

Expanding the Range of Behavioral Factors in Economic Simulations

H. Joel Jeffrey

Economic simulations typically focus almost exclusively on economic variables. If non-economic factors are included at all, it is usually in some form of utility function calculation. This paper presents a model that allows formal specification of a much broader range of factors, processes, and quantities involved in human communities—families, businesses, ethnic groups, nations, work teams, cultures. The phenomena include the hierarchically structured social practices of the group, the principles that underlie choices in the community, and the recognizable positions or statuses in the community. This allows us to model intrinsic or expressive behavior, capturing the concept of multi-aspect identity and the impact of the principles of the group on individual behaviors, all in formal and quantitative form. Having these factors represented formally enables the creation of significantly more realistic simulations incorporating a much wider range of variables, particularly when the economic facts and quantities of interest are affected by and affect several other kinds of factors that are not, on their face, economic.

In any discipline, simulations are based on the concepts of that discipline—the states, objects, processes, and relationships among them (including quantitative attributes), represented explicitly as a formal model. Thus, in a simulation of the Belouzhov-Zabotinsky chemical reaction, we find variables representing chemical objects, quantities, and the mathematically stated relationships between them (see Thompson and Stewart [1986]). Similarly, in a simulation of a computer system, variables represent parts of the system and the processing of input. In each case, the concepts are elements of the underlying theoretical framework that defines the discipline.

In the modeling of economic systems, this logic leads naturally to simulations in which economic factors, processes, and relations between them are represented formally. In most cases, the underlying theory is neoclassical economics, which can be summarized as (bounded) rationality based on self-interest. However, unlike simulations of systems with physical particles, chemical reactions, or predator-prey relationships in animal populations, economic simulations are more complex. Economic systems address facts and issues directly involving human behavior. As a result, limiting simulations to purely economic facts and processes has been subject to two kinds of objections.

First, the disciplines of psychology, sociology, and anthropology (to name only three) all address human

behavior. And the psychologists, sociologists, and anthropologists all tell us that economic factors alone are not sufficient to describe and explain human behavior (see Abelson [1996], Ossorio [1981], Putman [1981], and Spradley [1979]). The kinds of facts cited in such criticism range from “expressive” behaviors (also called “intrinsic practices” in sociology and psychology), to the influence of identity and group membership, and the multiplicity of memberships in modern societies. In other words, the same individual who is a member of a family and a culture may also be an employee of a business, a member of a profession, a member of a religious group, and a member of several other social groups, each with their own coherence and identity.

The psychologists, sociologists, and anthropologists note that all these factors affect behaviors with economic consequences, and as a result solely economic models are incomplete. For example, in a study of the spread of birth control, Chattoe [2001] notes that the choice to adopt birth control practices depends on such non-economic factors as the potential adopter’s religion and devoutness of belief.

Some economists (and philosophers) point out that these other factors are explainable in terms of self-interest and economic impact. However, they still need to be included in some form. Practically speaking, unless we are working in the relatively narrow range of behaviors in which only *prima facie* economic factors exist, we must include these other factors in our models.

The customary way to include these other factors in economic models has been to expand the domain of the utility function. While this provides a way to incorporate any number and kind of non-economic factors, it

H. Joel Jeffrey is a Professor of Computer Science at Northern Illinois University.

Requests for reprints should be sent to: H. Joel Jeffrey, Dept. of Computer Science, Northern Illinois University, DeKalb, IL 60115. Email: jeffrey@cs.niu.edu

has an important practical limitation. The non-economic factors include behaviors and influences that themselves are highly structured and complex. As a result, restricting a model's facts, objects, and processes to those that are purely economic forces a simulation to incorporate a second, separate, model of the relationships of the non-economic factors in the utility function. In short, to produce simulation results that will translate accurately to real-world decisions, we are forced to incorporate a multiplicity of non-economic factors in our economic models.

To illustrate, consider a computer software maker building a document management system for a large bank. Transferring files from the document repository is one of the processes that puts a significant load on the computing resources. The software makers creating the system need to model the design to determine whether it can handle the actual load. To do this, they must find out precisely what the system will be used for. The model must include not only the specific commands, but the entire hierarchically structured set of work practices in which the file transfer is a step. For example, a bank officer may be transferring files to prepare for a site visit to a client company; by conducting a site visit, the officer may be performing due diligence on the customer; and due diligence is a step in carrying out the practice of the loan division, namely, to invest in low-risk businesses.

