their external validity). Experimental methods pay for their high internal validity with low external validity. However, the reverse is true for historical, ethnographic or archaeological methods, which have high external validity and low internal validity – historians cannot re-run actual historical events, archaeologists do not have access to a complete archaeological record, and ethnographers cannot assign traditional villages to different experimental and control conditions.

The solution is to treat these different methods as complementary, rather than in competition with one another. Experiments can potentially be used, *alongside* historical, archaeological and ethnographic methods, mathematical models and computer simulations, to more fully explain the cultural variation observed by cultural psychologists and cultural anthropologists. As noted by Insko et al. (1980, p. 437), "a theory of social evolution that is buttressed with a combination of evidence from laboratory-experimental, archaeological, and contemporary-ethnographic settings would be more convincing than a theory that was supported by anthropological data alone." As long as the aforementioned limitations are constantly borne in mind, and the results of experiments are never over-interpreted or relied on to the exclusion of other sources of evidence, it would be lamentable if cultural scientists ignored the unique benefits of experimental simulations of cultural phenomena.

Some of the limitations mentioned above are unavoidable, such as the difference in time scales (it is unfeasible to run experiments for more than a few hours) or the preexisting norms and expectations brought to experiments by participants. Other limitations, however, might be at least partly reduced by taking measures to increase the external validity of the experimental methods outlined above. Although university students are most readily accessible to psychologists, there is no reason why a more diverse sample of participants, including non-students, cannot be used. Cross-cultural psychologists have shown that experiments with non-Western, usually East Asian, participants are both feasible and valuable. People from traditional small-scale societies might also be used, in a manner similar to recent cross-cultural economic experiments (Henrich et al., 2005). Indeed, the inhabitants of contemporary small-scale societies are almost certainly more similar to the people responsible for the cultural change simulated by Insko et al. (1983) and Mesoudi and O'Brien (in press) than Western university students, and so may provide a more valid demographic[8]. Finally, there is no reason why experimental participants must be anonymous, and psychologists might look to recruit groups of friends or families, to look at issues such as reputation, status or relatedness.

Another common criticism is that experiments over-simplify what are often vastly complex cultural and social systems. This criticism misses the point of experiments; their very usefulness lies in their simplicity, as it is only by simplifying that immense complexity that we can begin to tease out the effects of critical variables and

[8] Note, however, that contemporary and prehistoric traditional societies are not identical, and should not be considered equivalent. Nor are all contemporary small-scale societies identical to each other.

hope to explain complex systems in an incremental, piece-by-piece fashion. Indeed, this willingness to simplify complex real-life systems partly underlies the success of evolutionary biology in the face of similarly complex biological systems (Mesoudi et al., 2006), and cultural scientists would do well to imitate this methodological tactic. We should also recognize that reality itself features inherent limitations. A group of prehistoric Great Basin hunters, for example, would have been constrained in their behavior and possible cultural variation because of limitations on the available prey, the raw materials available to make tools, average rainfall, and so on.

One reason for the rarity of cultural simulations such as Insko et al. (1983) within social psychology is probably the practical limitations of running such studies. Although the replacement and constant-group methods typically require large numbers of participants, large amounts of time and a high degree of organization, such methods are becoming more and more feasible given the advent of large computer networks in psychology labs, allowing participants to engage in relatively sophisticated computer games such as Mesoudi and O'Brien's hunting game. The internet also offers huge potential (and huge samples) for studying cultural transmission experimentally. Reframing experiments as computer games and implementing them on the internet rather than in psychology labs might also partially reduce the aforementioned artificiality of psychology experiments and the impact of preexisting experiment-associated social norms.

Finally, in the discussion of cultural evolution, we looked at how this integration of small-scale experimental simulations and large-scale population-level variation and change has a precedent in the biological sciences, where simulations of biological evolution in the laboratory have been used to explore and explain specific macro-evolutionary patterns. Adopting an evolutionary approach to the study of culture can facilitate a similar cross-disciplinary integration of methods, data and theory in the social sciences, such as that advocated here between experimental social psychology on the one hand and cultural psychology and cultural anthropology on the other. This cross-disciplinary integration of social, evolutionary and cultural psychology can mutually benefit each of these individual disciplines, and provide much-needed explanations for cultural change and cultural variation.

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References

Allport, G. W., & Postman, L. (1947). *The psychology of rumor*. Oxford: Henry Holt.

Atran, S. (1998). Folk biology and the anthropology of science: Cognitive universals and cultural particulars. *Behavioral and Brain Sciences, 21*, 547-609.

