Resistant roots of institutional diversity across societies: An evolutionary framework

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ABSTRACT

Consisting of formal and informal rules, cultural-cognitive schema, and routinized processes, institutions are the foundation of social life. Yet we do not have a systematic understanding of resistant roots of institutional diversity across societies. Following an evolutionary framework, we review the literature and discuss how a series of mutually exclusive and sequential “replicators” have come to jointly predispose human behaviors. Through social transmission, these replicators form lineages, which contribute to different levels of societies. We suggest that our review can provide a new research agenda regarding human behaviors in the social sciences. Limitations are also discussed.

KEY WORDS: Evolution, Institutional Diversity, Society, Human Behavior

“The people from different civilizations have different views on the relations between God and man, the individual and the group, the citizen and the state, parents and children, husband and wife, as well as differing views of the relative importance of rights and responsibilities, liberty and authority, equality and hierarchy. These differences are the product of centuries.”

—SAMUEL P. HUNTINGTON (1)

INTRODUCTION

Defined generally as a diverse set of formal and informal rules, routinized processes, and (in organizational institutionalism) cognitive-cultural schema, institutions shape human behaviors (2-7). There has been an ample literature on institutions across multiple social science disciplines [for a review, see, e.g., Campbell, (2004)]. Yet we do not have an integrative conceptual framework to organize a fragmented literature and evidence on resistant roots of institutional diversity across societies.

In this paper, generally following Hodgson and Knudsen (8)'s evolutionary framework, we review the literature and address the question: *What are the resistant roots in institutional diversity across societies?* We break this question down into its two components: (1) *resistant roots in a society's institutions*; (2) *boundaries of societies defined by shared institutions*. More specifically, we review the discussions and evidence in the literature and group findings into a series of mutually exclusive and sequential "social replicators" that *predispose* the patterns of human behaviors. These replicators continuously reproduce or preserve over time predisposed patterns of human behaviors. Each new replicator emerged historically as a critical juncture in social evolution and remains resistant to further changes. They self-reproduce at a relatively high precision, which leads to preservation of the behavioral and social patterns over time and across human populations. Together, these replicators play a salient impact on modern-day human behaviors and social relations.

Throughout the paper, we first briefly review the evolutionary framework of replicators (Hodgson & Knudsen, 2010) that emerged in an evolutionary sequence, namely: genes, pre-linguistic habits, grammatical languages, customs, writing systems, judicial systems, and scientific paradigms. Then we review the literature to discuss how each replicator predisposes patterns of human behaviors and thus

serves a resistant root in the institutions of a society. We further discuss how the transmission of each replicator draws lineages and thus forms the boundaries of a society. Lastly, we discuss implications of our review for a future agenda concerning human behaviors – a common issue concerning many social sciences.

AN EVOLUTIONARY FRAMEWORK

Evolutionary theorizing has been adopted in both natural and social sciences to explain diversity (8-16). It is a theoretical device to examine the underlying factors in the processes and patterns of adaptive changes over time or in history, which usually transform a population (e.g., species, organizations, societies) from simpler into more complex forms (9, 10). There is a long tradition of evolutionary theorizing about cultural, social, and economic phenomena as well as biological, even before Charles Darwin (9), although not all scholars agree on the value of a generalized form of Darwinism across all fields of study (which issue lies beyond the scope of our study). As suggested by Mesoudi (11), the Darwinian formulation that is common to many evolutionary approaches is to propose a sequence that begins with some process of variation within a population of some entity (e.g., species, organizations, or societies), leading to selection by the environment, and then to the retention and reproduction (or inheritance) of selected varieties.

Evolutionary theorists often draw lineages to define the boundaries between categories such as species, or in our context to distinguish between societies. To characterize and map lineages, a basic concept in evolutionary theorizing about retention or reproduction is a replicator. A replicator is a resilient program or set of codes and a self-reproducing unit of heredity (e.g., a gene) (15), which confers adaptive solutions to problems or constraints as they continuously arise, and so guides the development of the entity or the system with which it is associated (17, 18). Replicators are hosted by a relatively cohesive entity (such as an individual, an organization, or a society), usually termed a “interactor”, which interacts with its selection environment in ways that lead to changes in the population of interactors and their replicators (17, 18). Replicators copy or reproduce themselves through a cumulative and iterative replication process, leading to distinct lineages, and hence to diversity and complexity (12, 13, 15). When expressed in these replicator-interactor terms, evolution proceeds through the sequence of variation in the

replicators of a population, followed by an environmental selection of these varieties as they are represented through the interactors (8, 11), and which varied replicators are inherently capable of reproducing or sustaining themselves.

A social replicator differs from a biological replicator in a few ways. A biological replicator such as a gene meets the criteria of longevity, fecundity, replicative fidelity, and stability (15). In “routines as genes”, Nelson and Winter (19) suggested considering organizational routines of behavior as a social replicator. A social replicator meets a similar condition for a capacity for self-reproduction, but follows different and relatively less restrictive criteria, including a capacity to copy itself, similarity with a copied self, information transfer or retention, and resistance to change (8, 20). A biological replicator can be thought as a special case of social replicators in that it meets a more strictly set of standards.

