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Modularizing Small Group Theories in Sociology

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Abstract

This article asserts that it is beneficial to formulate theories using methods specifically designed to facilitate and promote integrations. Although it is written using illustrations primarily from sociology, the discussion is relevant to other fields to whatever extent their theories may be deemed informal (i.e., presented without explicitly defined terms, distinct propositions, or logical calculi for deriving hypotheses). Constructing theories in a modular fashion makes the processes of development and explication more efficient, and the products more generally useful. Modules are semiautonomous components designed with sufficient flexibility that they can be assembled into larger combinations which are capable of generating explanations and predictions that individual modules could not manage alone. The general benefits of modularization are demonstrated for a variety of applications, and the argument is made that modularizing our theories would facilitate refinement, integration, and problem solving. Included are several illustrations in which two or more formal theories or parts of theories from the small group literature in sociology are linked in useful ways. More explicit attention to modularizing formal theories from the outset should enhance the potential for easier integrations and solutions to a broader array of substantive problems and applications.

Keywords

theory construction, theory integration, group, modular theory

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Although not considered a mainstream area of sociology, small group theories and research nevertheless cover an enormous range of topics that touch the lives of every human being. Without going so far as to declare the cup half empty, however, the depth and precision of theories and research in this area do not approach their breadth. Some longstanding programs of small group research in sociology have shown evolutionary changes and developments that broaden their scope, increase their precision, and increase their applicability to real-world problems, but they are the exceptions. Borrowing an insight from Freese (1980), for the most part sociology grows laterally. That is, it accrues ideas and observations such that later contributions add to earlier ones, but do not generally integrate with them or improve on them. To varying degrees, the small group theories of other social sciences may also be characterized as accumulating laterally, but the focus of this article is not on assessing the state of theorizing across these different fields. The focus here is almost exclusively on the small group literature in sociology. Even so, nonsociologists likely will find that these characterizations apply to at least some of the work in their own areas. To the extent that that is the case, the theoretical methods to be advocated below would serve those theories just as well.

The next section discusses the source of the lateral accumulation problem, with the remainder of the article focusing on a solution. The goal is to make theories deeper, more cumulative, and increasingly useful for researchers and practitioners both within and outside of their fields of origination. These ends are achievable using a modified version of standard scientific theory construction. Below I will advocate for the development and use of a library of *modular theories* that is currently in early stages of development. Users will contribute modules, modify existing modules, or withdraw sets of modules that operate in an integrated fashion to guide further research and applications. In contrast to other discussions of the potential benefits of building connections across theories (e.g., De Dreu & Levine, 2006; Moreland & Levine, 2008), the following offers an explicit methodology for doing so.

A View on Knowledge

In modern conceptions, *knowledge* resides not in the accumulation of vast amounts of information, but in the way that the information is structured and in what we can reliably and validly assert on its behalf (e.g., Brachman & Levesque, 2004). Some arrangements and some assertions simply are better than others for making reliable and valid explanations of social phenomena and for locating practical solutions to problems. Although it would be fatuous to promote any one epistemology as superior for *all* purposes, there is an approach that not only has great intuitive appeal but also has a solid empirical basis. *Connectionist* explanations in fields as disparate as cognitive neuroscience, computer science, genetics, and social psychology (e.g., Read & Miller, 1998) share certain fundamental presuppositions. In each case there is an image of knowledge as embodied by a web of distributed symbolic representations. Common to all of these views is the idea that linkages among otherwise disparate elements are crucial to the functioning of the larger system. In a similar vein, the metaphor of a *fabric of science* used by philosophers of science and working scientists alike predates modern connectionist approaches by many decades. This is the idea that interconnectedness among scientific fields is endemic to the functioning of the institution of science. The metaphor achieved the status of a truism long ago, even without the benefit of today's improved understanding of the deeper implications and consequences of science's web-like structure.

The fabric that has emerged in science over centuries of progress is in part the product of myriad activities transpiring within the individual fields. As scientists in one field toil in their pursuit of a deeper understanding of the phenomena that interest them, they discover that sometimes it is expedient to capitalize on knowledge already gained in other fields. Each field has its own distinct array of problematics, intellectual tools, and theoretical solutions, but there also are connatural points of overlap that bring fields into closer proximity to one another. For example, sociology benefits from affinities with psychology (e.g., social precursors and consequences of different emotions; Turner & Stets, 2005), anthropology (e.g., ethnographic research on working women; Ehrenreich, 2001), and economics (e.g., the economics of deviant lifestyles such as drug dealing; Levitt, 2005).

Even while energized by the work of its constituents, the fabric of science also has a life of its own. It self-organizes and evolves at multiple levels as a kind of epistemological ecosystem, broadening its reach at frontiers, deepening at the loci of research fields, focusing attention on threadbare gaps, folding onto itself at unexpected integrations, and constraining all that transpires within it through the ties and patterns that exist at any given moment. There is a crucial difference, however, between the dynamics of scientific knowledge and those characterizing natural systems: The selection process in science is not natural. *We guide it.* Each field is an engine of innovation, but just as importantly, each is also a filter that screens out bits of theory and research that fail to pass muster. The flip-side of this screening process is that a field's received knowledge becomes whatever theory and research have passed through the mesh of its selection criteria at a given point in time.