In principle, empirical data on file transfers might exist, but in practice what can be accurately estimated is the number of site visits. Thus, having accurate input data depends on having an accurate model of non-economic business practices, which may have economic inputs and impacts but do not themselves involve the overt use and manipulation of economic facts, objects, and processes.

This paper presents a model and methodology for incorporating the wide range of facts and processes that affect economic behaviors and choices in a single, formally articulated framework. The framework descriptions may be used, directly or indirectly, as the basis for simulations that explicitly represent these factors and their relationships. We refer to this framework as the *community practice model*.

The essential features of our model are described as follows.

- Everything a person does constitutes engaging in a *social practice* of a *community* of which they are a member. By “community,” we mean any coherent group of people: families, businesses, ethnic groups, entire nations, work teams, etc. Following customary anthropological use, the social practices of the community consist of the organized patterns of action recognizable by members as single, known, repeatable, “done things.”

Both of these key concepts are defined formally below.

- Everything that happens in a community is an instance of engaging in an *instantiated version* of a social practice. A version is a set of other, smaller practices that constitutes a case of engaging in the overall practice. Thus, giving a surprise party, for example, requires engaging in several other, smaller, practices—planning the party, selecting the venue, inviting the guests, and so forth.
- The practices of a community are organized hierarchically. At the top are the *intrinsic* practices, which may be engaged in because an individual occupies a certain position, or has a certain relationship with another member of the community.
- Social practices have an elaborate logical structure, including the smaller component practices, the logical roles, and the actual persons and objects that fill those roles. This logical structure includes optional subpractices, and alternate ways of accomplishing the same component practice (for example, in a city, one can walk, drive, or take a train to a destination).
- An organization is a particular kind of community, one with a *mission*. The mission is the single, all-encompassing reason the organization exists. The mission may be to win market share (e.g., a tobacco company marketing department), to win the war in Europe (the Allied Expeditionary force in World War II), to build a working atomic bomb (the atomic bomb team in the same war), or to become the number one car maker in the world (Toyota Motor Company).
- What makes a community or an organization what it is—and therefore the characteristics that must be modeled in any simulation—include the practices, concepts, cultural choice principles, and recognizable positions in the community, whether official or unofficial.
- An individual is a member of several different communities (as illustrated by Chattoe's [2001] observations), and typically occupies several positions in the same community. For example, an academic may also be a professor, a husband or a wife, a father or a mother, and a brother or a sister.
- Each position gives the individual reason enough to engage in social practices intrinsic to that position and the community. For example, chess players play chess, mountain climbers climb mountains, CEOs devise corporate strategies, doctors care for patients, mothers and fathers raise children, etc. In particular, individuals at all times are engaged in practices intrinsic to their positions.
- Each individual has a number of relationships with others in the community, whether on the basis of their position (e.g., being a teacher means having a teacher-student relationship with other

individuals), or simply by being a member of the community (e.g., being a friend).

- Having relationship R_i means one is tautologically motivated to engage in social practices $P_1^1, P_1^2, \dots, P_1^n$, to degree d_i^1, \dots, d_i^n . More generally, for each relationship R_i and each practice P_j , P_j is consistent with relationship R_i to degree d_{ij} , where $0 \leq d_{ij} \leq 1$.
- In addition to relationships, individuals have other motivations μ_1, \dots, μ_m , which may be of the following four types:
 - *Prudential*: doing something in one's own direct self-interest. This type of motivation is the customary focus of traditional economic analyses.
 - *Hedonic*: doing something for the pleasure or "the fun" of it. Examples would include going to an amusement park, watching a sporting event, or reading "for pleasure."
 - *Ethical*: doing something, or refraining from doing something, for ethical reasons. Ethical motivations are frequently the subject of philosophical arguments, with some arguing that ethical motivations are prescientific intuitions or convenient fictions to be replaced with prudential (self-interested) motivations. Simulations must also take these factors into account, whether they can be replaced with groups of other motivations or not.
 - *Esthetic*: doing something, or not doing something, on the basis of
 - the traditional concept of beauty or esthetic value, or
 - appropriateness.
- Some may argue that esthetic motivations should also be replaced with other, self-interested, ones. But the point is that these motivations need to be included in economic simulations in some form.
- An individual is always engaging in one practice *of the several he or she could engage in, in this situation*. In this sense, human action is deliberate. (This is *not* postulating "rationality" or any "decision-making process." Rather, it is merely a reminder that an action is always chosen from one of several alternatives.) In any situation, individuals can always be said to be engaging in the practice they feel represents the highest "payoff," the one with the highest sum of reasons to choose it over others.

