MODELING PARTICIPANT FLOWS IN HUMAN SERVICE PROGRAMS

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ABSTRACT

Participants flow into, through and out of human service programs in complex ways: into a program's screening process and out again without receiving services (ineligibility); from one state of receiving services to another (progress and setbacks); and out of the program and back in (repeating). The complete set of flows, if described accurately and measured precisely, is valuable for understanding a program both qualitatively and quantitatively.

Drawing on the traditions of the information systems field, we propose a methodology for defining and graphically modeling participant flows. The methodology, Status-Transition-Cycle (STC) mapping, suggests a common approach for program planning, knowledge transfer, statistical reporting, and information systems design. We present the principles, components, and implications of STC mapping and a case study of its use.

MODELING PARTICIPANT FLOWS IN HUMAN SERVICE PROGRAMS

1. Introduction

Human service programs accept participants and eventually discharge them. Participants, in other words, flow through programs. The entry and exit of participants is recognized as a common structural element of programs (Rutman and Mowbray, 1983; Lohmann and Lohmann, 2002). It may seem, on the surface, simple and self-evident. This is because the entry and exit of participants functions as a *semantic convention*, a commonly accepted way of modeling a particular kind of situation.

Semantic conventions determine how enterprises organize their data (Hays, 1996). For this reason, a strong semantic convention can play a key role in rationalizing a whole field of endeavor. A familiar example is in the area of commercial orders, which have been recorded for millennia. Parties (persons or organizations) order goods from other parties. Each order has a date and terms of payment. Each order has one or more detail lines, each of which represents a quantity of a certain product at a certain price. Each line has an extended value and the order as a whole has a total value. This semantic convention organizes data in a way that allows buyers and sellers to interact with each other smoothly throughout the world. Workers trained in one commercial environment find that the convention holds true everywhere else. Forms printed by thousands of independent vendors replicate the convention. Software developers use the convention to design databases. And the convention makes it possible to arrive at data exchange standards that facilitate electronic commerce.

The entry and exit of a program participant is, by comparison, a semantic convention of very limited power. It means that human service programs generally consider that a participant has a date of admission and a date of discharge. They reflect this in their data management practices. Beyond that, though, particular program types (e.g. homelessness, violence prevention, substance use treatment or vocational training) develop subject-specific practices on what data about entry and exit are relevant and how the data should be captured and organized.

The fact that participants flow through programs, however, is neither obvious nor trivial. Rather, the present semantic convention makes it so by focusing too narrowly on entry and exit points. That focus does not adequately reflect the real complexity of a program's structure and its participants' trajectories.

In real life, participants flow into a program's screening process and out again without receiving services (ineligibility); they flow out of the program and into it again (repeating); and in a broader sense, they flow from one state of receiving services to another (progress and setbacks). The complete set of these participant flows, if described accurately and measured precisely, is valuable for understanding any program both qualitatively and quantitatively.

Drawing on the graphical modeling traditions of the information systems field (see Appendix), we present a methodology for modeling participant flows. This methodology applies broadly to the human service sector, and its structure offers a new semantic convention that can be useful for program planning, knowledge transfer, statistical reporting and information systems design.

The methodology is based on three patterns. First, a program has a set of categories that organizes the universe of its actual and potential participants. In this methodology, each category is a *status*. Second, during their involvement with the program, individual participants undergo *transitions* from one status to another in meaningful and structured ways. These transitions reflect the program's clinical and business rules. Third, certain transitions mark the beginning or the end of a participant's present involvement with the program. A complete instance of a particular participant's involvement can therefore be represented as a sequence of transitions through statuses from entry to exit. In this methodology, such a complete sequence is a *cycle.* And in many programs, the same participant may have multiple cycles.

People who design, implement and evaluate programs implicitly work with these patterns, but the patterns have not previously been formalized. The Status-Transition-Cycle (STC) mapping presented in this paper provides an explicit framework for modeling them in a rigorous and unambiguous way.

