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CULTURAL PROGRESS IS THE RESULT OF DEVELOPMENTAL LEVEL OF SUPPORT

Michael Lamport Commons
Department of Psychiatry, Harvard Medical School, Cambridge, Massachusetts, USA

Eric Andrew Goodheart
Dare Institute, Cambridge, Massachusetts, USA

How is cultural progress possible? Historically, no other animal has progressed as humans have. Conventional wisdom suggests that by having language, people accumulate knowledge, which produces progress. Such Formal stage 10 wisdom begs fundamental questions. Thus, we assert the cultural necessity of levels of support, or scaffolding, for people to develop higher stages of hierarchical complexity. The resulting, wider accessibility to higher-stage action and knowledge, which requires higher stages of development to understand, enables social and scientific progress. With memes and downward assimilation, larger proportions of society gain access to advanced thinking with support, in turn enabling cultural progress.

KEYWORDS: Culture, development, hierarchical complexity, levels of support, memes, progress, scaffolding.

The purpose of this article is to develop the argument that in any society, progress necessitates supported performance of its members, and this should be embedded in cultures at the levels of support their members need. A society characterized by non-supported performance would be the macro version of Piaget's functional method of measuring development (i.e., tasks one can perform on one's own demonstrate the individual's stage of performance). People would be confronted with problems more than two stages above where they are functioning and thereby fail at making progress. If society provided no forms of support for people's performance of tasks, there would be no way for people to benefit from the discoveries of others, living or dead. We argue that such developmental benefits are vital dimensions of cultural progress.

The concept *progress* is susceptible to myriad interpretations. Our focus is not generically on "progress," but specifically on *cultural progress.* This concept derives less from considering individuals and more from evaluating how the culture is sustaining and developing itself. This manifests, of course, in both collective and

Address correspondence to Michael Lamport Commons, Ph.D., Dare Institute, 234 Huron Ave., Cambridge, MA 02138-1328, USA. E-mail: commons@tiac.net

individual behaviors and quality of life as well as in a society's institutions. This is why the issues of supported or non-supported performance are emphasized.

Because humans are social animals equipped with language ability, it may seem merely rhetorical to consider the non-existence of progress due to non-supported performance. The human family supports the development of its children by instructing, encouraging, and admonishing, and exposing them to the wider world. In most societies, this exposure includes schooling. Most young humans have support to learn to perform new tasks. Adolescents and adults in every culture, except when immersed in war, have at least some social mechanisms available to support their learning of new skills, trades, and other kinds of jobs. Although unevenly distributed at present, post-secondary education is widely institutionalized around the world. Clearly, then, there are at least some forms of cultural support for young and mature adults in performing new tasks.

The following discussion begins with introducing the concept of support. The seven levels of support are introduced after they are set in the context of their measurable impacts on task difficulty and performance. These are measurable because the Model of Hierarchical Complexity enables quantification of development and the levels of support (Commons, Trudeau, Stein, Richards, and Krause, 1998). With that background, the concept of downward assimilation and memes are discussed in connection with their cultural role and high stages of performance. The conclusion considers implications for the future if a culture fails to sustain and develop itself by embedding developmental levels of support.

THE CONCEPT OF SUPPORT

Support describes the conditions in which aids are offered to one performing a task. The task demands of a given stage are reduced by offering such aids to performance. *Task* refers to any kind of action undertaken by an individual or group. Tasks have widely divergent timeframes, for example, from moments to years. Support, then, may have to represent much more than a short-term helping hand. By contrast, if one could only behave in the context in which Piaget measured stages of development, progress would not exist. With the exception of their work on imitation, Piaget (Inhelder and Piaget, 1958) simply presented problems with neither any form of assistance nor any extra task demands. Fischer (Fischer and Lazerson, 1984) gave the name functional level (non-optimal) to Piaget's method of presenting problems. He argued that Piaget's method gave no support to an individual's performance (0 stage demands). Vygotsky (1966) introduced the notion of support as it has come to be used in research on stages of development. He suggested that two levels of support exist. With the first form, a person imitates another person's performance. As shown later, this makes a problem easier by one stage (–1 stage demands). With the second, even stronger form of intervention, a person is directly instructed in an action or dragged through actions. This makes the task easier by two stages (–2 stage demands).