This final principle expands the concept of maximum utility to encompass *all* an individual's motivations: prudential, hedonic, ethical, and esthetic.

The novel aspect of our model is not the various specific concepts, such as communities, relationships, motivations, or identities. Rather, it is that all these as-

pects of group and individual behavior are explicit and articulated in a single, formal, logical framework that incorporates all of the relationships among them.

For the sake of clarity, we first illustrate our formalism, and then present the formalism itself. In the following sections, we present an easily recognized example of behavior that includes economic and non-economic factors. We then give the formal definitions of community and practice, and give two applications, the first to the work practices of an actual software company, and the second to a ritual feast in Tongan village society that incorporates social and economic factors. This provides a clear illustration of how valuable it is to represent a variety of factors even when we are only interested in the economic ones.

Illustrative Example

A couple in America goes out to dinner to celebrate their wedding anniversary. They go to a nice restaurant, have wine with their meal, and end with dessert. Note first that the practice of "eating dessert" is immediately recognizable as a known, repeatable "done thing"—if two people have dessert in separate places on separate occasions, both are instances of "having dessert."

Next, we can see the hierarchical structure of these practices: 1) Going out to dinner at a nice restaurant is a practice; 2) to do it, one engages in several other, smaller practices, such as going to the restaurant, dining, and paying; and 3) dining consists of several other, even smaller component practices, often called "courses"—having salad, soup, the main course, and dessert.

Many of the subpractices involved are optional, or may be achieved via alternate practices. The couple must go to the restaurant (or it is not an instance of "dining out"), but they may walk, take a car, take a train, or take a taxi. Salad, soup, dessert, and wine are all optional. But not all possible logical combinations of dining can be considered "dining out." If the couple goes to the restaurant, orders a bottle of wine, and has dessert, it would not be dining out, although it might be considered going out for dessert. The valid combinations of subpractices are the valid versions of it—those combinations recognized by the culture as engaging in this practice.

When the couple actually has a bottle of wine and their meal, specific objects fill the logical roles of "main course," "dessert," "the wine," and so forth. Thus, the couple having the dinner are engaging in an *instantiated* version.

Celebrating a wedding anniversary, the largest practice in this example, is a clear example of an "expressive" or "intrinsic" practice. A couple celebrates their anniversary as an expression of their relationship, not

in order to gain something or avoid some consequence. (In fact, an apparent anniversary dinner that was actually a means to a business partnership, or a means for one of the couple to avoid the other's anger, would not *be* an actual anniversary celebration.) This is an example of a non-economic practice with economic consequences, because the couple must have sufficient economic resources to pay for the meal.

Going out to dinner is only one way to celebrate an anniversary. Two of the more well-known alternatives are buying gifts for each other and going on a cruise. These actions bear no resemblance to each other, but are recognizable *varieties* of this practice.

Finally, note that the practice of ordering wine with the meal reflects the identity—that is, the community membership—of the individuals. The acceptability of wine as part of dining out is a principle in what might be called “mainstream Western culture.” But a number of other cultures—or communities—do not share it. If the individuals dining out are members of one or more of those communities, they are making a choice to act as a member of one community over another. (This is again the situation Chattoe [2001] describes in his discussion of a Catholic's choice to use birth control.) This is a second form of choice that may be impacted by non-economic facts that nevertheless can have a very large economic impact.

In order to highlight the hierarchical structure of our example's practice and subpractices, consider Figure 1.

Although the subpractices are numbered sequentially, no actual temporal relationships are assumed, whether sequential or parallel. Any such relationships are explicitly represented as formal *constraints* on the occurrence of subpractices.