There is no consensus in sociology on what ought to count as theoretical knowledge, at least judging by our peer-reviewed publications. A content analysis of more than 450 articles in top journals found that only a small percentage satisfied even minimal criteria for good theorizing, such as having clearly defined key terms and unambivalent testable claims (Markovsky, 2006a). Other research also found an array of different beliefs, practices, and training methods among sociologists in leading graduate programs, with sizable minorities of instructors of required graduate theory courses admitting to negative attitudes toward science, logic, and rigorous theorizing, and portraying such practices negatively in their training of graduate students (Markovsky, 2008). Not only does this state of affairs pose a problem for sociology's advancement, but it also limits opportunities for its threads to be woven into the larger fabric of science. Different social sciences manifest these problems to different degrees, but the problems are perpetuated whenever excessive informality is tolerated in the language and logic of theories. Within sociology at least, science-oriented scholars have called for more rigorous standards, mainly via a series of monographs in the 1960s and 1970s on theory construction (Webster & Markovsky, 2006). Despite this, based on the content analyses and interviews cited above, there has been virtually no change in more than a generation. It seems a different approach is needed.

In the following sections I will first review the essential properties of any good theory. Next, I will discuss the idea of modularization and then make the case for modular theory building. Finally, I will illustrate some of the different kinds of theoretical integration that modularization facilitates within sociology's small group literature, followed by some concluding thoughts.

Theories and Nontheories

When a theory is presented informally, it may be impossible for readers to distinguish between the author's presentation *of* the theory and his or her discussion *about* the theory. Again, this situation characterizes the publications of different fields to varying degrees, but it is the norm in sociology. It does not matter whether the practice merely reflects an expository style or whether it signals deeper problems such as a failure to think through the meanings of terms or to check the logical integrity of arguments. In either case, ambiguity, ambivalence, and gaps in the written theory will result in multiple and potentially mutually contradictory interpretations by readers. This is a serious problem, especially for those outside of the immediate research area seeking to conduct tests or applications.

Informal theories have the great benefit (to the author) of ringing intuitive bells in most readers' minds, including the minds of journal referees, grant review panels, and book editors. That is because we so readily give authors the benefit of the doubt and find ways to interpret their words in ways that make sense to us. This may lend a patina of accessibility to the writing, but it does no good for the development and dissemination of reliable and valid knowledge. When theories are left open to multiple interpretations, they become difficult or impossible to test definitively or to apply with confidence. If *social influence* is left undefined in your social influence theory, then how do other interested researchers know whether they have operationalized it correctly? How does one determine whether applications and tests are valid? How can scientists in other fields be confident enough to integrate such work with theirs?

Sociological theory designates a wide variety of intellectual objects, from rigorous scientific formulations to stream-of-consciousness excurses. It would be unreasonable to suggest that one definition is unequivocally better than another. However, for the purposes of integrating one theory with another, whether within the social sciences or elsewhere in the broader fabric, not just any theoretical form will do. At the very least, as alluded to earlier, it is critical to be able to distinguish elements of discourse considered by their author to be *part* of a theory from elements considered to be *about* the theory. In much sociological theorizing this is all but impossible to do. The next section provides a simple and clear definition for *theory* that would go a long way toward ensuring the more efficient development of theories and their ability to interface well with others. It is not the only way to define theory, but it is a way that facilitates modularization while remaining consistent with standards of scientific theory building.

Theory Components

It may not be generally obvious when reading in the social sciences that there are really only four essential components in any good theory. *Terms, statements, arguments,* and *scope conditions* may be present but appear under alternative labels. They also may be inextricable from informal discourse, muddled or incomplete, or absent altogether. Whichever the case, unless there is a one-to-one correspondence between these elements as conceived by the theorist and as understood by the reader, something will be lost in communicating the theory. As a consequence, the theory that is communicated and ultimately translated into empirical terms and operations will not be the theory that its author intended. Therefore, it pays to know the meanings and functions of these essential components and to use them in an explicit way whenever attempting to communicate theoretical ideas. When this is done, all the valued qualities of scientific discourse emerge on their own and our theories move closer to the ideals of being free of contradiction, free of ambivalence, communicable, abstract, general, precise, and parsimonious.

Terms

Theoretical *terms* (sometimes called *concepts*, e.g., Cohen, 1980) are words or symbols used to communicate meanings from the theorist to the reader. To do so effectively requires using a combination of (a) simple or *primitive* terms whose meanings the theorist is confident will be understood in a uniform way by the theory's readers, and (b) *defined* terms, the definitions for which consist of primitive and/or previously defined terms. The result of careful decisions about terms and definitions is a *terminological system* that imparts clear meanings to its specialized language. Such formal language is needed to communicate novel theoretical ideas with precision, but it is also based on more fundamental terms whose meanings the theorist can safely assume are already shared by the broadest audience possible.

Lest the theorist commit the *error of reification*, a distinction must be maintained between the abstract terms of the theory and the concrete objects and events in the empirical world to which those terms ultimately may be connected. Think of terms as a set of lenses that are ground in ways designed to sharpen the focus on some things, albeit to the exclusion of others. The *group* lens should neither be created in a way that ties it exclusively to particular groups at particular times and locations nor need it be defined in a way that indicates all other objects that other theorists may have referred to by this label. Rather, its definition should establish criteria by which any object in the universe can be adjudicated either as an instance of a group, or not an instance, for the purposes of the theory in which the term is embedded. Furthermore, for the sake of parsimony and ease of communication, the theorist should minimize the number of terms. Theories should be indicative, not evocative, and the terminological system should only express what is needed to transfer the theory from the mind of the theorist into the mind of the reader with minimum loss of fidelity.