Compared to biological replicators, whose random mutation in the process of reproduction is relatively rare, variations in social replicators tend to occur more frequently, whether through random (blind) mutation or guided modification through an active entrepreneurial agent (9-11). Unlike Darwinian biological replication, social replication follows a Lamarckian form of inheritance, that is, replicators may be acquired by an interactor and then deliberately or intentionally replicated to succeeding generations (11). This is because the prescriptions in a social replicator are relatively accessible and modifiable by its carriers (e.g., human individuals, organizations, etc.), whereas it is difficult, if not impossible, for a species to access and modify their own genes’ prescriptions (with the potential change by clustered regularly interspaced short palindromic repeats [CRISPR]).

BIO-ECOLOGICAL ROOTS

In the absence of social replicators, humans are just like other animal species, predisposed by an individual’s biologically inherited and inborn traits (codified and replicated through genes), which interact with ecological conditions (e.g., geography, climate, etc.) to form behaviors (21). Behavioral geneticists have made significant progress in linking genetic influences to human behaviors (22-27). On the one hand, all humans today may share a common ancestral population in East Africa about 100,000 years ago (28-30). Some psychological and behavioral traits such as the social conformity and imitation

biases of our common ancestors were likely adaptive mental models that were attuned to their particular wild natural environments (11). Present-day generations have genetically inherited these traits in the form of “universal preferences” or “evolved psychology” (31, 32). On the other hand, our genetic differences, although small (less than 1%), may play a significant role in our individual differences in behaviors. For instance, in a recent meta-analysis of 62 independent effect sizes and 100,000 participants, Vukasović and Bratko (33) estimated that 40% of individual differences in personality were due to genetic influences. As another example, Hatemi, Medland (34) studied 12,000 twin pairs and found that they had significant similarities in their attraction to political ideologies.

For their role as behavioral predispositions, genes across human populations are a biological root in institutional diversity. Specifically, without genetic engineering (e.g., CRISPR), human genes are transmitted vertically from biological parents (half from each), and thus the genetic roots on institutions run through biological families. In this way, genes of individuals are “synthesized” into biological family lineages – a primitive and basic unit of a society. Because of this pathway of transmission, the scope of genetic diffusion is limited to biological family lineages. While most genetically related people live in the same geographically-bounded community, the boundary of a family lineage does not have to stop at any geographic borders. One obvious example is the widespread Caucasian population around the globe. An opposite example is that many aboriginal people have lived in small isolated areas for generations within a subnational region (e.g., bands in Papua New Guinea). Genetic variation between lineages may cause subjective barriers such as discrimination and miscommunication (especially if racial marks are observable) (35), thus hindering social interactions and the diffusion of other replicators (36). Burns and Sommerville (37), for instance, find that Caucasian infants tend to incorporate racial similarity (Caucasian vs. Asian) into their selection of social partners. At the population level, genetic diversity is found to be negatively related to the degree of interpersonal trust (28).

Genetic diversity alone does not explain institutional diversity but interacts with ecological conditions to do so. Social replicators emerged essentially as adaptive tools for human genes to populate (38). The resilience of replicators is an adaptive response to the persistent genetic-ecological conditions

that have selected them (38, 39). There has been ample empirical evidence to partially support that ecological conditions are related to the diversity in social replicators. Among the earliest field works was Diamond (40), who found that the climate factors might explain the emergence of early European civilization. More specifically, there has been discussion and empirical evidence in the literature to attribute bio-ecological conditions as a determinant in social replicators. First, on pre-linguistic habits, Talhelm, Zhang (41) found that collectivist social habits in certain parts of China are associated with local people's historical reliance on a cooperative system of large-scale agriculture such as growing rice. Second, on grammatical languages, as another example, Galor, Özak (42) found that pre-industrial geographical and agricultural characteristics were the root causes of modern cross-language variations in their structure of the future tense and the presence of grammatical gender and politeness distinctions. Third, two recent empirical studies, Spolaore and Wacziarg (43) and Gutmann and Voigt (44), found strong correlations between judicial/legal systems and bio-ecological conditions of a country. The former, based on 4,560 country pairs from 96 countries, found empirical evidence that differences in democracy score were statistically significantly related to genetic and geographic distance. The latter studied 99 countries and found that the rule of law index was statistically significantly related to ethnic fractionalization, geography (e.g., absolute latitude, climate, landlock or island), and a bio-ecological composite based on number of annual/perennial wild grasses and number of domesticable big mammals.

SOCIAL REPLICATOR ROOTS

Drawing upon an extensive review of evolutionary studies in multiple disciplines (e.g., 9, 10, 13, 15, 17), Hodgson and Knudsen (2010) proposed a hierarchy of six social replicators for social evolution. Sequentially, they are pre-linguistic habits, grammatical languages, customs, writing systems, judicial systems, and scientific paradigms, each of which can be seen as a consequence of the interaction between earlier replicators and an interactor's (i.e., a society's) selection environment.

Definitions

Pre-linguistic Habits Habits are recurring behavioral tendencies and they may automatically repeat in relatively familiar and unchanged contexts unintentionally and non-volitionally (45). The

emergence of pre-linguistic habits of social interactions (hereafter “habits”) such as sounds, body languages, and facial expressions and the underlying habits of thought marks the first major information technology in social evolution (8). We humans build up habits of thought and communications in infancy by associating nonverbal signals with social meanings (14, 46).