Formalism: Communities and Practices

Following Putman [1981], we can formally describe a community as a 6-tuple relation $\langle M, P, S, C, Cp, W \rangle$, where M = members, P = practices, Cp = choice principles, S = statuses, C = concepts and W = world.

- The *practices* parameter specifies the social practices of the community. Practices encompasses everything a member of that community can do *as* a member of that community; whatever they do will be engaging in one or more of the practices of the community.
- The *choice principles* refer to the values of the community, and are one of the key ways in which communities differ. The values of the community govern the choices of the members, and are therefore one of the important kinds of information we need. The values, or the shared principles of the

group, are explicitly represented in the rules of the social practices of the community.

- The *statuses* parameter refers to the recognizable positions in the community. These are all the positions identifiable by members of that community, both formal and informal. “President,” “senator,” “husband,” “child,” “respected leader,” “doctor,” “farmer,” etc., are all names of positions in different communities. Each status has certain intrinsic practices associated with it that are intrinsic to the members. This point is central to the concept of a status, because it means that those in the status will always be motivated to engage in those practices.
- The *concepts* of the community refer to the distinctions acted on by the members of the community by engaging in the practices. They are specified by formal name. When further description is necessary, they are specified by a formal description D , a list of the major constituents of the item (by formal name), and the (formally named) relationships between them (see Ossorio [1978] for a more complete specification).
- The W represents the community's world. However, this does not imply a list of all the items available to the members. Rather, it is a specification (once again, by formal name) of the major constituents of the community's world and their relationships. In practice, the W parameter represents the most fundamental distinctions found in the practices of the community. In a business, for example, the major constituents are often “customers,” “regulators,” and “competitors.”

Each *practice* is described with a set of 7-tuples. Each component of each 7-tuple represents one facet of the practice. We term such formal descriptions the *social practice canonical form (SPCF)*. Each SPCF consists of a set of *paradigms* P_i , the major varieties of the action. Thus, $SPCF S = \{P_i\}$, where each P_i consists of:

$$\langle S, E, G, C, V, Sk, Kn \rangle$$

and where

S = the *stages/options* of the practice, the other, smaller, practices necessarily or optionally involved in carrying out the practice. The list of stages/options is essentially a task analysis.

E = the *elements*, the logical roles of persons or objects in the practice.

G = the *eligibilities* of individuals for each role, specified by lists of individuals or formal rules.

C = the *constraints*, e.g., the dependence of the occurrence of combinations of stages/options on either another stage/option or on specified states of affairs.

FIGURE 1

Couple celebrates their wedding anniversary.

Paradigm 1: Couple buys gifts for each other.

Paradigm 2: Couple dines out at a nice restaurant.

Paradigm 3: Couple goes on a cruise together.

Couple dines at a nice restaurant.

1. Couple goes to the restaurant.
 - a. (Option) By car.
 - b. (Option) By train.
 - c. (Option) Walking.
2. Couple gets seated.
3. (Optional) Couple examines menu.
4. (Optional) Couple examines wine menu.
5. (Optional) Couple orders wine.
6. Couple orders food.
7. Couple eats meal together.
 - a. Husband eats meal.
 - i. (Optional) Person eats salad.
 - ii. (Optional) Person eats soup.
 - iii. Person eats main course.
 - iv. (Optional) Person eats dessert.
 - v. (Optional) Person drinks wine.
 - b. Wife eats meal.
 - i. (Optional) Person eats salad.
 - ii. (Optional) Person eats soup.
 - iii. Person eats main course.
 - iv. (Optional) Person eats dessert.
 - v. (Optional) Person drinks wine.
 - c. Husband and wife converse.
8. Couple pays.
9. Couple departs.

V = the *versions*, the sets of stages/options that are considered by members of this community to be valid instances of this practice.

Sk = the *skills* needed to carry out this practice that affect how the stages are carried out.

Kn = *knowledge*, an item-by-item specification by name of the facts, concepts, or perspectives required for the practice.

(The SPCF is a formalism originally devised by A.O. Putman to extend Ossorio's [1978] basic process unit.)