Without support, each person might discover some knowledge. To discover that knowledge, they may have had to function at a very high stage. There might thus be more knowledge developed, but that knowledge may require too high

a stage of performance for others to understand. Support lowers the effective stage demands necessary to function at a given stage. By lowering the effective stage demands, support may allow a person to downward assimilate stage tasks; support provides individuals with simplified forms of tasks, facilitating downward assimilation. Together, support and downward assimilation make the acquisition of new knowledge possible. Drawing on Vygotsky, Arlin, and Fischer, the concept of levels of support may be generally formulated as we do here.

MEASURABLE EFFECTS OF LEVELS OF SUPPORT ON PERFORMANCE

The idea of level of support or demand for independence as used here derives from Arlin (1975, 1984), Fischer (Fischer, Hand, and Russell, 1984), Gewirtz (1969), and Vygotsky (1962, 1966). Vygotsky is one of the first researchers to refer to scaffolding, now also known as level of support. There are seven levels of support, shown later. The withdrawal or provision of stimuli in stage tasks increases or decreases the level of support. In other words, the higher and more positive the level of independence from support, the less support there is in doing a task. Levels of support exist at every stage. In some cases, the stimuli that are effective in providing support may vary somewhat by stage. Each decrease in level of support increases the relative difficulty of a task by one stage. The seven levels of support are transfer of direct control, stimulus control, pervasive imitation, direct, problem finding, question finding, and phenomenon finding.

We locate the highest stages of individuals by examining historical figures, the stage of the tasks they carried out in solving problems, and the kind of support that existed for their activities. We also understand the general stage demands on large numbers of members of that culture. The invention of scientific culture by an individual requires the paradigmatic stage. In the most basic sense, scientific culture is one in which experiments are conducted and the results transmitted widely throughout the community. As Commons and Richards (1995) show, because there is no support for the invention, the lowest stage possible for the invention would be the paradigmatic stage. Finding a problem increases stage demand by one (Arlin, 1975, 1977, 1984). Finding the question that allows for finding a problem to address the question increases stage demand by yet another stage. Finding and identifying the underlying phenomenon requires one more stage. Essentially, there is no direct stimulus control other than that provided by the environment because there is nothing one is asked. Nor is there a history of reinforcement that would induce the subject to detect the phenomenon. Only after a phenomenon is recognized may questions be formulated and problems designed.

The development of scientific culture is illustrated by the manufacturing of tools dedicated to specific purposes. Such invention and manufacture require people to conduct experiments to determine which shaped tools work best for each purpose (e.g., scrapers, cutters, spear points). Hence, variable tool manufacture and use require Formal order 10. The same is true for tools to be widely manufactured and used. The distribution of stage scores are approximately 1 stage per standard deviation in the population from early Cro-Magnon (Commons and Richards,

1995). That distribution guaranteed that while there would be a means sufficient to support a number of tool and strategy developers; the variance would support the existence of the Paradigmatic stage 13.

In this article we talk about the normative cultural stage rather than the highest stages of leaders within the culture. The rate of cultural invention depends then on a large number of factors, only one being the availability of very high stage inventors. This accounts for why we have always had paradigmatic inventors and yet never had a paradigmatic culture. In fact, the stage of a culture's activities approaches the stage of its inventors' activities, progressing gradually from the Formal stage 10 to the Systematic stage 11, and then from the Systematic stage to the Metasystematic stage 12, and so on. As the stage of cultural activity increases, the amount of support for invention increases. Even though individuals might act at one of the highest stages, for example, paradigmatic, societal development always lags behind individual development. This is because at each stage of cultural development, cultural innovators outstrip their contemporaries with respect to development, at least within their domain of innovation. In order for a culture to progress, there must be a supply of innovators who work with minimal support from their culture. The size of this supply seems to be the largest bottleneck in cultural development.