Grammatical Languages Enabled by some pre-linguistic habits such as sound patterns and gestures that allowed phonology, languages emerged in order to extend simple symbols into more complicated and grammatical messages (47). Grammatical languages are found to be unique to humans (48), as distinct from the extent of any utterances and speech of other animals (49). Such languages consist of a universal system of linguistic rules (50), that include giving semantic meanings to symbols related to the basic cognitive categories of intuitive concepts, and creating a structure of morphology and syntax which assemble and organize these concepts (47, 48).

Customs Grammatical languages enable small groups such as families and bands to eventually transition into larger-scale tribes as a result of the establishment of settled communities (39). With an increasing population density, complex interpersonal relations, and potential threat from neighboring societies, communal activities such as conventions and traditions emerged to share special social meanings, forming customs (38, 51). Well before the emergence of modern civilizations, customs emerged and became shared in tribal societies as new social norms that helped to stabilize increasingly complex social relations in a growing society (8). Customs made it possible to formulate and stabilize social relations such as social status, hierarchy and the division of labor, which enabled charismatic leaders and surrounding elites (precursors of local chiefs and bureaucracies) to emerge and to maintain internal group cohesion and to negotiate intergroup relationships (51). Gradually, kinship-based tribal relations transitioned into codes and norms designed to solve social problems on a larger scale and at a higher level of complexity (52). As an example, kinship-based beliefs in the afterlife of their common ancestors gave way to communal worship of a supernatural being or a spirit guide in the pursuit of some universally desirable characteristics (e.g., physical strength, fertility, harvest, etc.) on a larger scale (39, 53).

Writing Systems From the beginnings of communal communications in societies writing systems

emerged, and they are often taken to represent the start of human civilization (54). Writing systems essentially are the written symbols of spoken languages (Diamond, 1998), with each written unit representing a single basic sound or phoneme (alphabetical, abjad or abugida systems), a whole syllable (syllabic systems), or a whole word (logographic systems) (55-57). Writing was adopted for its advantages over verbal languages and the merely verbal and artistic forms of customs, because it is possible to store and transmit relatively symbolic and standardized information through an enduring media (e.g., stone, paper, computer, etc.), where knowledge may thereby be better preserved beyond a person's or a society's life.

Judicial Systems and Laws Norms of morality and justice embodied in customs are not

easily transmittable and enforceable in a large population, until their underlying principles become articulated and codified into laws (58). Here we focus on judicial laws that are written into codes and enforced by the state, as distinct from customary laws that rely primarily on verbal means. While an effective judicial system requires coercive enforcement by a state, it is also enabled by earlier replicators, such as our predisposition to conform to authority (11), our innate instinct to punish violations of reciprocity and fairness (59), pre-existing customary laws in the absence of government (60), and writing systems as a means of social control (61).

Scientific Paradigms Since at least Copernicus, science has constantly challenged

conventional customs, beliefs and laws, using reliable observations, mathematically disciplined reasoning, and highly articulated languages (62). While there is a continual long-standing controversy over the definition of science (63), we follow Kuhn (64)'s concept of "paradigms", because of their resistance and highly precise replication across individuals and over time – which is the essence of a social replicator. Paradigms define the foundational logics and empirical methodologies, upon which scientific knowledge progresses (64). These paradigms provide a solid basis for further research because they are sufficiently unprecedented to attract an enduring group of adherents away from alternative views of the world, and yet open-ended enough to leave much in need of resolution through continuing research programs (64).

Paradigms define legitimate problems and methods for a research field for succeeding generations (64). Within a paradigm, a community of scholars and practitioners emerges that uses a common language and accepts modes and protocols for investigations (65). Aristotle's *Physica*, Newton's *Principia* and *Opticks*, Franklin's *Electricity*, and Smith's *Wealth of Nations*, can all be said to be such paradigms in which their respective disciplines and subfields of science have been grounded.

Social Evolution

At the society level, these replicators follow the sequence of social evolution in human history (and often acquired following the same order by a person throughout a life time). The addition of new replicators may also cause changes in the nature and role of earlier replicators once they are combined into a new system, since each new system synthesizes in a novel way inherited and more recently emerged elements. The sequencing of these institutional features of human societies also seems to coincide with the structure of cognitive development of individuals in their learning processes. Specifically, each of these replicators is sequentially acquired over a person's development from infancy and remains enabled and constrained by earlier ones. In this way, these replicators are not only salient factors from a historical perspective on the evolution of societies, but they also remain integral to our modern way of life.

For social replicators to be resistant roots like bio-ecological conditions in institutions of a society, two criteria must be met for a social replicator. First, its behavioral prescriptions must be resistant to change. That is, like genes, each social replicator rarely mutates. Second, it plays an enduring role in behavioral predispositions, thus as an enduring part of institutions, predisposing patterns of human behaviors.