Each parameter of the SPCF is given a formal name. The description formally encodes both the logical structure of the practice and the actual individuals involved in instantiated versions of it. What occurs is an instantiated version of a practice, that is, a specific set of stages/options recognized in the community as a way of engaging in this practice, with an actual individual or object filling the logical roles (the elements).

Using the SPCF allows us to clarify what we have earlier described as "use or manipulation of economic concepts." Specifically, we can now formalize this concept as follows: Economic practices are those whose SPCFs involve economic elements. To illustrate this formal structure, see Figure 2, where we describe a portion of the SPCF for a high-level practice in an actual large software firm (see Jeffrey and Putman [1983]).

Several software systems using SPCF descriptions have been built, including the one this example is from. Examples include a system to coach managers in specifically human-oriented management practices, an automated marketing coach for a major accounting firm, and a system enabling loan clerks at a major bank to create signature-ready documents. One of the most interesting features of the SPCF is its demonstrated capability to formally represent a range of human behaviors that were not previously considered capturable in a machine-usable form.

Each of the practices 1-1, 1-2, 1-3, 2, 3, 4-1, 4-2, 4-3, 4-4, and 5 themselves have SPCF descriptions that completely specify each of those practices at that level of detail. This further elaboration continues down to any level of description needed or desired, including persons issuing commands to software and the execution of the command by the software/computer system. The next example further illustrates this recursive elaboration capability.

Social Practice Description of the Fakaafe

Since a wide variety of practices impact and are impacted by economic facts and processes, the usability of the community practice model is directly dependent on the range of practices to which it can be applied. To illustrate this applicability, we give the SPCF descrip-

tion of a different kind of practice, a feast (called "a fakaafe") in honor of a visiting Wesleyan minister that regularly takes place in Tongan village society (Bennardo [1996]).

For reasons of space, we present only the practice-subpractice structure. We omit the other parts of the descriptions, constraints, elements, actual individuals, and eligibility rules for the roles. However, as shown in the No. 4 ESS example above, these parts play a central role in capturing the nuances and details of actual life involving these practices.

Name of the Practice: Tongan Wesleyan villagers hold a fakaafe.

Stage-Option Structure:

1. People in the village decide who will give the fakaafe.
2. Members of the household giving the fakaafe plan it.
 - 2.1. Household members choose the food for the fakaafe.
 - 2.1.1. Kainga members decide on the number and the size of pigs for the fakaafe.
 - 2.1.2. Kainga members decide on the number and the size of goats for the fakaafe.
 - 2.1.3. Kainga members decide on the number and the size of sheep for the fakaafe.
 - 2.1.4. Kainga members decide on the number and the size of fish for the fakaafe.
 - 2.1.5. Kainga members decide on the quantity of shellfish for the fakaafe.
 - 2.1.6. Kainga members decide on the number and the size of vegetables for the fakaafe.
 - 2.1.7. Kainga members decide on the beverages for the fakaafe.
 - 2.1.8. Kainga members decide on the desserts.
 - 2.2. Household members decide who shall contribute food for the fakaafe.
 - 2.3. Household members decide who shall contribute utensils and decorations.
 - 2.4. Members of the family giving the fakaafe ask kainga members to contribute to the fakaafe.
 - 2.4.1.1. Family member sends request for help to family member abroad.
 - 2.4.1.2. The kainga member decides whether to contribute.

FIGURE 2

Name of the Practice: [Responsible persons in the Indian Hill Laboratory] find and fix a problem in [a No. 4 Generic].

Stages:

1. [Responsible persons in the Laboratory] find out about [a problem].
 - Option 1-1: [A person at Indian Hill] discovers a problem and reports it.
 - Option 1-2: [A person at Indian Hill] discovers a problem and has [the responsible programmer] file [a Failure Report].
 - Option 1-3: [A person at Indian Hill] discovers a problem and has [the FR coordinator] tell [the responsible programmer] about it.
2. [People who keep track of problems] track the course of the problem.
3. [The responsible programmer] decides the response to the problem.
4. [The responsible programmer] implements the chosen response to the problem.
 - Option 4-1: [The responsible programmer] produces a fix for the problem.
 - Option 4-2: [The responsible programmer] files a Not-Applicable Correction Report.
 - Option 4-3: [The responsible programmer] files a Not-Implemented Correction Report.
 - Option 4-4: [The responsible programmer] files a Cancel Correction Report.
5. [People in a support group] install the fix for the problem in [a No. 4 Generic].