Atran, S., & Norenzayan, A. (2005). Religion's evolutionary landscape: Counterintuition, commitment, compassion, communion. *Behavioral and Brain Sciences, 27*, 713-730.

Bangerter, A. (2000). Transformation between scientific and social representations of conception: The method of serial reproduction. *British Journal of Social Psychology, 39*, 521-535.

Barkow, J. H., Cosmides, L., & Tooby, J. (Eds.). (1992). *The adapted mind: Evolutionary psychology and the generation of culture*. Oxford: Oxford University Press.

Barrett, L., Dunbar, R., & Lycett, J. (2002). *Human evolutionary psychology*. Basingstoke: Palgrave.

Bartlett, F. C. (1932). *Remembering*. Oxford: Macmillan.

Baum, W. M., Richerson, P. J., Efferson, C. M., & Paciotti, B. M. (2004). Cultural evolution in laboratory microsocieties including traditions of rule giving and rule following. *Evolution and Human Behavior, 25*, 305-326.

Benedict, R. (1934). *Patterns of culture*. Boston, MA: Houghton Mifflin.

Bentley, R. A., Hahn, M. W., & Shennan, S. J. (2004). Random drift and culture change. *Proceedings of the Royal Society of London Series B-Biological Sciences, 271*, 1443-1450.

Bettinger, R. L., & Eerkens, J. (1999). Point typologies, cultural transmission, and the spread of bow-and-arrow technology in the prehistoric Great Basin. *American Antiquity, 64*, 231-242.

Boyd, R., & Richerson, P. J. (1985). *Culture and the evolutionary process*. Chicago: University of Chicago Press.

Boyd, R., & Richerson, P. J. (1996). Why culture is common, but cultural evolution is rare. *Proceedings of The British Academy, 88*, 77-93.

Boyer, P. (2002). *Religion explained: The evolutionary origins of religious thought*. New York: Basic Books.

Buss, D. M. (1994). *The evolution of desire: Strategies of human mating*. New York: Basic Books.

Byrne, R. W., & Whiten, A. (Eds.). (1988). *Machiavellian intelligence: Social expertise and the evolution of intellect in monkeys, apes, and humans*. Oxford: Clarendon Press.

Campbell, D. T. (1960). Blind variation and selective retentions in creative thought as in other knowledge processes. *Psychological Review, 67*, 380-400.

Carneiro, R. L. (1970). A theory of the origin of the state: Traditional theories of state origins are considered and rejected in favor of a new ecological hypothesis. *Science, 169*, 733-738.

Cavalli-Sforza, L. L., & Feldman, M. W. (1981). *Cultural transmission and evolution*. Princeton: Princeton University Press.

Choi, I., & Nisbett, R. E. (1998). Situational salience and cultural differences in the correspondence bias and actor-observer bias. *Personality and Social Psychology Bulletin, 24*, 949-960.

Choi, I., Nisbett, R. E., & Norenzayan, A. (1999). Causal attribution across cultures: Variation and universality. *Psychological Bulletin, 125*, 47-63.

Colegrave, N. (2002). Sex releases the speed limit on evolution. *Nature, 420*, 664-666.

Colegrave, N., & Buckling, A. (2005). Microbial experiments on adaptive landscapes. *Bioessays, 27*, 1167-1173.

Cooper, T. F., Rozen, D. E., & Lenski, R. E. (2003). Parallel changes in gene expression after 20,000 generations of evolution in *Escherichia coli*. *Proceedings of the National Academy of Sciences of the United States of America, 100*, 1072-1077.

Cosmides, L. (1989). The logic of social exchange: Has natural selection shaped how humans reason? Studies with the Wason selection task. *Cognition, 31*, 187-276.

D'Andrade, R. (1995). *The development of cognitive anthropology*. Cambridge: Cambridge University Press.