Resistance to Mutate

Pre-linguistic habits They come from repeatedly practiced behaviors that are liable to be stored in procedural memories, which are typically those that are "less subject to decay, less explicitly accessible, and less easy to transfer to novel circumstances" (66: 557). Over time habits become automatic responses and require minimal attention, deliberate control or resources for information search and learning, and

come to represent a baseline reaction to triggering environmental events (45, 67). They constrain any desire for changes because a new intention requires “sufficient strength and [...] skill to override well-practiced behavior” as well as “continued effort” (45). Therefore, people tend to find it very difficult to change their habits, even if such a change is driven by a rational intention, such as unhealthy habits of diet (68).

Programmatic languages Evolutionary linguists suggest that languages are a culturally transmitted replicator, characterized by a relatively slow rate of change (69, 70). For instance, focusing on Indo-European languages, Pagel (69) estimated that there was only 0.009 to 0.93 new cognate (defined by shared vocabularies and grammars) per 1,000 years, with a mean of 0.3 ± 0.18 , and that the half-life of a cognate is between 750 to 76,000 years, with a mean of 5,300 years. In addition, new languages within the Indo-European set appear on average only every 500-1000 years (69). While punctuational bursts are sometimes observed in language evolution in part to strengthen social identity and cohesion (e.g., Webster English), they occur very infrequently and may count for a minor portion of linguist evolution: e.g., 31% in the Bantu languages, 21% in the Indo-European, and 9.5% in the Austronesian (71). In fact, core vocabularies and grammars that are frequently used tend to be continually corrected from deviation from their established norms, and thus relatively conserved over time (69, 72).

Customs We restrict customs as replicators to only those that involve normative propositions. In other words, later recipients of a custom are expected to accept a coherent system of norms as earlier ones did, rather than only a symbolic or ceremonial acknowledgement. By this standard of coherence, perhaps the most important example of customs is religions, which are “a system of symbols which acts to [...] establish powerful, pervasive, and long-lasting moods and motivations” (73: 90), and coherently shape behaviors of their members through “religiously determined systems of life-regulation” (74). A key defining feature of religions is their consistent and fundamentalist doctrines, whether reinforced by worship from cathedrals, pyramids, mosques, or temples such as Christianity, Islam, Buddhism, Hinduism, and Judaism (75) or educated by morally prescriptive codes without a worship component such as Jainism, Buddhism, Taoism, Confucianism and stoicism (76).

Writing systems Once created and adopted, a writing system remains highly resistant to changes. As Coulmas (61: 11-14) summarized, writing systems serve important social functions such as “memory supporting” (“mnemonic”), “expanding the communicative range” (“distancing”), “medium of transmission [at a later time]” (“reifying”), and “regulating social conduct” (“social control”). These social functions of writing form a well-accepted common knowledge of the rules in a society, which reinforces standardization and inhibits copying errors. Re-educating people to accept new rules and standards that diverge from the structures of an existing writing system becomes very costly.

Judicial systems Judicial systems around the world differ fundamentally in their adherence to the principles of the rule of law. The rule of law can be said to exist only if historically a pre-existing body of codified principles is sovereign over politically powerful people who make and change laws (39). Judicial system principles (as opposed to specific laws and policies) are highly resistant to change, because of their removal of the right of punishment and violence from unauthorized individuals (8). This legitimizes the monopoly over these rights in a centralized system of specialized legal authority, that is, in the state or independent juries empowered by the state (8, 77), whose coercive power is constitutionally protected from challenges by any private citizens.

Scientific paradigms Paradigm shifts are rare events because they “must beat the rich-gets-richer dynamics of already established ideas and scientists” (78). Students tend to accept scientific paradigms “on the authority of teacher and text, not because of evidence” (64: 80). They seldom evoke disagreements over fundamentals (64); and when they do, it is often easier for those who dissent in the beginning of their academic career, when they start studying fundamentals, to move to another field or area, whose paradigms are more consistent with their own beliefs.

Enduring Behavioral Predispositions

While societies increasingly interact with one another, due to the depth of the respective roots of these environments in their underlying replicators, this does not necessarily lead to convergence, and indeed might even result in resistance to alternative such structures and hence cause divergence. Viewed in this way, human behaviors can be considered, at least partially, as a variety of sustained social

expressions, each such system being jointly *predisposed* by some separate and distinct set of the social replicators shared at the community level. In what follows, we examine the enduring predispositions of each replicator on modern-day human behaviors, which help explain resistance to institutional change and hence the basis of continued diversity.

Pre-linguistic habitual predispositions Habits transmit information through vivid sensual pathways, which enable people to read others' emotional states (79). Some of the more sophisticated habits such as gestures, body languages and facial expressions are shared across generations and form an enduring cultural identity for a society. For instance, in contrast to what most people do in the world, Bulgarians shake their heads to express affirmation and nod to mean negation (80). As another example, Western Caucasians are found to express emotions predominantly through their eyebrows and mouth, but East Asians do so more through eye movements and gaze direction (81, 82). Habits of thought that were built up in early pre-linguistic communications during childhood shape how people see the world in adulthood. Nisbett (83), for instance, attributes the cultural differences between Asians and Westerners partially to their preverbal habits of thought. Specifically, Asian parents tend to use more verbs to emphasize interactions when they speak to their preverbal children, whose habits of thought in turn tend to start with contexts and relationships (83). Western parents, on the contrary, tend to use more nouns to emphasize objectives, and therefore their children tend to have a habit of thought that considers individual objectives as separate beings (83).