Elements

1. Responsible persons in the laboratory.
2. A problem.
3. A person at Indian Hill.
4. A failure report.
5. The responsible programmer.
6. A not applicable correction report.
7. A not implemented correction report.
8. A cancel correction report.
9. The FR coordinator.
10. People who keep track of problems.
11. People in a support group.
12. A No. 4 generic.

Individuals

1. Any person at Indian Hill.
2. Member of the 4ESAC.
3. Any technical staff member at Indian Hill.
4. 4E5.
5. 4E6.
6. Members of the No. 4 support group.
7. The FR for the problem.
8. The Not Applicable CR for this problem.
9. The Not Implemented CR for this problem.
10. The Cancel CR for this problem.
11. Incorrect behavior by a No. 4 machine.
12. People in system test.
13. People in a development group.
14. People in the field support group.
15. Bill Davidson.
16. Jane Arment.
17. Mary Lamont.

Versions:

- (1-1 or 1-2 or 1-3), 2, 3, 4-1, 5
(1-1 or 1-2 or 1-3), 2, 3, (4-2 or 4-3 or 4-4)

- Option 1: The kainga member agrees to contribute to the fakaafe.
 - Option 2: The kainga member refuses to contribute to the fakaafe.
- 2.4.1.3. The kainga member contributes to the fakaafe.
- 2.5. Members of the family giving the fakaafe decide who will be responsible for which tasks in special circumstances.
3. Members of the family giving the fakaafe gather the food for the fakaafe at the premises of the household giving it.
- 3.1. Tongan village boys capture free-range animals.
- 3.2. Tongan village boys bring the captured animals to the household where the fakaafe is to be held.
- 3.3. Tongan village men bring crops from their gardens to the household.
- 3.4. The women and children of the family collect shellfish.
- 3.5. The men and women buy food at the market.
4. Members of the household prepare the food for the fakaafe.
- 4.1. The men of the household prepare the oven.
- 4.1.1. The men of the household fill the oven with wood.
- 4.1.2. The men of the household light the wood.
- 4.1.3. The wood in the oven burns.
- 4.1.3.1.1. The wood in the oven oxidizes.
- 4.1.3.1.2. The burning wood emits heat.
- 4.1.3.1.3. The wood emits smoke.
- 4.2. The men and women of the household cook the food.
5. A member of the family invites a church member to the fakaafe.
- 5.1. A member of the family giving the fakaafe issues an invitation to a church member to come to the fakaafe.
- 5.2. The church member responds to the invitation.
- Option 1: The church member accepts the invitation.
 - Option 2: The church member declines the invitation.
6. Family members prepare the room for the fakaafe.
7. Family members and guests take part in the fakaafe.
- 7.1. Family members and guests sit down for the fakaafe.
- 7.1.1. The chief sits on a mua.
- 7.1.2. The visiting Wesleyan minister sits in the place for the visiting minister.
- 7.1.3. The ofisa kolo sits in the place for the ofisa kolo.
- 7.1.4. Other fakaafe guests sit down.
- 7.2. Family members and guests say a brief prayer.
- 7.3. The head of household gives a speech.
- 7.4. The visiting minister gives a speech.
- 7.5. The chief gives a speech.
- 7.6. Family members and guests enjoy the feast.
- 7.6.1. Family members and guests eat the food.
- 7.6.2. The fakaafe guest gives a speech.
- 7.6.3. The chief signals the end of the fakaafe, leaving the room.
- 7.6.4. Other family members and guests leave.
- 7.7. The others who prepared the food for the fakaafe eat.
8. The women of the household distribute the remaining food to the family and kainga.
- 8.1. The women of the house distribute the remaining food to the family members who are present.
- 8.2. The women of the house distribute the remaining food to other members of the kainga.
- 8.2.1. The women give the food for any absent families to a child to deliver.
- 8.2.2. The child delivers the food to any absent families.

Including such minute descriptions as the stages of wood burning may seem unnecessary. However, our goal is to capture both economic and non-economic influences on economic factors, and the specific actions that directly impact or are impacted by economic facts may be at any level of detail. Thus the ability to capture practices at all levels of detail is important.