Dawkins, R. (1976). *The selfish gene*. Oxford: Oxford University Press.
Dobzhansky, T. (1937). *Genetics and the origin of species*. New York: Columbia University Press.
Dunbar, R. I. M. (2003). The social brain: Mind, language, and society in evolutionary perspective. *Annual Review of Anthropology, 32*, 163-181.
Durham, W. H. (1992). *Coevolution: Genes, culture, and human diversity*. Stanford: Stanford University Press.
Elena, S. F., & Lenski, R. E. (2003). Evolution experiments with microorganisms: The dynamics and genetic bases of adaptation. *Nature Reviews Genetics, 4*, 457-469.
Gangestad, S. W., Haselton, M. G., & Buss, D. M. (2006). Evolutionary foundations of cultural variation: Evoked culture and mate preferences. *Psychological Inquiry, 17*, 75-95.
Geertz, C. (1973). *The interpretation of cultures*. New York: Basic.
Gerard, R. W., Kluckhohn, C., & Rapoport, A. (1956). Biological and cultural evolution: Some analogies and explorations. *Behavioral Science, 1*, 6-34.
Gould, S. J., & Eldredge, N. (1977). Puncuated equilibria: The tempo and mode of evolution reconsidered. *Paleobiology, 3*, 115-151.
Graebner, F. (1905). Kulturkreise und kulturschichten in ozeanien. *Zeitschrift fur Ethnologie, 37*, 28-53.
Graebner, F. (1911). *Methode der ethnologie*. Heidelberg: Ethnologische Bibliothek.
Grimes, B. F. (2002). *Ethnologue: Languages of the world, 14th edition*: Summer Institute of Linguistics.
Gurerk, O., Irlenbusch, B., & Rockenbach, B. (2006). The competitive advantage of sanctioning institutions. *Science, 312*, 108-111.
Hall, K. R. L. (1951). The effect of names and titles upon the serial reproduction of pictorial and verbal material. *British Journal of Psychology, 41*, 109-121.
Hamilton, W. D. (1964). The genetical evolution of social behaviour, I and II. *Journal of Theoretical Biology, 7*, 1-52.
Harris, M. (1989). *Cows, pigs, wars & witches: The riddles of culture*. New York: Vintage.
Heine, S. J., Lehman, D. R., Markus, H. R., & Kitayama, S. (1999). Is there a universal need for positive self-regard? *Psychological Review, 106*, 766-794.
Heine, S. J., & Norenzayan, A. (2006). Toward a psychological science for a cultural species. *Perspectives on Psychological Science, 1*, 251-269.
Henrich, J. (2001). Cultural transmission and the diffusion of innovations: Adoption dynamics indicate that biased cultural transmission is the predominant force in behavioral change. *American Anthropologist, 103*, 992-1013.
Henrich, J. (2004). Demography and cultural evolution: How adaptive cultural processes can produce maladaptive losses - the Tasmanian case. *American Antiquity, 69*, 197-214.
Henrich, J., Boyd, R., Bowles, S., Camerer, C., Fehr, E., Gintis, H., McElreath, R., Alvard, M., Barr, A., Ensminger, J., Smith Henrich, N., Hill, K., Gil-White, F., Gurven, M., Marlowe, F. W., Patton, J. Q. & Tracer, D. (2005). "Economic man" in cross-cultural perspective: Behavioral experiments in 15 small-scale societies. *Behavioral and Brain Sciences, 28*, 795-855.
Heyes, C. (2000). Evolutionary psychology in the round. In C. Heyes & L. Huber (Eds.), *The evolution of cognition* (p. 3–22). Cambridge, MA: MIT Press.
Huxley, J. S. (1942). *Evolution, the modern synthesis*. London: Allen & Unwin.

Insko, C. A., Gilmore, R., Drenan, S., Lipsitz, A., Moehle, D., & Thibaut, J. W. (1983). Trade versus expropriation in open groups: A comparison of two types of social power. *Journal of Personality and Social Psychology, 44*, 977-999.

Insko, C. A., Gilmore, R., Moehle, D., Lipsitz, A., Drenan, S., & Thibaut, J. W. (1982). Seniority in the generational transition of laboratory groups: The effects of social familiarity and task experience. *Journal of Experimental Social Psychology, 18*, 557-580.

Insko, C. A., Thibaut, J. W., Moehle, D., Wilson, M., Diamond, W. D., Gilmore, R., Solomon, M.R., & Lipsitz, A. (1980). Social evolution and the emergence of leadership. *Journal of Personality and Social Psychology*, *39*, 431-448.

Jacobs, R. C., & Campbell, D. T. (1961). The perpetuation of an arbitrary tradition through several generations of a laboratory microculture. *Journal of Abnormal and Social Psychology, 62*, 649-658.

Kameda, T., & Nakanishi, D. (2002). Cost–benefit analysis of social/cultural learning in a nonstationary uncertain environment: An evolutionary simulation and an experiment with human subjects. *Evolution and Human Behavior, 23*, 373-393.

Kameda, T., & Nakanishi, D. (2003). Does social/cultural learning increase human adaptability? Rogers' question revisited. *Evolution and Human Behavior, 24*, 242-260.