2. Methodological components

[FIGURE 1]

The six symbols shown in Figure 1 embody the fundamental concepts of STC mapping. Three of the symbols—a shaded cloud, an unshaded rectangle and a shaded one—represent categories of people. The shaded cloud stands for the whole universe of potential participants who are unknown to the program. An unshaded rectangle represents an “internal” status, a particular category of present or potential participants who are currently involved in some way with the program. A shaded rectangle is an “external” status, a category that is not currently involved with the program. The other three symbols represent transitions, movements that people may make between the categories. An arrow crossed by a circle stands for a transition that begins a potential participant’s involvement (cycle) with the program, and an arrow crossed by a bar is a transition that ends a cycle. A plain arrow represents an internal transition, i.e. one that occurs within a cycle. Transitional arrows of any kind may be marked with numbers representing the various reasons why the transition might occur; if so, the numbered reasons are listed in a legend.

[FIGURE 2]

The STC map in Figure 2 models a job-counseling program. It shows that every potential participant goes through an intake assessment, and may be found ineligible based on any of three reasons: failing a means test, having a job, or living outside the program’s catchment area. Those who are eligible go on to receive counseling. Their case is then closed, either because they completed the program or because they left without completing it. Anyone who has been found ineligible, or whose case has been closed after receiving the counseling, may return to the program later, passing through the same intake assessment.

A key point in this example is that INTAKE is an internal status. This may seem counterintuitive, challenging the convention that a participant is “in” a program only after being accepted to receive services. However, the status is considered internal because the person has entered a recordable relationship with the program. This reflects the cyclical aspect of STC mapping. For those potential participants who are eligible, intake assessment is the beginning of their cycle of receiving program services. Those found ineligible, though, also go through a cycle of entry and exit, though it is only an intake cycle and does not include services. The importance of this point will become clear when we examine the methodology’s practical implications.

2.1 Statuses

Managers of human service programs should find the construct of statuses familiar, as most programs necessarily divide participants into different categories. Some programs may already use the term “status” while others refer to a category of participants as a “group” or “stage” or “phase” or by some other nomenclature.[1]

Visually, a status resembles a *process* on a traditional flowchart—both are represented by rectangles and both use arrows to indicate paths of flow. The meaning of the two is fundamentally different, however. A status is not a performed action, it is a category of participants. Sometimes a status—such as INTAKE in the Job Counseling Program—corresponds to a single process. But often, participants in a particular status will go through many different processes. For example, the status RECEIVING COUNSELING might include creating a resume, receiving three coaching sessions on interview skills, and attending a workshop on internet job searches; the STC map does not attempt to represent these. And other statuses—such as INELIGIBLE and CASE CLOSED—indicate that a participant is not going through any process at all.

[1] For a number of reasons, the term “status” is most appropriate for our purpose. A “group” could mean a category based on inherent personal characteristics (such as age) or accidental circumstances (such as geographic location). But in STC Mapping, the statuses indicate the participant's relationship to the program. A “stage” or “phase” could be taken to suggest a predetermined and invariable sequence. For all but the simplest programs, though, STC Mapping usually reveals that a participant may follow any of several possible sequences.

In order to coherently organize the universe of participants, the set of statuses must meet four requirements:

1. Each status in the set must be *semantically well-defined*, so that program staff understand and agree on its meaning.
2. The statuses must be *programmatically significant*, so that they serve as the basis for analyzing performance and adjusting policies.
3. Each status must be clearly understood as *either internal or external* to the program.
4. The set of statuses must be *both exhaustive and mutually exclusive*, so that the STC map completely covers all potential, present and past participants, and each participant is in exactly one status at any given moment.

2.2 Transitions

A participant's trajectory entails transitions from one status to another. If programmatically significant statuses have been established, transition will mark some important shift in the participant's relationship to the program.

Within any program's set of statuses, only some transitions will be permitted. For example, in the job-counseling program, a direct transition from CASE CLOSED back to RECEIVING COUNSELING is prohibited because the program requires that intake procedures be followed again. The set of permitted transitions, then, expresses clinical and business rules about how participants flow into, through, and out of the program.