The fakaafe description, and the No. 4 ESS description, may also give the impression that an SPCF is simply a set of detailed discursive statements, as might be found in an anthropological discussion. Although the hierarchically organized practices, subpractices, elements, and individuals are typically stated in ordinary English sentences for the sake of readability (e.g., “Members of the household giving the fakaafe plan it”), these sentences are formal names, not discursive

English statements that “refer” to physical things. “Members of the household giving the fakaafe” is the name of an element in this practice, instantiated by individuals as articulated in the eligibilities.

In the anniversary example, “a nice restaurant” is the name of an element, not simply an adjectival phrase “referring” to a concept that is virtually impossible to formally render. The SPCF for this social practice includes individuals and eligibility rules that specify what individuals can or must do to instantiate the element. It is possible, however, that elements, individuals, eligibilities, and constraints may specify objects, states, or conditions that are recognized by members of the community but which cannot be defined physically or algorithmically. But to be useful for our purposes, the community practice model must allow us to specify everything human beings do, as fully as possible, not merely those things that can be currently defined with sets of physical or computational mathematics.

Methodology

With a formal specification of a community or set of communities, including SPCFs of the communities’ practices, we proceed with a simulation via mathematical or statistical modeling of the behaviors and phenomena of interest, using the SPCF to guide factor selection or as the basis for agent-based simulation. The advantage of having an SPCF description of the cultures or communities of interest is that we can directly model as many types of events and behaviors as we desire.

To perform SPCFs for agent-based simulation, we directly simulate the life of the communities of interest, i.e., the daily practices engaged in by members, and measure the economic quantities as the community activities proceed. We measure any variables or quantities of interest, economic or otherwise, whether they are direct outcomes of practices, resources in practices, or quantities derived from them.

In more detail, the algorithm is as follows:

For each time $t_0, t_0 + \Delta t, t_0 + 2\Delta t, \dots$

For each individual I

1. Assess I’s motivations—prudential, hedonic, ethical, and/or esthetic—to engage in each practice P_i , including intrinsic practices, which as indicated are automatically given a non-zero weight. The practices intrinsic to a person are those intrinsic to his/her position.
2. I performs practice P_i with the highest motivation. I takes into account both community choice principles and individual preferences,

for which there is a version that I is eligible for and has the resources for—that is, the individuals necessary to take the places of the elements in that version.

3. Each stage of the version is itself a practice with an SPCF, and so the stage itself occurs by engaging in a version of that practice. The recursion ends when there is no further description of the practice available, and engaging that practice is represented by the occurrence (or failure) of the bottom-level practice.
4. Each time practice P_i^j occurs, it produces an outcome (by definition). When any quantitative change in a state of affairs occurs, such as consumption of a resource or creation of an amount of a resource, the list of state of affairs descriptions is updated. The updates to be done on the occurrence of each process are represented along with the SPCF of the practice; they represent the difference between initial and final states. The outcome of some practices may be a change in the physical location of individuals.
5. When a practice occurs whose outcome is the creation or change of a social practice, the SPCF for the practice is updated.
6. Each social practice has an associated *latency*, a time period after completion of the practice during which the reason to engage in it is zero. These latencies vary by individual and practice. Latencies model the empirical fact that, although a practice may be intrinsic, it is common for there to be a delay before the person wants to engage in it again. Latencies provide the formal mechanism for including biological and physical facts in the simulation, without the need to articulate and represent the relationship between physical and behavioral facts. Examples include eating a meal, going to a movie, or taking a vacation.
7. That I is engaging in practice P_i is a fact, recorded and observable by other members of the community (or, if desired, by a subset of the members). In some cases, observing that I is doing P_i gives other individuals J reason to do P_i .
8. More generally, the capabilities of each individual to observe the various facts and quantities that record the state of the portion of the world being modeled are facts recorded as such. When each individual I acts, he/she acts on the information he/she has, not on all the information that is present.
9. Non-behavioral events, things that happen in and to the community, are specified by representing how those things occur in the real world by alteration of the specification of the facts

representing the world state. In this way, events such as crop failure, bankruptcy, or an attack by someone outside the community are included.