LEVELS OF SUPPORT AND THE HIERARCHICAL COMPLEXITY OF PERFORMANCE

Levels of support are used when scoring the hierarchical complexity of performance of a task. They are also meaningful when analyzing for any other reasons the conditions under which tasks are performed. In scoring contexts, one wants to measure task performance with different levels of support. For example, let us say that people fail to do a Formal order 10 task without support. But with one level of support—that is, showing them how to do a similar task—they accomplish the Formal order 10 task. This tells us that they are performing at the Abstract stage 9 without support. This could be demonstrated by giving them an abstract task without support. Changes in the level of task difficulty directly impact the resulting hierarchical complexity score of the performance. Examples of how we approach these levels in testing, for instance, are included in the descriptions that follow (Commons and Richards, 1995).

The following seven items comprise the range of levels of support that have been identified. The levels have been quantified with independence numbers from –3 to +3. This is because each different level of support has quantitative impacts in performance terms. The title of each level of support begins with the number of stages of performance by which that level of support changes the task difficulty. In the list that follows, we state, in this order, (1) the independence number, (2) the name of the level of independence of or from support, (3) how support changes the measured stage relative to unaided problem solving, and (4) the action with respect to the subject is stated. The explanations follow.

1. **–3 levels of support: Manipulation**
   Manipulation changes measured stage of performance by –3 stages. This level of support involves one being moved through each step to perform it. This is literally walking individuals through the task by moving them through each step of solving a problem.
2. **–2 levels of support: Transfer of stimulus control**
   Transfer of stimulus control changes measured stage of performance by –2 stages. The supportive actions are being described during each step. This is a form of direct instruction. Vygotsky (1962) refers to performance established using transfer of stimulus control as the scaffolded performance. For example, let us give the classic example of a very young child learning to use buttons to indicate the difference between birds and non-birds. To begin with, the child has already been trained to press the left button when a red square appears on a computer screen and the right button when a green square appears. The green square is then placed on pictures of birds and the red square on pictures of other animals. With these prompts, the child performs the tasks of discriminating the class of birds from non-birds flawlessly. Slowly, the colors are faded out and the child correctly responds to birds and non-birds perfectly. In this example, the colored squares are the stimuli that control the behavior at first (prompts or cues). The control is transferred to the new stimuli of birds versus non-birds. Moore and Goldiamond (1964) and Terrace (1963) used such transfer in their errorless learning procedures. Holland and Skinner (1961) used this transfer of control procedure in programmed instruction. In another example, first, train discriminative performance with one set of stimuli on one task. These stimuli become the prompts or cues. Second, use the same prompts and cues to control performance in another task. Third, slowly remove the prompts. For example, to train reading (the discriminative performance), train a child to follow your pencil. Then read each word with the participants, pointing to words they are reading. Slowly withdraw saying the words. Then withdraw pointing at them.
3. **–1 levels of support: Pervasive imitation**
   Pervasive imitation changes measured stage of performance by –1 stages. The supportive actions are shown to the participant. Gewirtz (1969) suggests that *pervasive imitation* includes delayed imitation, or observational learning. The imitated action may be written, depicted, or otherwise reproduced. Piaget and Inhelder (1973) extensively studied stage using these methods. Fischer and Lazerson (1984) call this form of control the optimal level. A rough parallel between recognition memory and imitation exists in that they both involve immediate reproduction. In the earlier example, the child learning to discriminate the class of birds from non-birds, the adult could do this task while the child watches.
4. **0 levels of support: Direct**
   Direct action changes measured stage by 0 because this is the usual measured stage. This level can also be called hacking or unaided problem solving. There is no supportive action. The problem is given without any special aids or demands. Fischer and Lazerson (1984) call this the functional level. Most of Piaget's work

was done at this level. There is a parallel here to free recall memory. Following our example, one would just provide the children participants with birds and non-birds and test to see if they discriminate among them.