A *typology* is a classification system that organizes a set of terms into categories or along one or more dimensions. A classic example is Steiner's (1972) typology of additive, conjunctive, and disjunctive work groups. If its terms are well defined, then a typology may prove useful for the purpose of classifying empirical instances of theoretical phenomena. By itself, however, a typology does not make any testable claims and so does not constitute theoretical knowledge.

Statements

Statements are the vehicles that carry theoretical claims. These are verbal constructions obtained by juxtaposing terms in declarative sentences. Theoretical statements capitalize on already meaningful terms and logical connectives to assert things that transcend their elements. Thus, the meaning of *divide eight by two* cannot be inferred by examining a simple listing of its constituent terms and their definitions, and its meaning can also change considerably if the numerical terms are switched.

There are many kinds of possible relationships among terms in a statement. Some are quite worthless for theoretical purposes, such as the noncausal, nondirectional, noncommittal, and all-too-common *X may be associated with Y* or its slightly stronger cousin *X varies with Y*. Two very common—and more useful—logical forms include *If X, then Y* (the *material implication* in logic), and *X causes Y*.[1] There are many familiar refinements of the causal form, including *Increases in X produce increases in Y* or algebraic functions expressing how variations in one term's values are affected by variations in some other set of factors (e.g., $F = MA$, from which derives *increases in an object's mass or its acceleration produces an increase in its force*). In each case, the individual terms and logical or mathematical operators must be well defined. A statement is only as clear and communicable as its most obscure term.

Arguments

Analogous to the organized arrangement of terms within statements, theoretical arguments are sets of statements that, through transformations using *logical calculi*, can be used to generate explanations that individual statements alone cannot. Even an extremely simple argument demonstrates the point:

If *W*, then *X*.

If *X*, then *Y* and *Z*.

If *W*, then *Y* and *Z*.

In a properly formed argument using propositional logic, the first two of the above three statements are typically called *premises*, and the third statement is the *conclusion*. That the conclusion is logically derived from the premises is indicated by the horizontal line. Whether using propositional logic, linear algebra, or differential equations, an argument is the application of a logical principle to transform a set of premises into a conclusion such that, if the premises are true, then so is the conclusion. Confusingly, sometimes premises are called axioms, propositions, assumptions, postulates, or by other names, and conclusions may also be called derivations, deductions, or theorems. What is crucial is not the names by which these statements are designated, but the *role* that each plays within the theoretical argument. Even more confusing is that only a small proportion of published work identifies its premises and conclusions, and an even smaller proportion checks their logical integrity (Dilks, Irwin, & Markovsky, 2006).

This discussion has emphasized the deductive aspect of scientific theories, a property critical for the modularization process described below. This is not to deny that theories evolve through a dual inductive/deductive process. Induction, in the form of theoretical conjectures (Popper, 1963), is the creative engine for the growth of theories. Deduction, in the form of deriving the testable implications of those conjectures, is the process that ensures validity. Without induction theories would lack innovation; without deduction, they would lack verisimilitude.

Scope Conditions

It is important that theories are clear about the empirical domains to which their authors intend them to be applied. Rather than trying to anticipate and enumerate every possible concrete application, scope conditions specify provisional and abstract criteria that are not bound to particular times and places (Foschi, 1997; Walker & Cohen, 1985). Just as important as their role in informing others when an empirical setting is appropriate for using the theory, they also rule out unwarranted applications and tests never intended by the authors. Physicists have indicated to parapsychologists that using quantum theory, whose scope conditions rule out phenomena more macro than the subatomic, is inappropriate for explaining ostensive psychic events (Stenger, 1990). It would be similarly invalid to apply the theory of status characteristics and expectation states to a small group that is not collectively oriented toward a task, one of that theory's several scope conditions (e.g., Wagner & Berger, 2006).

It is especially important when attempting to knit together two or more theories that there are points of intersection in their scope conditions. Nonoverlapping scope would negate any potential benefit of an integration. On the other hand, scope conditions are always provisional, and so proposing areas of shared domains for previously disparate theories may promote new discoveries. Moreover, in the long run the goal is to minimize the number and complexity of scope conditions, for each condition signifies a constraint on the theory's applicability that one would hope is eventually relaxed as the theory is refined, tested, and expanded. It would then make sense to develop theories with an eye toward future integrations, such as by conducting tests that would validate one's theory within the scope conditions known to be shared by another theory that may be usefully linked.

Modularization in General

A *module* is a separable component of a system that is designed for integration with other components of varying structure and function. *Modularization* is the process of designing such elements. Modular construction is found in many common processes, such as the production of computer programs and integrated circuitry, as well as certain kinds of office furniture, kitchen appliances, and houses to name just a few. A bit closer to the fabric of science metaphor, one of the world's largest pieces of folk art, the NAMES Project AIDS Memorial Quilt, now contains more than 46,000 3 ft × 6 ft modular panels, each memorializing an AIDS victim. Eight of these panels are bound together to form a *block*, and at this writing there are close to 6,000 blocks and growing. The Project's Web site (http://www.aidsquilt.org) includes instructions for how to construct a panel that can be integrated with other panels in the larger quilt. As in all modular systems, abiding by constraints and guidelines on the production of individual modules ensures that they will integrate with others and contribute to the whole. As with many modular systems, the AIDS quilt's fundamental modules—the individual memorial panels—are functional and meaningful on their own. They also operate in concert to produce an effect that could not be achieved by disparate individual modules, such as the quilt's emotional impact on observers when even fractional portions are unfurled across acres of land for public viewing.