The set of transitions must follow five rules:

1. There must exist at least one transition from UNKNOWN POTENTIAL PARTICIPANTS to some internal status, but there cannot be any transition back into UNKNOWN POTENTIAL PARTICIPANTS. Once known, a participant should never again be unknown.
2. Every internal status must have at least one transition into it and at least one out of it. Participants do not stay involved in the program forever.
3. Every external status must have at least one transition into it from an internal status. The map must show how participants exit the program.
4. There may not be any transition into an external status from the UNKNOWN POTENTIAL PARTICIPANTS or from another external status. A change in the participant's status with the program can only occur when a transition is flowing into, through or out of the program's internal statuses.
5. Every permissible transition must be represented on the map. The map is both descriptive and prescriptive.

2.3 Cycles

Once the statuses and transitions have been mapped, it is simple to mark the transitional arrows with a circle or bar to indicate the opening or closing of a cycle. Any transition from an external status to any internal one necessarily constitutes the opening of a new cycle, while a transition from an internal status to an external one closes a cycle. Because statuses are marked as internal or external, marking cycle boundaries may seem redundant. STC mapping is a graphical modeling methodology, however, and the presence of the circle or bar emphasizes the boundary to the reader's eye.

3. Implications

The basis of STC mapping is that generic patterns exist for the overall class of service programs, and these patterns can serve to develop a more formal model of any particular program. In many professions, practitioners perceive common patterns that they can use to formalize their work. Over time, the most popular and successful of these formalisms evolve into standards. The combination of formalizing and then standardizing the knowledge base will rationalize a field. Such a rationalization has many practical functions: agreement on professional standards, knowledge transfer to and training of practitioners, a common professional language, better record-keeping and reporting practices, more effective information systems, and data sharing among systems.

3.1 Qualitative program planning, implementation and evaluation

Charting the boundaries of a human service system is a necessary prerequisite to monitoring the system; in addition, the very act of charting it often leads to improving the way the system works (Giller, 1996). As a tool for qualitative description, STC mapping will assist both program design and evaluation.

Initially, the process of defining statuses ensures that program planners and staff understand and agree on how to categorize the universe of participants. Mapping the transitions does the same for the clinical and business rules of how a participant's relationship with the program may change over time. The completed STC map then becomes a well-defined model for internal communication, in turn supporting staff training, knowledge transfer, quality assurance, and modifications of program procedures.

For external use, the completed STC map—when accompanied by a list of definitions of statuses and transition reasons—constitutes an informative, precise, compact and standardized way of describing major operational aspects of a service program. This will help in communicating program characteristics to funders, who in turn can use STC maps to evaluate and compare different programs.

Correctly executed, an STC map can reveal a program’s criteria for admission, many of its major service milestones, conditions for successful and unsuccessful completion, and whether it permits reentry. The STC map can also indicate the program's degree of flexibility in dealing with events in participants’ lives. It thus provides a snapshot of the program and its guiding philosophy. The very exercise of creating an STC map for external consumption thus challenges managers to give good reasons for—and if necessary reconsider—their program’s design.

3.2 Quantitative analysis

A common way of measuring a program’s output is through the volume of its caseload, whether as a whole or at specific points of its service delivery process (Poister, 2003). Because STC mapping is a standardized way of modeling a program’s participant flows, it suggests a number of formats for standardized quantitative reports.

Programs generally need to report figures on their census of current and former participants and those in the intake process. A list of all statuses, with the current count in each, meets this need. Programs also usually need to report figures on intakes, completions, other discharges, and important milestones achieved. This is represented by a list of the program’s significant transitions, with the count of participants who went through each. There could be descriptive statistics on how long participants stay in different statuses. Formats could also be devised to shed light on a program's cyclical aspect: there could be standardized statistics on the participants who go through one or more cycles resulting in ineligibility before being accepted for services, and on those who go through more than one cycle of services.

Most programs already compile statistics of this sort, but STC mapping streamlines the process in several ways. First, the methodology points to these standardized formats. Second, the STC map directly links the statistics to a schematic qualitative description of the program. Third, the concept of cycles helps communicate the difference between statistics on individuals and statistics on their (potentially multiple) passages through the program. Fourth, the STC map guides the program to collect and organize its data in an unusually comprehensive and flexible way: the program will be able to deliver statistics on any participant flow that the map represents. Increasing pressures from government oversight agencies and funders for better performance measurement (Kettner, Moroney and Martin, 1999) could make STC mapping a helpful tool for many programs grappling with these demands.