5. **+1 levels of support: Problem finding**
   Problem finding changes measured stage of performance by +1 stages. For example, participants are asked to generate a problem that illustrates a causal relationship. The lack of a supportive action is the additional requirement of discovering a problem. Arlin (1975, 1977, 1984) used this level of support as a stage beyond formal operations. She calls this stage problem finding when the problem to be found is a Formal order 10 ("formal operations") problem. Note that if the problem were at that Formal order 10, a successful performance would be at the Systematic stage 11 (Formal order $10 + 1 = 11$). From this example, the participants would already have to have had a class of formal operational causal relationships. Then they would simply sample one such relationship. In another example, participants are given an issue and they are asked to give an example of such a problem. Here, we restrict the meaning of problem finding to one where the issue is narrowly defined and an instance of the issue is given. This is what it takes to create a moral atmosphere.
6. **+2 levels of support: Question finding**
   Finding the question changes measured stage of performance by +2. The supportive action is discovering the question. Building on Arlin's work, a more difficult situation that lacks even more discriminative stimulus support, is to present subjects with a phenomenon and have them find a problem and an instance in which to solve that problem. Participants have to create a description of the system first, and then create and solve a problem based on that system. Embedded in the task of question finding is the subsidiary task of problem finding. But one first has to define the question and only then find a problem to answer that question.
7. **+3 levels of support: Phenomenon finding**
   Discovering the phenomenon changes measured stage of performance by +3. Phenomena are to be found in the task. Essentially there is no direct stimulus control because there is nothing one is asked; nor is there a history of reinforcement that would induce the subject to detect the phenomenon. Phenomena are broad descriptions of multiple complex systems. Only after a phenomenon is recognized may questions be formulated. Examples illustrate this point. This was the case with Darwin's discovery of evolution. He had to discover the phenomenon of evolution before he could ask the question as to what the nature of evolution was. For example, are evolutionary changes random or do they have a purpose? Physical motion is a phenomenon. The question is, what are the laws of motion? We give the problem to test what determines the period of a pendulum. Presenting the pendulum problem is the unsupported formal operational task.

DOWNWARD ASSIMILATION

The account presented here specifies how levels of independence help or hinder downward assimilation. Assimilation involves the interpretation of events in terms

of existing cognitive structure (Piaget, 1954). Downward assimilation is the process by which a problem that is of too high a stage to perform is made easier through the provision of support.

For example, at Metasystematic stage 12, some people may coordinate the notions that elementary logic and elementary set theory have the same structure, and anything that is true in elementary logic will turn out to be true in elementary set theory and vice versa. Ideally, this would then be taught in college classes. Or people may coordinate the systems of modularity in evolutionary psychology and domain-general mechanisms in comparative cognition by applying the Model of Hierarchical Complexity to both (see "Toward a Cross-Species Measure of General Intelligence," this issue). Publications disseminate knowledge. When individuals perform even at the highest postformal stages, paradigmatic and cross-paradigmatic, their discoveries become accessible to a wider number of people with such support. This is the action of downward assimilation.

Downward assimilation became increasingly possible due to language and methods for remembering and communicating, both in the present and in the future. Such means include information such as rhymes, poetry, songs, writing, manuscripts, libraries, books, printing, news media, broad access to education, higher education, computers, and the Internet. In some sense, these are all forms of education. With changes in stage of performance in social domains due to these newer modes of remembering, downward assimilation became more universal. As a consequence, there has been a like change in social status. The stage of individual performance has also changed in many domains.

For example, historically, the definitions of humanity and thus the notions of who deserved respect have changed from including almost no one, to including lords, male land owners, males in general, males and females, and, now, to citizens over ages 18 to 21 regardless of race, creed, or national origin. These things seem obvious to us now, but they were uncommon in earlier eras. Another example of the consequence of increasing amounts of assimilation of past advances during cultural evolution is a shift in who is considered a person by society and the law. In historical stone-age cultures, in a total war, all the men on the losing side were killed, women were raped, and children abandoned. After "civilization," men, women, and children were turned into slaves, at least preserving their lives. Although such violence still persists in some areas of the world, it is now generally deplored. This meme of deploring such violence to other human beings is now institutionalized in international documents and agreements. The Geneva Convention and the United Nations' Universal Declaration of Human Rights are examples of institutionalizing such healthy memes.