Modularization is not essential for good art, but the same cannot be said for modern technology. Consider the Kibo module, launched in 2009 by the NASA space shuttle *Discovery* and installed at the International Space Station (ISS). As with the modules that preceded it, Kibo was designed to add a number of new capabilities to the ISS while capitalizing on the station's existing systems including life support, power, and communications. Following NASA's specifications led to a perfect integration despite the fact that Kibo was built in Japan, many thousands of miles away from the module to which it connected. The ISS benefits significantly, but still only marginally, from

Kibo's presence. In contrast, the 20 years of concerted effort that went into Kibo would have been pointless if not for the existence of the space shuttle and the ISS. There was tremendous pressure on Kibo's designers to make it function seamlessly with the station, but they knew the potential benefits: They did not have to incorporate a launch system or any of the other major systems required of an autonomous space vehicle. It is also notable that within the Kibo module are 23 equipment racks, 4 arriving with modular devices already in place and the rest to be populated by equipment from later missions. Within the rack-mounted units are modular components, such as power units, integrated circuits, and memory chips. This makes Kibo an exquisite illustration of the use of modularity at multiple levels.

The general benefits of modularization are evident in the efficiencies it imparts. In addition to advantages in assembly processes such as those illustrated above, there also are important advantages insofar as replacing and upgrading outmoded components. Consider the tiny memory flashcards popularized with the explosion of inexpensive digital photography. If your gadgets were purchased within the past few years, then the same memory card that pops in and out of your digital camera probably fits a slot in your plasma television and also in your laptop computer. These cards also work with video cameras, mobile phones, digital audio players, and personal digital assistants. Just several years ago a flashcard with 16 megabytes of memory cost around $35. At this writing the same money buys a card with 1,000 times that capacity. Because the cards and the devices were designed to work together, one can vastly increase the functionality of *all* the devices that work with the cards without having to alter the devices themselves. Reconfiguring or expanding an office space designed with modular furniture is similarly uncomplicated, as is upgrading a hard drive or replacing a burned-out power supply in a personal computer.

The benefits of modularity do not come without cost, much of which is incurred up-front in the design phase. One problem is anticipating whether and how a module will operate in conjunction with other not-yet-conceived modules. At least early in the process, module development is likely to be highly nonlinear as nascent modules and components co-evolve. A second problem involves committing to interfaces. Modules must be able to communicate with and respond to one another in appropriate ways, and at some point designers must establish a configuration of virtual plugs and sockets that will be shared by every potentially adjacent module. A third problem is resolving the trade-off between flexibility and functionality. Each module must be able to perform certain functions, but there is a danger of modules growing too large, expensive, complex or unpredictable if too many capabilities are built in, or not particularly useful if capabilities are too meager. The uncertain needs of potential users must be anticipated, and the risks of designing and producing a failed modular *system* must be assumed knowing that such a cost would far exceed that of a single failed module. The risks can be well worth taking, however, as indicated by the great success of modular systems in so many domains. Moreover, once a modular system is established, the risks and costs of developing new components plummet.

Formalizing and Modularizing Theories

Most theories in sociology are akin to the earliest computers: cobbled together from components designed for other purposes, prone to inaccuracies, and with few substantive connections to one another. It is still common to see work that cites more than century-old *classical theories* as though they embody the best we can offer. These theories are largely untestable as written, virtually unchanged and unimproved over time, but still used to justify contemporary research. The group process theories that appear in the illustrations to follow are exceptions to the sociological norm. Each is a formal theory that has evolved through multiple stages, with predecessors supplanted by newer versions having increased depth, breadth, and/or precision.

Any theory can be improved by paying careful attention to its components and to the interrelationships among its components. The idea of attending to the formal properties of small group theories in sociology goes back nearly a half century (Berger, Cohen, Snell, & Zelditch, 1962). Still, however, few theorists do so (Markovsky, 2006b, 2008). Many contemporary scholars associate formal theorizing with terse, rarified systems of mathematical equations that bear no connection to our phenomena of interest, and that cannot possibly serve as well as the loose and discursive approaches that characterize most of our theoretical work. As described in the earlier section on the elements of theories, all that is required for a well-constructed theoretical argument is a set of clearly defined terms and logically related statements. Mathematical statements can be used to satisfy these criteria, but so can carefully formulated verbal arguments. This means that most existing discursive theories can be recast as formal theories *if* an author or another interested party makes the effort to purge excess verbiage, leaving just those (a) premises and conclusions needed to complete an argument, (b) primitive and defined terms needed to communicate those statements, and (c) scope conditions under which those statements are deemed to be applicable. From the standpoint of the modularization criteria presented below, it makes no difference whether we modularize old theories or build new theories that are modularized from the outset.