Kashima, Y. (2000). Maintaining cultural stereotypes in the serial reproduction of narratives. *Personality and Social Psychology Bulletin, 26*, 594-604.

Kohler, T. A., & Gumerman, G. J. (Eds.). (2000). *Dynamics in human and primate societies: Agent-based modeling of social and spatial processes*. New York, NY: Oxford University Press.

Kroeber, A. L. (1948). *Anthropology*. New York: Harcourt, Brace and Co.

Kroeber, A. L., & Kluckohn, C. (1952). *Culture*. New York: Vantage.

Kuper, A. (1999). *Culture: The anthropologist's account*. Cambridge, MA: Harvard University Press.

Lehman, D. R., Chiu, C.-Y., & Schaller, M. (2004). Psychology and culture. *Annual Review of Psychology, 55*, 689-714.

Lenski, R. E., & Travisano, M. (1994). Dynamics of adaptation and diversification - a 10,000-generation experiment with bacterial-populations. *Proceedings of the National Academy of Sciences of the United States of America, 91*, 6808-6814.

Lipo, C. P., O'Brien, M. J., Collard, M. & Shennan, S. (Eds.). (2006) *Mapping our ancestors: Phylogenetic approaches in anthropology and prehistory*. New York: Aldine.

Mace, R., & Pagel, M. D. (1994). The comparative method in anthropology. *Current Anthropology, 35*, 549-564.

Mace, R. & Holden, C. J. (2005). A phylogenetic approach to cultural evolution. *Trends in Ecology and Evolution, 20*, 116-121.

Masuda, T., & Nisbett, R. E. (2001). Attending holistically versus analytically: Comparing the context sensitivity of Japanese and Americans. *Journal of Personality and Social Psychology, 81*, 922-934.

Maxwell, R. S. (1936). Remembering in different social groups. *British Journal of Psychology, 27*, 30-40.

Mayr, E. (1982). *The growth of biological thought*. Cambridge, MA: Harvard University Press.

Mayr, E. (1996). What is a species, and what is not? *Philosophy of Science, 63*, 262-277.

Mayr, E., & Provine, W. (Eds.). (1980). *The evolutionary synthesis*. Cambridge, MA: Harvard University Press.
McElreath, R., Lubell, M., Richerson, P. J., Waring, T. M., Baum, W., Edsten, E., Efferson, C. & Paciotti, B. (2005). Applying evolutionary models to the laboratory study of social learning. *Evolution and Human Behavior, 26*, 483-508.
Mendel, G. (1866). Versuche über pflanzen-hybriden. *Verhandlungen des Naturforschenden Vereines, Brünn, 4*, 3-47.
Mesoudi, A. (2005). *The transmission and evolution of human culture.* Unpublished PhD thesis, University of St Andrews, St Andrews, UK.
Mesoudi, A. (in press). The experimental study of cultural transmission and its potential for explaining archaeological data. In M. J. O'Brien (Ed.), *Cultural transmission and archaeology: Issues and case studies*. Washington, D.C.: Society for American Archaeology Press.
Mesoudi, A., & O'Brien, M. J. (in press). The cultural transmission of Great Basin projectile point technology: An experimental simulation. *American Antiquity.*
Mesoudi, A., & Whiten, A. (2004). The hierarchical transformation of event knowledge in human cultural transmission. *Journal of Cognition and Culture, 4*, 1-24.
Mesoudi, A., Whiten, A., & Dunbar, R. I. M. (2006). A bias for social information in human cultural transmission. *British Journal of Psychology, 97*, 405-423.
Mesoudi, A., Whiten, A., & Laland, K. N. (2004). Is human cultural evolution Darwinian? Evidence reviewed from the perspective of 'The Origin of Species'. *Evolution, 58*, 1-11.
Mesoudi, A., Whiten, A., & Laland, K. N. (2006). Towards a unified science of cultural evolution. *Behavioral and Brain Sciences, 29*, 329-383.
Morgan, T. H. (1932). *The scientific basis of evolution*. New York: W.W.Norton.
Murdock, G. P. (1932). The science of culture. *American Anthropologist, 34*, 200-215.
Murdock, G. P. (1967). *Ethnographic atlas*. Pittsburgh, PA: University of Pittsburgh Press.
Murdock, G. P., Ford, C., Hudson, A., Kennedy, R., Simmons, L., & Whiting, J. (1987). *Outline of cultural materials (with modifications)* (5th ed.). New Haven, CT: Human Relations Area Files.
Neiman, F. D. (1995). Stylistic variation in evolutionary perspective - inferences from decorative diversity and interassemblage distance in Illinois woodland ceramic assemblages. *American Antiquity, 60*, 7-36.
Nisbett, R. E., Peng, K., Choi, I., & Norenzayan, A. (2001). Culture and systems of thought: Holistic versus analytic cognition. *Psychological Review, 108*, 291-310.
Northway, M. L. (1936). The influence of age and social group on children's remembering. *British Journal of Psychology, 27*, 11-29.
Pigliucci, M. (2003). Species as family resemblance: the (dis-)solution of the species problem? *BioEssays, 25*, 596-602.
Pinker, S. (1997). *How the mind works*. New York: W. W. Norton.
Plotkin, H. (1995). *Darwin machines and the nature of knowledge*. London: Penguin.
Plotkin, H. (1997). *Evolution in mind: An introduction to evolutionary psychology*. Cambridge, MA: Harvard University Press.
Richerson, P. J., & Boyd, R. (2005). *Not by genes alone: How culture transformed human evolution*. Chicago: University of Chicago Press.
Rogers, E. (1995). *The diffusion of innovations*. New York: Free Press.