There must be a cultural backdrop that can downward assimilate discovery. A discovery may be regarded as a new pattern of behavior performed by an individual or individuals in various situations. Dawkins (1982) calls these behavior patterns memes. Memes are to cultural evolution as genes are to evolutionary biology: the basic unit of information that is transmitted from one individual to another. The difference is that memes are more like viruses. They can infect people. When people's actions develop into higher stages of development, they are more easily infected with the most hierarchical complex memes. Inventions can only build on previous inventions and are limited by the stage of development of those

inventions. That is why the stage we assign to cultures can be so much lower than the stage attained by the most developed individuals. Formal and informal education are the means by which memes are acquired (Cavalli-Sforza, Feldman, Chen, Kuang-Ho, and Dornbusch, 1982). Increasing support for the education of people reasoning at lower stages ensures that people can downward assimilate discovery.

Innovators must be teachers in order for their new memes to be acquired by others. Findings need to be spread by *infection of memes* (Commons, Krause, Fayer, and Meaney, 1993; Trivers, 1985). This dramatically slows the process of discovery, because a particular set of contingencies is required in order for new cultural information to be transmitted. In detecting a set of contingencies that apply to a particular situation, an individual is thereby infected with the meme carried by those contingencies. In executing a behavior that is controlled by that set of contingencies, the individual is further infected. Thus, there are degrees of infection by memes. Moreover, because any contingency selects behavior, it can represent one or more memes. The infecting meme is the subjects' resulting behavior. All effective education, training, and communication result in a transmission of progressive memes. Conversely, poor education, training, and communication can transmit regressive memes. Progressive findings need to be stored in order to be passed on. Regressive memes need to be recognized for their impacts on cultural progress. The rate of progressive memes' impacts depends on increasing contagion so that the innovators come into contact with the most advanced forms of the present culture. The culture needs to embed the demand process—and deliver on it—so that innovators' efforts, and the very notion of innovation itself, pay off.

CONCLUSION

If cultural memes convey that every person must fend for himself or herself, or families and organizations fend for themselves, for example, then it is unlikely that cultural progress will be developed or sustained. If cultural institutions place time-limits on how many years of explicit support are afforded to persons, families, and organizations, increases in the hierarchical complexity of those entities' performances are likely to be unnecessarily slow. This incurs costs to societies in the form of crime, prison and justice system costs, and social and health services. This is because unaided performance increases tasks' difficulty by multiple orders of complexity. Without support, large proportions of populations hold back cultural progress in two ways. They not only incur additional societal costs, but they also deprive society of high-stage performers whose influence fosters cultural progress in the form of memes and downward assimilation of more advanced knowledge and action.

Research in the field of Precision Teaching has shown how we can reliably and easily raise unsupported and unaided learning as well as aided performance by at least one stage. This knowledge need not be confined to formal education. Such knowledge silos stymie cultural progress. Instead, by working on downward

assimilation and teaching, much of what has been discovered can become widely available. This is the basis of real progress.

Once there is accessibility to a higher-stage action and knowledge requiring a higher stage of development to understand, there is tangible social and scientific progress. Individual progress means that there are more high-stage-functioning people. By allowing for downward assimilation, a large proportion of a society has access to even the most advanced thinking. This, in turn, makes it possible for a wider group of people to learn and to innovate. Learning and innovation are thus the root of increases in hierarchical complexity of performance. In this world of disparate cultural statuses, cultures of more advanced societies will foster their own progress more by providing developmental levels of support for other societies. The concept of levels of support applies at all scales, from individuals to organizations to societies. The worldwide benefit for the future of spreading such supportive memes could hardly be quantified.

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