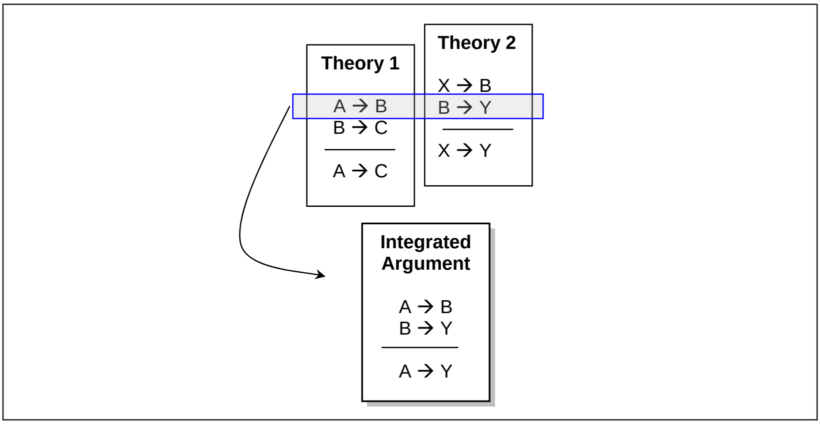

Figure 1. Integrating two theories

When two theories are formalized, it is a relatively simple matter to know whether they may fruitfully connect and work in concert. To do so their scope conditions and statements must intersect, and so they must also share one or more terms. To illustrate the intersection of theoretical statements, suppose we have two small theories as shown in Figure 1. For the purposes of this illustration, only their formal structures are relevant, not their substantive content. Letting → symbolize a causal relationship, Theory 1 explains how changes in A lead to changes in C. Theory 2 explains how changes in X cause changes in Y. These theories may be knitted together for some novel purpose *only if* there is a basis for a logical connection between them. In this case, the statement A → B from Theory 1 can be conjoined with the statement B → Y from Theory 2. Together they can be used as premises in a new argument from which derives a new statement, A → Y. Another way to look at this is that the two theories can be combined for the purposes of explaining the relevance of A to Y. The theories thus are able to accomplish something that neither alone could manage. If B is not well-defined, or not defined the same way in the two theories, then confidence in the validity of the new derivation must diminish accordingly.

Modular theories are formal theories designed for prospective integrations. Thus, in addition to the defining properties of formal theories that were enumerated earlier, a theory is modular when it is designed so that some of its terms, statements, and scope conditions intersect with those of one or more other theories. Just as Theory A is preferred over Theory B if, all else being equal, the former is more parsimonious, more general, or more precise than B, so is modular Theory A preferred over modular Theory B if, all else being equal, A has proven to integrate more readily with other theories.

In view of the earlier discussion about the general properties of modularization, we may expect that well-formed modular theories will differ from current formal theories in certain ways. First, modular theories will be evaluated by a different standard. Parsimony, generality, precision, and other properties of formal theories remain important; however, a modular theory must further prove its value through successful integrations with other modules. Until it does so, it remains a provisional module at best, analogous to the provisional status of untested theories. Second, modular theories should be relatively small insofar as the numbers of terms and statements they contain. Rather than having a library containing a small number of large modules, having a large number of small modules allows more flexibility in assembling them as needed for particular applications, and it simplifies the process of upgrading individual modules and assemblages of modules without the need for system-wide revisions. Third, whereas currently theorists' primary concern is with the creation and modification of individual theories, modular criteria shift some of the attention to the theory's potential connections with a range of existing modules. In the long run this should increase the potential for successful integrations.

It is not common practice to develop theories in ways that facilitate logical intersections with others. For sociological theories, the opposite would seem to be more the norm. After they review prior work, theorists frequently introduce their own esoteric languages, enhancing the apparent uniqueness of their contributions. No glossary is provided for either the old or the new formulations, further obscuring possible commonalities between them. The illusion of meaningfulness and originality is complete when we factor in readers' charitable presumptions that published authors know what they are talking about. It does not matter whether some authors do this out of laziness, pressure for career advancement, or an honest misunderstanding of what it means to make an original contribution. It is counterproductive.

Just as the process of developing scientific theories is never-ending, so it is with modules. It may be useful to conceive of the process as evolutionary. As noted by Markovsky et al. (2008),

> Theories improve over time as those that are more "fit" for their explanatory purposes survive to be further developed, while those that fare less well fade into oblivion from accumulated falsifications and disuse . . . [T]heories respond to selection pressures from multiple sources. In response to self-criticism and peer review, responsible authors will

> replace ambivalent terms with clearer ones; ill-specified propositions with better ones; overly narrow scope conditions with broader ones. For a field interested in modularization, there is another selection pressure: Modularized theories that work well with other modules will be used more than those that seem only to work in isolation. It is a case of *survival of the most useful.* (p. 232)

The examples that follow are integrations of existing formal theories, theories that may be regarded as provisional modules. Although the theories were not designed with modularization in mind, the explicitness of their terms and statements has facilitated these integrations and they exemplify most of the central issues discussed thus far.

Illustrations

Modularization facilitates theoretical integrations, and the following cases were selected to illustrate some of the different ways that integrations may be structured. Although they will not be explicated at quite the level of detail shown in Figure 1, the first of the three illustrations does resemble that form. The terms, statements, and scope conditions of two previously unconnected theories are linked, the theories generate derivations that would not have been possible otherwise, and those derivations were supported in empirical research. It bears noting that in some cases the word *theory* is used to refer to sets of closely interrelated theories (Wagner, 1984). This reflects common usage, but it can be confusing. Below it should be clear from the context when the referent is a single theory or a program of theories.

Lateral Integration: Resistance Theory and Reward Expectations Theory

Elementary theory is a program of theory and research introduced in the early 1980s by David Willer and colleagues (for background and details, see Willer, 1999; Willer & Emanuelson, 2006). It has since generated a steady flow of theoretical developments and empirical tests. Structurally, elementary theory incorporates several relatively discrete but intersecting theories that qualify as modules. It begins with the idea that actors pursue their interests through the social relations in which they are embedded. Positive and negative sanctions may be transmitted between actors, with their patterns determining whether the relation is exchange-based, coercive, or conflictual. Its theories are formalized through a combination of verbal and mathematical statements.