Conclusion

Examining steps (1), (2), and (8) allows us to articulate the relationship between the community practice model and the neoclassical approach. As in the neoclassical approach, each individual is always engaging in the practice with the highest “payoff,” to the best of that individual’s ability to recognize it (bounded rationality). However, that payoff and its calculation have been greatly expanded in several ways:

- The basic “impetus” for engaging in practices is that they are intrinsic to the individual. This includes such ordinary and basic practices as acquiring food, water, and so on, but also includes a large number of community practices. Because intrinsic practices are those engaged in for *no* return other than the fact of engaging in them, this is a major philosophical and practical deviation from traditional approaches. The psychological phenomenon accompanying engaging in an intrinsic practice is *satisfaction*.
- Practices engaged in simply because they are intrinsic to one’s position (status) include a number that have long resisted traditional neoclassical thinking: voting, joining a union, etc. The community practice model approaches these practices by simply noting that they are recognizable by members of the community as “doing what one does” in those positions, and therefore require *no* justification or reward. This may appear to be an evasion of the question. However, it is actually an acknowledgement of the basic behavioral reality of such practices. To put it another way, models that lack justification for collective action are not incomplete; the search for such justification reflects an insistence on a particular theory that is inconsistent with the observed facts.
- Nothing in the community practice model insists that the outcome of a practice must benefit the actor. This is consistent with the fact that motivations other than self-interest include ethical reasons for engaging in an action, or choosing one action rather than another for esthetic or hedonic reasons. The entire art “industry,” for example, is dependent on the fact that people buy works of art for esthetic reasons. Similarly, people ride rollercoasters and take vacations for hedonic reasons (Ossorio [1981]).

As we noted at the outset, some authors posit that such motivations must be replaced by some form of self-interested description, and such work is in no way impeded by our model. Neither, however, is it required in order to create simulation models of a wide range of behaviors with economic impacts that are influenced by a range of non-economic factors.

- The utility function algorithm includes weights that reflect the fact that each individual’s actions and choices reflect the choice principles of the communities of which they are a member, as well as their choices of which community to act as a member of.

In short, the community practice model so greatly expands the concept of “self-interest” or “enlightened self-interest” that the term becomes misleading. We believe it is more appropriate to summarize the principle of the community practice model as: “Each individual acts to get the greatest perceived *value*—whether satisfaction, self-interest, doing the right thing, doing something esthetically pleasing or appropriate, or doing something fun.” This formulation allows us to pursue economic modeling and simulation, but still be responsive to the psychologists, sociologists, and anthropologists.

References

- Abelson, Robert. “The Secret Existence of Expressive Behavior.” In Jeffrey Friedman, ed., *The Rational Choice Controversy*. New Haven, CT: Yale University Press, 1996.
- Bennardo, Giovanni. *A Computational Approach to Spatial Cognition: Representing Spatial Relationships in Tongan Language and Culture*. Doctoral dissertation, University of Illinois at Urbana-Champaign, (1996), pp. 307–312.
- Chattoe, Edmund. “The Role of Agent-Based Modelling in Demographic Explanation.” <http://users.ox.ac.uk/~econec/rostock-0.pdf>, 2001.
- Jeffrey, H.J., and Anthony O. Putman. “MENTOR: Replicating the Functions of an Organization.” In K.E. Davis and R.M. Bergner, III, eds., *Advances in Descriptive Psychology V*. Greenwich, CT: JAI Press, 1983.
- Ossorio, Peter G. *What Actually Happens*. Columbia, SC: University of South Carolina Press, 1978.
- Ossorio, Peter G. “Outline of Descriptive Psychology for Personality Theory and Clinical Applications.” In K.E. Davis, ed., *Advances in Descriptive Psychology*, V. Greenwich, CT: JAI Press, 1981.
- Putman, Anthony O. “Communities.” In K.E. Davis, ed., *Advances in Descriptive Psychology*, V. Greenwich, CT: JAI Press, 1981.
- Spradley, James P. *The Ethnographic Interview*. Fort Worth, TX: Harcourt College Publishers, 1979.
- Thompson, J.M.T., and H.B. Stewart. *Nonlinear Dynamics and Chaos*. Chichester: John Wiley and Sons, 1986.