3.3 Design of information systems

The methodology has direct implications for information systems, in particular the design of databases. The root of a database design is its data model, which represents a group of entities, their attributes and how the entities are related to each other. Data modeling theorists have created detailed handbooks of the data model patterns commonly found in commerce, accounting, manufacturing, insurance, telecommunications, and many other industries (Hays, 1996; Silverson, 2001a, 2001b). Common data models for human service programs, however, are less well developed.

A database is only as good as its underlying data model, and a principal dimension of data model quality is *conceptual completeness*; it must adequately reflect the scope of the domain that it claims to represent (Reingruber and Gregory, 1994). In human service programs, the simple semantic convention that a participant is accepted and discharged often leads to a data model—and therefore a database—that does not capture the complexity of participant flows in real life. A database design may treat every passage through a program as a separate case record unlinked to the same participant's previous and subsequent passages, or fail to capture or link data on ineligible applications; if so, it will make it difficult to analyze larger patterns, both in the lives of participants and in the program's efforts to reach targeted populations. A database design may not accurately track how participants flow from one state of receiving services to another; such a design will make it harder to spot patterns that could illuminate reasons for success and failure.

STC mapping offers a solution to this problem because each of its three major components—statuses, transitions and cycles—translates to an entity within a data model. An information system based on such a data model will accurately capture how participants flow through the program. It will capture each of a participant's transitions, when it occurred and why. The system will capture the participant's complete history of one or many program cycles, with each cycle containing its specific sequence of multiple transitions. Such a system will record data on program flows with a completeness that facilitates program evaluation, in addition to delivering the quantitative measures outlined above. Because STC mapping is applicable to many different kinds of human service programs, such a data model could be used in information systems across the human service sector.

4. Guidelines for using the methodology

When drafting an STC map, an effective procedure is to determine the statuses first, then establish the transitions.

4.1 Determining statuses

In general, the set of statuses for most programs can be divided into three functional areas. There will be at least one status for participants currently receiving services; one or more for participants who received services in the past; and one or more for potential participants who will be or have been evaluated for eligibility to receive services. Each of these functional areas formalizes a particular aspect of a program's work. Statuses of current participants indicate different sets of service practices, statuses of former participants relate to how their cases terminated, and statuses of potential participants embody business rules of the intake process. A good approach is to address one basic area of participants—current, former, or potential—at a time.

Within that area, each proposed status should be well defined. It is a good exercise for program staff to come up with a formal definition of each one. Difficulties and disagreements on the meaning of a status are useful, as they indicate that the program's business rules are in flux, that the rules are ambiguous, or that staff understanding of them is uneven. In any case, the discussion is an opportunity to unearth and resolve issues. STC mapping facilitates this discussion by uncovering the areas of ambiguity, allowing them to be more clearly defined.

At the same time, it is important to verify the programmatic significance of each status. Are the statuses so general that they miss important distinctions, or so finely drawn that they are unwieldy or irrelevant? The goal is to find the workable solution that best describes the program. A couple of standard questions can be helpful. Does each proposed status represent a distinct programmatic relationship with those participants? If there is excessive overlap between two statuses, it may be that they are actually only one status, with only some superficial labeling differences; those two can be reformulated as one. Also, do the proposed statuses cover the major ways that participants are categorized for management reporting purposes? If an important category of participants is missing, that may indicate that some statuses need to be subdivided.

The set of statuses must also be exhaustive and mutually exclusive. Is it possible to imagine a participant who would not fit into any of the statuses that have been proposed? Is it possible to imagine a participant being in more than one of the statuses simultaneously? If either of these scenarios is plausible, then the set of statuses still needs to be revised.

Finally, it is necessary to formally define the borders of the program by distinguishing between internal and external statuses. As this is based on whether the program is currently interacting with the person in any formal way, the distinction is usually self-evident.

4.2 Determining transitions

Just as there are distinct functional areas of statuses, there are several distinct patterns of transitions, and it is helpful to approach them one at a time.