Resistance theory is a mathematical component of elementary theory that is used to predict mutual payoffs when two competing actors must reach an allocation agreement. An actor's resistance to a particular exchange outcome, *x*, is the ratio of (a) how much more than *x* an actor believes that he or she could gain given the best possible outcome, to (b) how much less than *x* the actor would earn given the worst possible outcome. The predicted payoffs are those which entail equal resistances for both parties. Resistance theory has been extended so as to be applicable in networks where actors may negotiate and exchange with multiple others (Willer, 1999).

Willer, Lovaglia, and Markovsky (1997) investigated whether negotiated exchange outcomes are affected by the negotiators' relative status levels (see also Thye, Willer, & Markovsky, 2006). They noted that (a) elementary theory explains how favorable network location leads to the use of power and favorable exchange outcomes; (b) *reward expectations theory* shows how competence expectations form in a manner consistent with rewards that are received by self and other; and (c) *status characteristics theory*, on which reward expectations theory is based, shows that influence occurs in a manner consistent with competence expectations. Taken together, these insights form a coherent argument whereby favorable structural locations lead to favorable rewards, which in turn lead to expectations of competence, resulting in higher influence.

Based on this argument, Willer et al. (1997) theorized that, when structural power and status are consistent (e.g., low-status actors are in low-power positions, high-status actors are in high-power positions), negotiated outcome differentials will be accentuated. When status and power are inconsistent, outcome differences will be reduced. The bridge between status and power was based on the resistance theory (i.e., status characteristics alter the resistance of actors in different network positions, leading to the hypothesized effects). *Expectation advantages* were calculated in accord with status characteristic theory's mathematical model, then plugged into the resistance model used by elementary theory. As shown in Figure 2, Willer and his colleagues also addressed the issue of scope conditions, suggesting that the collective and cooperative aspects of the negotiation process were sufficient to serve as a point of intersection.

Integrations such as the above are *lateral* in the sense that they take previously unconnected theories, establish a bridge from a component of one to a component of the other, and conjoin them to address phenomena that neither alone explained. (Barnum & Markovsky, 2007, provide another similar integration linking status characteristics theory and social identity theory.) This conforms to the spirit of modular theorizing, although neither theory originally was developed in ways intended to foster modular integrations per se.

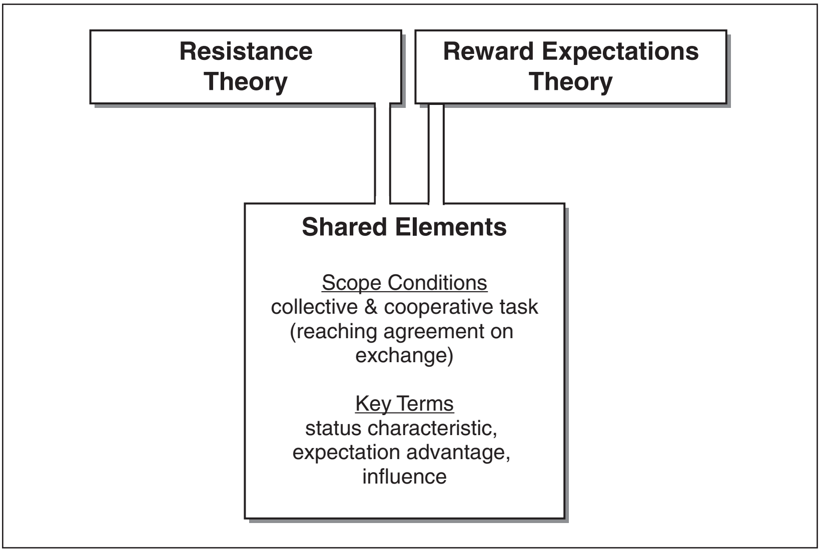

Figure 2. Linking resistance theory and reward expectations theory

It was because of the fact that each was formulated so explicitly that it was possible to build an integrative bridge between them.

Programmatic Integration: Expectation States Theory

Expectations states theory is one of the oldest continuous programs of formal theory development and associated research in social psychology, beginning with Joseph Berger's doctoral dissertation more than 50 years ago (see recent reviews by Wagner & Berger, 2006, and Berger & Webster, 2006, for fuller explications and citations). It is frequently cited as an illustration of theory formalization, its authors having accomplished this through a combination of verbal and mathematical statements. Initially, *power and prestige theory* sought to explain the emergence of correlated inequalities in the observable power and prestige orders (OPPO) of small, newly formed groups of status equals working to solve a collective task. The OPPO was operationalized so as to include the opportunities granted to group members to make contributions to a collective task, their problem-solving attempts, communicated evaluations of those attempts, and mutual influence on task-related opinions. Berger argued that these observable behaviors were correlated due to their connections to a single underlying process. In that process, the enactment of *any* type of power and prestige behavior leads members to develop performance expectations for one another, which then become manifested in a stable way for *all* types of subsequent power and prestige behaviors.

The status characteristics theory, used in the previous illustration, actually was built on the earlier power and prestige theory. It addresses the question of how OPPOs emerge when actors initially are differentiated by certain kinds of valued social characteristics. *Specific status characteristics* such as mathematical ability carry performance expectations for a specific kind of task, and *diffuse status characteristics* such as age or race carry general expectations that pertain to potentially wide arrays of tasks. The theory connects initial status conditions to power and prestige outcomes via a series of logically connected assumptions. These specify a status-organizing process in the context of a cooperative group task. Actors are assumed to treat a status characteristic that initially differentiates them as though it is relevant to the collective task unless it is explicitly dissociated. This leads to *expectation advantages* on the part of those who possess higher status characteristics. The theory has been further generalized to deal with multicharacteristic situations, multitask sequences, and other factors.