Grammatical linguistic predispositions The complexity and abstractness of grammatical languages make it possible to form, store and transmit complicated information from an individual's mental model to a large group of people (8, 84-86). With grammatical rules and their associated mental models, languages have an enduring influence on their speakers through shared semantic meanings and perception framings that guide behaviors (84-88). Psycholinguists suggest that language is the primary means by which we gain access to the contents of others' minds and the medium by which subjects' responses are elicited (89). For instance, Athanasopoulos, Bylund (90) and Choi and Bowerman (91) found that bilinguals lexicalize motion events according to the grammatical constraints of the language in

which they operate. As another example, Chen (92) found that speakers of languages that grammatically associate the future and the present are more likely to have future-oriented behaviors such as saving, non-smoking, safer sex, and less obesity.

Customary predispositions Customs such as ceremonies and communal gatherings legitimize the recognition and acknowledgement of their underlying moral codes and norms (51), and so serve to reinforce their persistence. Relatively institutionalized customs such as religions are sustained by a system of specialized bureaucracies (e.g., the Catholic church), norms and rules (e.g., the use of bibles), and international cooperation. Together, they teach followers certain moralities and beliefs, which in turn constrain their behaviors. Max Weber (93), for example, famously attributed the emergence of capitalism in Northern Europe to the Protestant work ethic. Studying Americans of different religions, Cohen and Hill (94) found that Jews value community and biological descent but Protestants value personal beliefs. Ferguson (95) argued that money lending (the precursor of modern banking) originated among Jews because they could charge an interest, which Christians were forbidden to do. Islamic finance forbids interest, gambling, and speculation – known as *Riba*, *Qimar* and *Gharar* - which are condemned in several verses of the *Al-Qur'an* (96).

Writing predispositions Writing and literacy is a major facilitator of large-scale cooperative behaviors by elaborating four cooperative tools of reciprocity, reputation formulation and maintenance, social norms and norm enforcement, and group identity and empathy (97). Different writing systems define differently the relationship between visual symbols and their underlying spoken languages, which requires different cognitive and neural processing to store and communicate information (98-102). Such differences in information processing and communications may affect how people behave in response to visual information and stimuli (103). For instance, Tavassoli (104) found that surface features of a brand such as colors had a stronger effect in logographs than in alphabets on consumers' brand evaluation.

Judicial and legal predispositions Judicial systems and laws form three facets of legal environments: the facilitative environment that passively provides an arena for action; the regulatory environment which seeks to regulate behaviors; and the constitutive environment that defines the basic

building blocks of acceptable behavior forms and social relations (105). The literature on how judicial systems and laws shape behaviors has been well developed in the extensive discussions related to formal rules in neo-institutional economics (3, 106) and regulatory pillars in neo-institutional theory (4) (for reviews, see, e.g., 105, 107, 108). The former perspective portrays a human agent as rational wealth-maximizers, who see the laws as a system of incentives and penalties (105). Whereas, the latter perspective portrays humans as cultural rule-followers, who see laws as a system of moral principles, scripted roles, and sacred symbols (105). There is a large literature on how families of legal systems affect modern political and economic behaviors. For instance, legal origins have been found to be a persistent determinant in investor protection (109), financial market regulations (110), regulation of entry, regulation of labor, press government ownership, conscription, formalism check collection, tenure of judges, and case law (77, 111).

Scientific paradigmatic predispositions Scientific paradigms provide algorithms, through which educated people rationalize their theories and behaviors (112). A relevant example relates to how scholars from different disciplinary backgrounds theorize about corporate governance relationships. Economists tend to rely on agency theory, which assumes self-interest and moral hazard to analyze managerial behaviors (113), whereas sociologists and psychologists tend to favor stewardship theory and depict subordinates as “collectivists, pro-organizational, and trustworthy” (114: 20). Such behavioral effects are also observed among practitioners. For instance, Fiss and Zajac (115) found that German CEOs with economics or law degrees tended to be more oriented to move away from the stakeholder value tradition into shareholder value maximization.

(RE)DRAWING THE BOUNDARIES OF SOCIETIES

Accepting that these social replicators are enduring behavioral predispositions, we may see human behaviors to be not only genetically/ecologically but also socially predisposed by a complex field of historically received replicators. Just like genetic transmission that forms biological family lineages, transmission of social replicators forms social lineages based on the shared ancestors in each social

replicator. Thus, humans are not completely idiosyncratic individuals but predisposed into multiple levels of societies, the boundary of each is defined by a shared lineage of replicators.

Insert Figure 1 about here

We therefore theorize about how each of the social replicators forms social lineages, which distinguish between insiders and outsiders, through its social transmission, and thus draw the boundary of societies. We argue that each replicator operates at a particular level of society, there being other levels that are formed by other replicators, and these levels and their respective boundaries between insiders and outsiders do not necessarily coincide. An insider at one level may be an outsider at another. We illustrate the sequences and relations among these replicators and their transmission in Figure 1. A bubble shows that each replicator on the X-axis corresponds to a different level of society on the Y-axis. In each bubble, behaviors and social relations evolve as programmed by a distinct replicator, that when considered together form multiple layers of a society. In addition to the effects of any specific replicator, at a systemic level we may also identify a boundary of the common ecological conditions of a society that constitute an overall selection environment.