First, in every program, an unknown person will enter the program's domain and become a participant or at least a potential participant. This must be represented by a transition from the UNKNOWN POTENTIAL PARTICIPANTS to at least one internal status. Many programs will place all new entrants into the same status, but some programs may have more varied intake possibilities. In such a case, there could be permissible transitions from UNKNOWN POTENTIAL PARTICIPANTS to multiple internal statuses.

Second, in most programs participants move from one internal status to another in the course of their involvement. Often there is a linear sequence of transitions that the program considers ideal, but for most programs the internal flows of participants may in fact move in a number of directions.

Third, in every program participants or prospective participants leave the program's ambit—that is, there are transitions from internal statuses to external ones.

Fourth, in many programs former participants or prospective participants may reenter the program at a later point. Such a potential for reentry is represented as a transition from the external status, in which the participants last ended, back into an internal status.

In determining each transition, analysis of it should include a list of the different reasons that can induce the transition. Listing the different reasons may uncover another level of business rules. (For many transitions, however, there will be only one obvious reason.)

After creating a draft version of the STC map, the transitions should be reviewed for logical consistency. Does each internal status have a transition into it and out of it? Is there a transition into each external status, and is there a transition out of the UNKNOWN POTENTIAL PARTICIPANTS? Are there any impermissible transitions among external statuses and the UNKNOWN POTENTIAL PARTICIPANTS that must be removed?

If the logical rules are met, the last issue is whether or not the set of transitions is complete. The goal is to represent all permissible transitions, not merely the most usual ones. For each possible pair of statuses A and B, the questions need to be asked: Is a transition from A to B permissible? What about from B to A? This discussion may have several dimensions. Some possible transitions are omitted because they would defy common sense, while the program's clinical or business rules may prohibit others for well-considered reasons. When an established program uses this methodology to analyze its processes and design a corresponding information system, this part of the discussion may be largely descriptive. For new programs, however, it is usefully prescriptive, as staff discovers and formalizes business rules.

5. Case Study: La Bodega de la Familia

La Bodega de la Familia, located in Manhattan's Lower East Side, is a direct services storefront program run by the nonprofit organization Family Justice, Inc. The mission of Family Justice is "to identify, apply, and disseminate effective practices in using family supports to improve the success of individuals under justice system supervision and, in so doing, to enhance the well-being of their families."

(www.familyjusticeinc.org) In addition to operating La Bodega, Family Justice carries out research and national technical assistance work.

At La Bodega, family case managers engage and support the families of people under community-based justice supervision (parole or probation). Much of La Bodega's work has focused on participants who have a history of illegal substance use. Its signature service is the Bodega Model[SM] of family case management. This approach brings the participant, family members, the justice supervision officer, and the family case manager together to identify the strengths and resources of the family and to build a network of healthy relationships that benefit both the participant and the family as a whole.

La Bodega opened its doors in 1996 as a demonstration project of the Vera Institute of Justice, a nonprofit organization that develops innovations in justice system practices, and it spun off from Vera in 2001 to become one branch of the new organization Family Justice. Seeking to enhance La Bodega's capacity to organize information for case management, program oversight, and research, the following year Family Justice contracted for a customized version of program management software that Vera had since developed. In the course of that project, software developers from Vera and staff from Family Justice analyzed La Bodega's participant flows.

5.1 A basic outline

Because La Bodega had been in operation for a number of years, many aspects of its participant flows were already well developed. It was immediately clear that there are three main statuses of participants receiving services. A status called ENGAGEMENT & ASSESSMENT (also known as Phase 1) corresponds roughly to the first month in the program. While the participant is in this status, the family case manager establishes a working team that includes the participant, family members and the parole or probation officer; he or she also explains the program's approach and assesses the family's needs for services. The bulk of participants are in the status FAMILY ACTION PLAN (or Phase 2). This involves creating and implementing a plan that sets behavioral goals, mobilizes family members, and supports problem-solving in the family. And BRIDGE PROJECT (or Phase 3) is a status of participants who, having completed their family action plan, still meet as a group to sustain the benefits achieved, maintain contact with resources, and learn leadership skills.