The *reward expectations theory* builds on the status characteristics theory. It applies in situations where valued objects or rewards are differentially allocated to actors in status situations and it explains how actors form expectations that associate different rewards with the possession of different status characteristics. The basic idea is that sets of socially validated beliefs called *referential structures* provide associations between valued social characteristics and levels of rewards. Referential structures may link rewards to social categories such as those provided by diffuse status characteristics, to abilities perceived to be relevant in the task setting, or to perceived capacities to contribute directly to the solution of the group task. The reward expectations theory capitalizes on the same assumptions and many of the same terms used in the status characteristics theory.

There are several other branches in the expectation states program. Most, like the reward expectation theory, have close ties to the status characteristics theory which itself has gone through several expansions and refinements since its introduction. Thus, the above discussion and Figure 3 indicate only a select few of the ties that exist among expectation states theories. As shown, the power and prestige theory and the status characteristics theory share scope conditions and some key terms, as do the status characteristics and reward expectation theories. Furthermore, the latter two theories share a set of assumptions pertaining to status organizing processes.

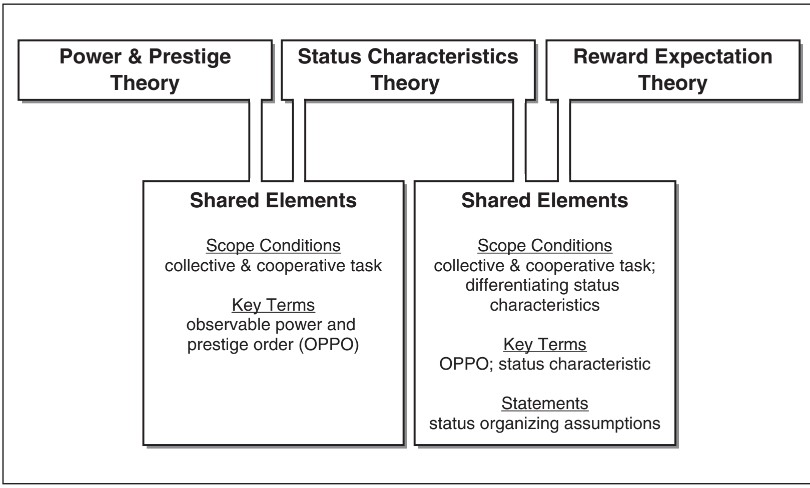

Figure 3. Linking expectation states theories

The three expectation states theories satisfy modularity criteria insofar as their form and connections. A given application, such as reducing interaction inequalities among children in classrooms, may only require the use of one or two modules. Modularity in the expectation states program differs from the kind of modularity described earlier, however. Although each expectation states theory was designed to integrate with other theories, those other theories are all within the expectation states program. Even so, others who have not been centrally involved with the program's development have found ways to integrate expectation theories with formal theories outside of the program (e.g., Thye, 2000). Moreover, throughout much of the program's existence the potential for modularization and external integrations has been limited by the relative dearth of formal small group theories. It would then seem quite appropriate that more researchers outside of the program might consider developing modules connectable to expectation states theories than the other way around. With the establishment of other programs of formal theory development in the last two decades, however, expectation states theorists ought to be looking outward in their efforts to develop even more useful modules.

Vertical Integration: Micro and Macro Justice Theory

Jasso's (1980, 2007) *distributive justice theory* provides a model for predicting experiences of injustice associated with distributions of valued goods.

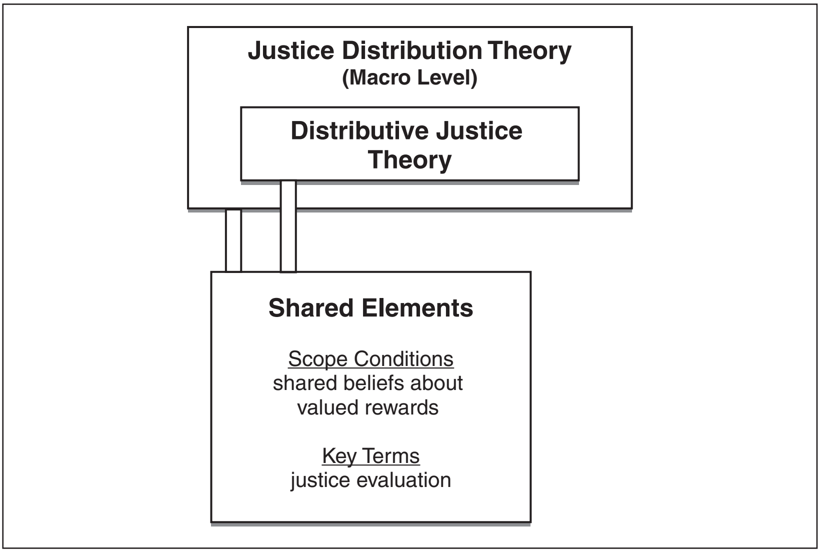

Figure 4. Vertically integrating distributive justice theory

Although Jasso has extended the theory since it was first introduced, the core argument remains the same. Injustice experiences are predicated on comparisons of actual rewards to beliefs about just rewards. In addition to this individual-level model, the theory offers a series of statements linking properties of the *distribution* of justice evaluations across a population (e.g., its mean, skewness, and lower extreme value) to group-level phenomena such as rates of emigration and mental illness. The theory's basic statements are stated explicitly, but some key terms are not defined (e.g., *justice*) and scope conditions are not provided. These elements may be supplied by Jasso or others in the future, but the formality of its core statements allows it to serve as a good illustration of vertical integration.