Below we discuss how each replicator forms a unique path dependence through the social transmission. Here, we follow the convention and define path dependence broadly as social processes, through which the outcomes depend on a set of earlier programs (that is, the roots of replicators) (16).

Pre-linguistic Habit Transmission and Interpersonal Social Groups

Pre-linguistic habitual path dependence Habits diffuse through interpersonal interactions and imitations, especially face-to-face communications (116). As such, although the diffusion of habits can be wider than vertical biological families, it is limited to closely-knit social groups that share the same repeating contexts and have effective personal communications among members (117). Hence, the boundary of habits does not generally coincide with a national boundary or genetic lineages, but is more likely to be limited to a social network in which members (regardless of nationality or biological

relatedness) have intensive interpersonal interactions. As one example, sports teammates practicing together tend to share similar routines, which may differ drastically from people outside the team. Many habits that are proven to enable effective communications may be later codified into other replicators (e.g., languages and customs), which enable wider social transmission (8, 118).

Interpersonal social outsidership Similar to subjectively perceived barriers between genetically defined populations, habits may also constitute social impediments between groups, due to our inherent in-group biases (59, 119, 120). For instance, Hamlin, Mahajan (120) found that preverbal infants prefer individuals who share the same food preferences over those who do not, and prefer individuals who treat similar others well and dissimilar others poorly. As another example, it is also found that judging emotional expressions among foreign cultural groups is more difficult (121).

Language Transmission and Ethnolinguistic Groups

Linguistic path dependence Spoken languages can spread through sounds and voice messages, so their capacity to replicate and establish social boundaries is not limited to sexual transmission or face-to-face interactions. As Pinker (48: 8994) summarized, language “allows messages to be composed out of elements, rather than drawn from a finite repertoire, it confers the ability to express an unlimited number of novel messages”. In pre-history, languages diffused with human migration and settlement (122). For instance, the Indo-European languages have been found to branch out with the spread of agriculture from Anatolia round 7,800-9,800 years BC (123). Since grammatical languages can be articulated as a system of rules, they can be taught by one person to a large group of students. Ethnolinguistic groups emerge and expand as a result of linguistic diffusion. Ethnolinguistic boundaries do not generally coincide with modern states, genetic lineages, or pre-linguistic habitual groups. For instance, English is the sole official language of the Commonwealth of Nations, consisting of 52 member states across the world, which were mostly territories of the former British Empire. In contrast, some countries have multiple mutually unintelligible languages (or dialects) such as Spain, Switzerland, or China.

Ethnolinguistic outsidership

Linguistic differences may form an enduring subjective barrier due to miscommunications. For instance, Desmet, Ortuño-Ortín (124) find that ethnolinguistic diversity in a linguistic tree is negatively related to public good provision and redistribution, and the effect is more significant for divisions that arose in deep history thousands of years ago, more so than in recent such separations. There are multiple facets of differences in the use of language that increasingly affect the operations of global business today (125, 126).

Custom Transmission and Traditional Societies

Custom path dependence

Customs may diffuse over a wide range not limited by biological families, face-to-face communications, or languages, largely because they facilitate the expansion of cooperative and socially coherent groups and thus enable societies to expand beyond these previous social boundaries (127). For instance, religions and their communal nature are found to have survival advantages for large-scale societies, such as cooperative and altruistic relations that promote social cohesion and economic prosperity (128-130). Shariff and Norenzayan (131) studied university students in Canada and found that they allocated more money to anonymous strangers when concepts of God were activated. Roes and Raymond (132) studied 186 societies and found that population size was positively correlated with group sanctioned deities who are directly concerned with human morality. In addition to communal activities, diffusion of customs has also been facilitated by missionaries and ambassadors throughout history, sometimes accompanying trade and military expansion (133).

Traditional outsidership

Differences between resistant traditions such as religions can be substantial. As Varshney (134: 26) suggests, “conflicts concerning religious laws, places of worship, or icons of special historic and cultural importance [...] can be deadly”. The majority of literature in fact evidences still widespread and persistent (*de facto*) religious segregation and conflicts in secular societies, such as the Protestant-Catholic school segregation in Northern Ireland (135), Hindu-Muslim conflict in India (134), Shia-Sunni violence in Pakistan (136), and the rise of anti-Muslim sentiments in the US and Western Europe (137, 138). Studies also suggest that it is very difficult for different traditions and religious beliefs to be assimilated into a shared common culture (139). Some major channels via which

different religious beliefs may be potentially assimilated are immigration, inter-religiously integrated schools, and interfaith marriage (135, 140), with interfaith marriage argued to represent “the final outcome of assimilation” (141: 408). However, empirical evidence suggests that such assimilation is more symbolic than substantive. For instance, children of mixed religious marriages in the US are found to be less committed to either religion than others whose parents believe in homogeneous religions (142, 143).