Rubin, D. C. (1995). *Memory in oral traditions: The cognitive psychology of epic, ballads, and counting-out rhymes*. Oxford: Oxford University Press.
Schank, R. C., & Abelson, R. P. (1977). *Scripts, plans, goals and understanding: An inquiry into human knowledge structures*. Oxford: Lawrence Erlbaum.
Segall, M. H., Campbell, D. T., & Herskovits, M. J. (1963). Cultural differences in the perception of geometric illusions. *Science, 139*, 769.
Service, E. R. (1975). *Origins of the state and civilization: The process of cultural evolution*. New York: WW Norton.
Shennan, S. J., & Wilkinson, J. R. (2001). Ceramic style change and neutral evolution: A case study from neolithic Europe. *American Antiquity, 66*, 577-593.
Sherif, M. (1936). *The psychology of social norms*. Oxford: Harper.
Shweder, R. A. (1990) Cultural psychology – what is it? In J. W. Stigler, R. A. Shweder & G. Herdt (Eds.), *Cultural psychology: Essays on comparative human development* (pp. 1-43). Cambridge: Cambridge University Press.
Sperber, D. (1996). *Explaining culture: A naturalistic approach.* Oxford: Oxford University Press.
Sperber, D., & Hirschfeld, L. A. (2004). The cognitive foundations of cultural stability and diversity. *Trends in Cognitive Sciences, 8*, 40-46.
Steward, J. (1955). *Theory of culture change*. Illinois: University of Illinois Press.
Talland, G. A. (1956). Cultural differences in serial reproduction. *Journal of Social Psychology, 43*, 75-81.
Tomasello, M., Kruger, A. C., & Ratner, H. H. (1993). Cultural learning. *Behavioral and Brain Sciences, 16*, 495-552.
Tooby, J., & Cosmides, L. (1992). The psychological foundations of culture. In J. H. Barkow, L. Cosmides & J. Tooby (Eds.), *The adapted mind: Evolutionary psychology and the generation of culture* (pp. 19-136). London: Oxford University Press.
Turchin, P. (2003). *Historical dynamics: Why states rise and fall*. Princeton, NJ: Princeton University Press.
Tylor, E. B. (1871). *Primitive culture*. London: John Murray.
Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes.* Cambridge, MA: Harvard University Press.
Ward, T. H. G. (1949). An experiment on serial reproduction with special reference to the changes in the design of early coin types. *British Journal of Psychology, 39*, 142-147.
Weick, K. E., & Gilfillan, D. P. (1971). Fate of arbitrary traditions in a laboratory microculture. *Journal of Personality and Social Psychology, 17*, 179-191.
Whiten, A., & Byrne, R. W. (Eds.). (1997). *Machiavellian intelligence II: Extensions and evaluations*. New York: Cambridge University Press.
Wright, S. (1932). The roles of mutation, inbreeding, crossbreeding and selection in evolution. *Proceedings of the Sixth International Congress of Genetics, 1*, 356–366.
Wynne-Edwards, V. C. (1962) *Animal dispersion in relation to social behaviour*. Edinburgh: Oliver and Boyd.
Xu, J. (2004). The prevalence and evolution of sex in microorganisms. *Genome, 47*, 775-780.