Although published together and characterized as being part of the same theory, Jasso's model of individual justice evaluations and her statements about societal impacts of distributions of evaluations could be treated as logically distinct modules. Figure 4 shows schematically the micro theory operating within the domain of the macro theory, the latter of which I have labeled *justice distribution theory*. A plausible scope condition for the micro theory is the requirement of social consensus regarding what rewards are valued and how much of them should be allotted to those possessing certain characteristics or enacting certain behaviors. The macro theory would similarly apply when a given reward is valued across members of a social system, but this module takes as its input only the justice evaluations of the actors in the system—the outputs of the individual evaluation processes—and uses properties of the shape of their statistical distribution to derive group-level outcomes. Thus, very few shared theoretical elements are needed for the combined micro and macro modules to jointly predict macro phenomena.

Although Markovsky et al. (2008) previously advocated the modularization of justice theories, this micro–macro or *vertical integration* illustrates a novel way that modularization could prove useful (for more on multilevel theory construction, see Turner & Markovsky, 2006; Markovsky, 1996). An applied researcher investigating wage effects in organizations may focus initially on the consequences of justice evaluations for personal job satisfaction. Initially, he or she may have no interest in the consequences of the distributional pattern of aggregate justice evaluations. However, capitalizing on a readily available *justice distribution module* that explains phenomena such as rates of dissatisfaction, sick leave, job turnover, petty theft, and white-collar crime on the shape of the distribution of individual justice sentiments may provide insights for instating more systemic changes. Rarely is everyone in an organization satisfied with their pay, however taking into account distributions of injustice perceptions rather than individual pay evaluations is more likely to suggest optimal strategies for minimizing feelings of injustice at the organizational level.

Discussion

Evolutionary processes require selection, and this brings us back to theories and to the people who make them. As noted earlier, scientific theories evolve in ways that are guided by collective selection processes (Campbell, 1974; Toulmin, 1967). Analogous to the Kibo module of the ISS, a given scientific theory at a particular moment in time is the product of trial-and-error selection processes that have occurred at multiple levels. Some of a theory's terms, statements, arguments, scope conditions, and connections to other theories are likely to have changed over the course of its history, and in ways that have increased parsimony, communicability, precision, and testability. Formal theory is the medium of choice for only a tiny fraction of sociological theories, and so we lack any institutionalized selection pressure that would shape our theories over time in ways that promote these desirable properties. As a consequence, most sociological theories evolve little, if at all, over time. Put differently, eliminate selection pressure and theories are much less likely to improve. Formalization renders theories transparent and thereby facilitates critical analysis. In sociology, however, not only is formalization nonnormative, but it is explicitly frowned on by many influential theorists (Markovsky, 2008). Modularization may offer a more palatable solution, both by simplifying the formalization process, and by making the benefits of doing so more immediately evident. Despite being an old idea, modularization has not yet been explored as a criterion or method for theory construction.

Imagine the consequences of an approach whereby, at the same time that we are examining our own theories for solutions to problems that interest us, we also look outward to see what other theories may be drawn in and tied to ours. This does not mean using a theory from one field to explain phenomena in another field's domain, such as when *game theory*, developed by mathematicians, is applied to the emergence of altruistic behavior in animal species. That is a valuable activity but does not entail integrating across domains as does modular theorizing. New applications are not new knowledge in the same way that the integration in Figure 1 produces a synthetic theoretical discovery.

Ultimately, what is needed is a virtual library of theoretical modules from which may be drawn different combinations for different purposes. That development process may be motivated in part by real-world problems that require multidisciplinary searches for their solutions. Recently this was driven home for the author while participating on a panel assembled to evaluate progress on a large federal grant project. The aim of the project was to create software tools that could predict where and when groups would spawn terrorist cells. In the course of developing their tools, the project scientists, nearly all of whom were software engineers and programmers, were mandated to take into account the best available knowledge from the social sciences. They applied considerable resources to the task of scouring relevant literatures in multiple fields including economics, political science, anthropology, sociology, psychology, and history. In the end, however, they bemoaned the absence of explicit, well-tested models that could be used in conjunction with their programs. They were forced either to invent such models on an ad hoc basis, or simply leave black boxes into which others might later insert factors and algorithms to capture the impact of pertinent economic conditions, communication structures, local histories, religious beliefs, and so on.

If the modularization idea has merit, then the small group literature in sociology would benefit by having a dynamic, open-access virtual library of modules that encourages contributions and use by as many scholars as possible. The author is currently engaged in a project to develop an online system for sociology with tools that will facilitate the submission, collective evaluation, and improvement of modules, incorporating incentive systems and automated search and analysis facilities that have proven useful in other kinds of applications. Today such a system would seem foreign. However, considering that modular theories are far *simpler* by design than most of the complex verbal constructions that are currently in use, there is at least some chance that it may help to raise standards of theoretical clarity and rigor by making it significantly easier to formalize and, eventually, to test theoretical ideas. This would lead to the more efficient growth of both theoretical and practical knowledge, and the provision of an invaluable set of tools for applied researchers.

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Note

1. The form *if X, then Y* is often used to suggest that *X* causes *Y*, but this is not necessarily the case. To say *if it is raining, then there are clouds* implies only that clouds are a *necessary condition* for rain (and that knowing it is raining is a *sufficient condition* for knowing there are clouds), not that raining causes clouds. Although frequently there are temporal clues as to the author's intent, it is best to be explicit about the nature of the relationship being asserted.

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Bio

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