It was also clear that the intake process had two main statuses. Staff have to assess each potential participant to make sure that he or she meets all of four criteria: criminal justice involvement, an address within the catchment area, availability of a family member (broadly defined), and willingness to participate. The status PENDING ELIGIBILITY SCREENING includes potential participants for whom eligibility has not yet been determined, while the status INELIGIBLE is for those who fail to meet one or more criteria.

Former participants have three statuses. Participants who are reincarcerated or who drop out of the program without having made substantial progress are in CASE CLOSED NOT SUCCESSFUL. Those who complete the program are in CASE CLOSED SUCCESSFUL. And there is another status CASE CLOSED INDETERMINATE for those who move away from La Bodega's catchment area, leave the program in order to enter a long-term residential treatment program, or drop out after making substantial progress.

5.2 Discovering complexities

Having arrived at this initial set of statuses, the next step was to map their transitions. At the beginning, this was very straightforward. Some potential participants moved from PENDING ELIGIBILITY SCREENING to INELIGIBLE. The ideal trajectory, though, was to move from PENDING ELIGIBILITY DETERMINATION to ENGAGEMENT & ASSESSMENT to FAMILY ACTION PLAN to BRIDGE PROJECT to CASE CLOSED SUCCESSFUL.

Not all successful participants follow this trajectory, however. The Bridge Project is a newer part of the program, and many earlier participants moved straight from FAMILY ACTION PLAN to CASE CLOSED SUCCESSFUL. A participant might even move directly from ENGAGEMENT & ASSESSMENT to CASE CLOSED SUCCESSFUL if, for example, the person had already solved his previous substance use problem while in prison. And not all participants make uninterrupted progress. A participant or family member might ask for a move back from BRIDGE PROJECT to FAMILY ACTION PLAN; and some participants might be moved back because of a relapse or temporary absconsion.

Setbacks and difficulties in participants' lives make for many possible trajectories. One who drops out soon or is reincarcerated for a significant length of time would, of course, move from any of the three active service statuses to CASE CLOSED NOT SUCCESSFUL. But there are also intermediate situations. It might happen that a participant would briefly abscond, be rearrested, or relapse and go into a residential treatment facility, but not end up reincarcerated for any significant period. Or a participant might be hospitalized for some unrelated reason. Such a case would need to be distinguished from other active cases, but still left open pending the outcome of that participant's situation. It was therefore decided to create a new status, ON HOLD. Transitions are possible from ON

HOLD to and from the three active statuses, and also from ON HOLD to CASE CLOSED NOT SUCCESSFUL.

Then further consideration of the intake process revealed the need for two more new statuses, PRE-RELEASE and WITHDRAWN. Some participants are referred to La Bodega and determined to be eligible some time before being released from incarceration. These are no longer in PENDING ELIGIBILITY SCREENING status. However, they need to be distinguished from those in ENGAGEMENT AND ASSESSMENT, who are out in the community and meeting with La Bodega's staff. But in some cases the referring authority might withdraw the accepted participant if, for example, a disciplinary problem delayed the person's release from prison. There needed, therefore, to be transitions from PENDING ELIGIBILITY DETERMINATION to PRE-RELEASE, and from PRE-RELEASE to both ENGAGEMENT AND ASSESSMENT and WITHDRAWN.

Finally, some initially ineligible people are referred again, and the program accepts former participants for readmission. There are therefore transitions back from all of the external statuses to PENDING ELIGIBILITY DETERMINATION, and these allow participants to begin new cycles.

La Bodega's participant flows thus turned out to be more complex than they appeared at first. The final STC map is shown in Figure 3. The program's information system tracks all flows. This will allow it to deliver in-depth historical reports on particular participants, caseload statistics for each status, and data about the patterns of flows among them.[2]

[2] The STC map does not, however, reflect the services that La Bodega often continues to provide to participants' family members after the participant's case has been closed. By its nature, an STC map models only the flows of those who are formally defined as participants.