Writing System Transmission and Civilized Societies

Writing system path dependence Writing is considered by many historians to define the start of human civilization (e.g., 54, 75, 144, 145). A community sharing a common writing system has therefore often been termed a civilized society, in contrast to traditional societies, in which communications rely primarily on interpersonal relationships, customs, and spoken languages. Since writing is associated with its underlying spoken languages, writing lineages may largely overlap with linguistic lineages. However, there are exceptions. For instance, both mainland Chinese and Taiwanese speak Mandarin, but they write in simplified and traditional Chinese respectively, which can be substantially different (e.g., 一 vs. 壹, pronouncing “/ē/” and meaning “one”), due to *The Chinese Character Simplification Scheme* promulgated on the mainland in the 1950s. Another example is Urdu and Hindi in India, which share grammar and a large part of their vocabularies, but base their writing on Arabic/Persian and Sanskrit roots respectively. A third example is second generations of immigrants, who speak their parents’ languages but can only write in alphabetical versions of these languages (e.g., *Pinyin* in Chinese).

Civilized outsidership Writing systems may create communicative barriers, especially between different types of language systems (e.g., the alphabetic vs. the logographic). One natural reason is that reading in a new language requires a modified neural network from the old system (146). Such modification can be very difficult for adults, because neural plasticity is at work only until around 10-12 years of age (102). Another reason is that written legal languages carry the function of social control in the particular historical context of each society, which may not always have translatable equivalents in

another society (147). For instance, basic British legal terms such as “common law” or “equity” have no equivalent in Islamic legal systems such as apply in Turkey (148).

Legal Transmission and Administrative Territories

Judicial system path dependence A judicial system entails the codification of principles into an impersonal authority (e.g., written records) and trains a group of legal specialists (e.g., lawyers, judges, police, etc.) (8). These make it possible to teach and enforce laws over a large population under a common coercive power (58). Historically, one pathway of judicial system diffusion has been the colonization of states and legal transplantation through empires, such as the adoption of Romano-Germanic civil law in continental European, Latin American, and some African and Asian nations, and common law in the United Kingdom and its former colonies (77, 110, 149, 150). The second pathway for diffusion of judicial systems has been the absorption of foreign judicial systems as a means of modernization (very often, westernization) such as occurred in Japan in the *Meiji* Restoration (149). A third pathway of diffusion is the reform of legal systems to bring them closer to the structure of Western laws in many countries under the world order of “embedded liberalism” after World War II (WWII) (151: 379). In one version of this process, new member states reform their legal systems as a requirement for joining regional trade blocs or economic cooperation agreements such as the European Union, the World Bank, the International Monetary Fund (IMF), the Organisation for Economic Co-operation and Development (OECD), and the World Trade Organization (WTO).

Judicial and legal outsidership (or foreignness) In any of the above mechanisms for the spread of legal approaches, by its very nature, the scope of judicial system diffusion is limited by the effective reach of a jurisdiction’s coercive power. And for this reason, the boundary of a judicial system defines an administrative territory such as a nation state, an autonomous region, an aboriginal territory, or an emirate. Therefore, this is the one category of replicators, in which outsidership and foreignness may take on the same meanings. Crossing the legal boundary of an administrative territory leads to differences in laws, regulations, and policies, as well as their enforcement characteristics. However, different judicial laws may be promulgated and enforced at different levels of government, suggesting that foreignness may refer

to outsidership from a nation, a state, a province, or a regional trade bloc, or some combination of them. For instance, Beugelsdijk and Mudambi (152) suggest that international business activities are challenged not only by national institutions but differences in various subnational rules and regulations. Institutional theorist Ostrom (153) also suggests that the policies and regulations of a community derive from multiple locations and levels of concurrent authorities.

Scientific Paradigm Transmission and Scientific Communities

Scientific paradigmatic path dependence Scientific inquires and investigations are given relative autonomy and academic freedom in universities and research organizations independent of any authorities (154). Unlike judicial systems, the diffusion of scientific paradigms is not bounded by nation states. In addition, their characterization by a high degree of articulation and codification (e.g., logical terms and mathematical expressions) suggests that scientific paradigms are relatively less bounded by linguistic or writing system differences, compared to more inarticulate or context-dependent knowledge such as customs and laws. The diffusion of scientific paradigms is supported by various scientific organizations and media, such as schools, universities, academic associations, joint research activities, textbooks, and so on. Therefore, the scope of studentship, membership, and readership of these organizations and media defines the boundary of a scientific paradigm.

Scientific paradigmatic outsidership Artificial barriers to knowledge transfer are often created by differences in methods and languages across knowledge areas and disciplines (155) as well as conflicts in basic assumptions (156). Thus, it is not surprising that empirical findings suggest that scientific works are mostly read and cited within their own discipline/field. For instance, a bibliometric analysis by Rinia, van Leeuwen (157) showed that the majority of citations in basic sciences are within the same discipline, such as physics (78.8%) and mathematics (72.9%). While we do see citations across disciplines, they have to overcome various practical barriers such as years of advanced training (e.g., a Ph.D.), study experiences (e.g., research, applications, and publications), as well as a sound understanding of basic logics and assumptions (e.g., behavioral assumptions, teleology, etc.). Mapping the lineage of scientific

paradigms is complicated, as scholars have to probe deeply into a given discipline's history of thought (158).