[FIGURE 3]

6. Conclusion

Status-Transition-Cycle mapping provides a methodology for uniformly analyzing and describing human service programs. It is not meant to replace the conventions that different types of service programs already use to describe their substantive data and processes. Rather, in one important area—modeling of participant flows—it aims to provide a completeness, logic and rigor that present conventions do not. Using STC mapping, a program developer or manager can represent a program's participant flows more precisely, reengineer them more adroitly, and communicate them more rigorously and consistently.

STC mapping provides a number of opportunities for future research. These include developing a clear methodology for converting STC maps into data models, exploring standardized reporting formats, building additional case studies on the use of STC maps, and doing empirical research on its efficacy in different human service environments. The results of this work will be of interest to information systems designers and practitioners, human service program developers, managers, and evaluators, and those in need of better information concerning the performance of service providers.

Appendix: modeling methodologies in information systems

The information systems field has a rich tradition of graphical modeling methodologies, a number of which represent flows among processes or changes in the state of objects. Although they are not easily useful to the analysis of human service programs, aspects of these methodologies have informed our development of STC mapping.

Finite state diagrams and their descendents

Perhaps the oldest computer-related modeling methodology is that of finite automata, proposed by British scientist Alan Turing (1936). Finite automata represent a machine that is a series of “states” with an “initial” state. Based on the input it receives, the machine can change its state. Finite automata were originally quite minimalist, and designed to model the input of binary numbers (1 or 0), as that was the state of computing at that time. Finite automata are usually defined with a mathematical formula, and can be represented graphically with a “finite state diagram” in which a state is a circle and an input is an arrowed line; each input creates a transition to a new state. Much later, Harel (1987) developed a more flexible notation called a “statechart” to address the same kind of situation. A descendent of this, the “state transition diagram” is one of the notations now included in Unified Modeling Language (UML), the general-purpose toolkit used to design, specify and document complex software (Booch, Rumbaugh, and Jacobson, 1999).

Flowcharts

Flowcharts represent a decision-making process by depicting a decision point and then the resulting actions that take place depending on the decision. Diamonds, rectangles and arrowed lines represent decisions, actions and the links between them. Flowcharts can model a wide range of decision-settings, from computer algorithms to emergency room protocols to criminal justice sentencing guidelines. They were very popular in the early years of information systems (Bright, 1959).

Data flow diagrams (DFDs)

Data flow diagrams describe how data move between processes in a system, and how different processes alter, manipulate, or display the data (Gane and Sarson, 1979). An arrowed line is a data flow that represents a specific grouping of data, while a circle represents a process that changes the data through various acquisition or manipulation processes. DFDs continue to be an important tool in the analysis and design of information systems.

STC mapping

At a superficial visual level, all of the above modeling tools share some features. In each, there is some initiation point, there are various containers (boxes or circles) that represent an activity or state, and there are flows between those containers. The meaning of a container and flow is different in each, however, and as a result each model is best suited to a different kind of analysis. Finite state diagrams and their successors focus on the representation of deterministic problems with predictable inputs. Flowcharts emphasize micro-level decision-making; they are suitable for specifying how to perform specific, narrow routines. DFDs permit the relationships between business processes of an organization to be unambiguously described.

Although semantically dissimilar, all three are “generalist” tools. Because they employ very abstract constructs, they are flexible enough be used to model a vast array of dissimilar situations. Because they are so abstract, though, using them is complicated, which tends to limit their popularity to information systems professionals. The complexity has reached its apogee in the Unified Modeling Language (UML), a massive methodology which attempts to encompass best practices developed by various groups of practitioners over decades. The technical specifications for UML are over 700 pages long (Object Management Group, 2001).

Unlike these generalist tools, Status-Transition-Cycle mapping is explicitly designed for modeling the progress of participants through human service programs. It is based on a set of commonalties specific to human service programs, and it formalizes them as modeling conventions. This has the overall effect of imposing a discipline on thinking about and planning human service programs. While imposing this discipline, STC mapping limits itself to a very few components and rules, making it straightforward enough for use by a layperson.