IMPLICATIONS FOR HUMAN BEHAVIOR

Many theories in social sciences hold a provisional view of default human behavior or behavioral assumptions of a human agent. Our review suggests that human behavior in an evolutionary sense may be predisposed by a series of replicators at different levels of societies. While we do not deny individual idiosyncrasies, our focus has been on group-level shared determinants of behavior. Thus, the default behavior, defined as predisposed tendency of a typical human may quite legitimately differ depending upon differences in the context of bio-ecological conditions, social replicators, and their interactions. Social scientists often struggle to define uniform rational goals underlying human behavior (159-161). As Simon (161) suggests, "the goal of an action is seldom unitary, but generally consists of a whole set of constraints the action must satisfy". In practice, researchers tend to choose (very often unconsciously) the objective functions that are consistent with their discipline-based rationality rather than the ones that may be most salient to the subjects they are trying to explain (7). This by itself is a disposition of scientific paradigms.

We suggest rethinking such discipline-based rationality in favor of a more complex socioecological system of naturally and socially structured rationalities. One difficulty is that the pursuit of a single dominant goal cannot explain how diverse actions are predisposed to adapt to the underlying bio-ecological roots and social replicators. Neither social conformity to external social environments nor wealth maximization adequately capture a human group's ultimate evolutionary goal, which is to sustain reproduction of its replicators. For instance, communities of people not only follow their scientific theories, obey local laws, respect local customs, but they are also primed with habits of thought underlying their writing systems, grammars, and genetically influenced biases. To survive and thrive, human groups need to continually experiment to find appropriate combinations of goals and learned behaviors that come to work well in ways that may not have been readily predictable in advance, and

which vary across both time and space as their environments shift at the same time as they are changing themselves.

Limitations

While we open up some potential new directions for theorizing about institutional diversity, we also recognize some unresolved issues that need to be addressed in future extensions. The first is co-evolution among replicators, especially their continued interaction and hence their interdependence. We have discussed the seven categories of replicators following the evolutionary sequence in which they first appeared (8), but the development of historically later replicators may likely cause renewed evolution in earlier ones. For examples, laws are increasingly shaped by scientific evidence and theories; people of similar scientific/disciplinary backgrounds are more likely to work together, reshaping habits. As we have argued already, institutional systems are complex.

A second is potential influence of parent replicators from different lineages in the making of a synthesized new lineage. Such influence can be asymmetric. For instance, while children inherit half of genes from each parent, the genetically inheritable personality associated with one parent may be more dominant. Also, languages and writing systems set different bars of literacy. For instance, compared to alphabetical systems such as English, which is a linear combination of twenty-six letters, logographic systems such as Chinese have a much higher bar of learning, for which thousands of complex characters and their visuals need to be memorized before one can read (162). Therefore, it is likely more Chinese forms are substituted by English than the other way around, when the two are synthesized into one system (Chinglish).

A third is the technologies of new media, which may have fundamentally changed the ways in which replicators are transmitted and synthesized across lineages. For instance, transmission of habits is increasingly driven by social media (e.g., YouTube vines); language learning is more facilitated by online tools; interdisciplinary knowledge integration is enabled by artificial intelligence (e.g., IBM Watson).

A fourth is a distinction between creative and evolutionary systems (16). Our current typology focuses more on the evolutionary patterns, with limited discussions on the proactive design and

engineering of human agents. We see more and more entrepreneurial and purposive people in the re-engineering at all seven levels of replicators and their transmission paths. Examples range from genetic engineering of human cells (163) to the creation of new scientific paradigms through a peer-reviewed journal process, just to name a few. We need to answer two questions. First, what are the effects of purposes on the process of replicator diffusion and synthesis? Second, are, or how are, these purposes predisposed by any replicators of the human agents who initiate an action?

Last, but not least, all replicators interact to impact human behaviors through their associated information and stimuli on the human brain and the neural system. Understanding how they interact to form perceptions and behaviors remains ambitious, without a better understanding of how all these sorts of knowledge and information are stored and processed in human brains (11). We suggest social scientists might have more meaningful collaborations with researchers in frontier disciplines such as neurosciences.

CONCLUSION

We have drawn on an evolutionary framework of bio-ecological conditions and social replicators to review the literature on resistant roots of institutional diversity across societies. This review not only helps us understand the resistant roots of institutions of a society, but also provides a suitable typology through which to better understand the multifaceted character of societal boundaries, and the complex and pluralistic goals underlying predisposed human behavior. We encourage additional conceptual and empirical inquiry to help scholars further understand the diversity and complexity of all levels of replicators, as well as to further investigate the processes through which these replicators influence and co-influence human behaviors.

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Figure 1. An Evolutionary Framework of Resistant Roots of Institutional Diversity

Legend: G=gene; P=prelinguistic habit; L=grammatical language; C=custom; W=writing system; J=Judicial system; S=Scientific paradigm; E=Ecological conditions. The white bubbles (G and E) represent bio-ecological roots of institutions of a society, in the absence of social replicators. Colored bubbles represent social replicators, sequentially emerged and evolved as resistant roots of institutions of a society. Each bubble gives rise to a different level of society, based on shared social replicator lineages.