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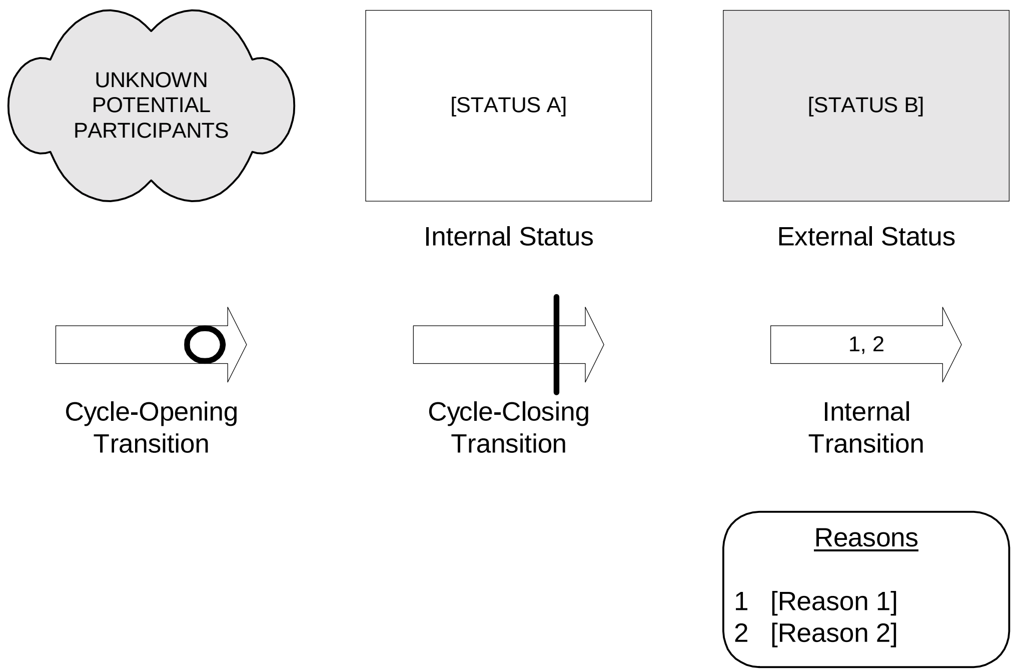

Figure 1: Status-Transition-Cycle Symbols

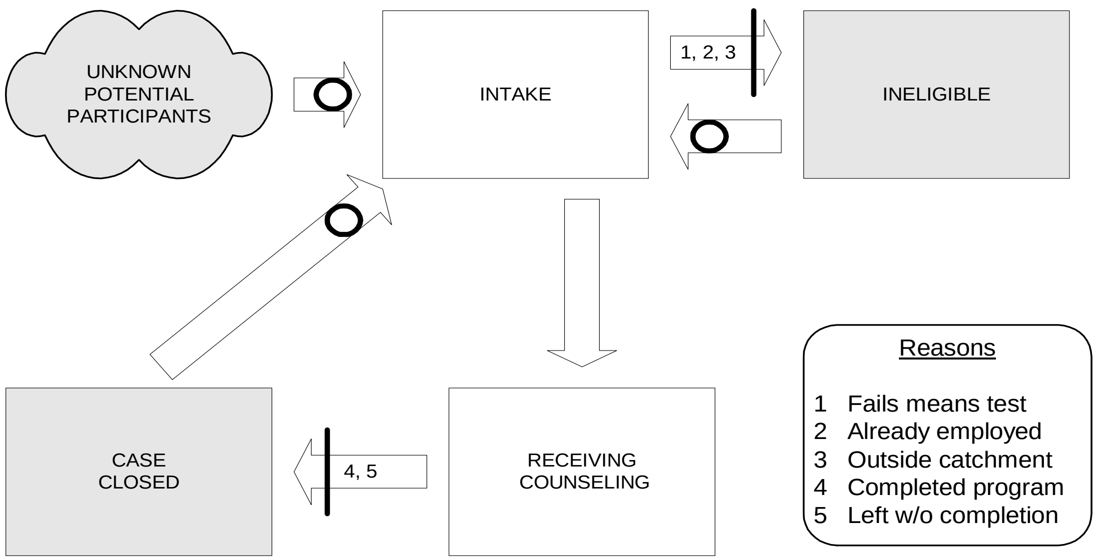

Figure 2: Job Counseling Program

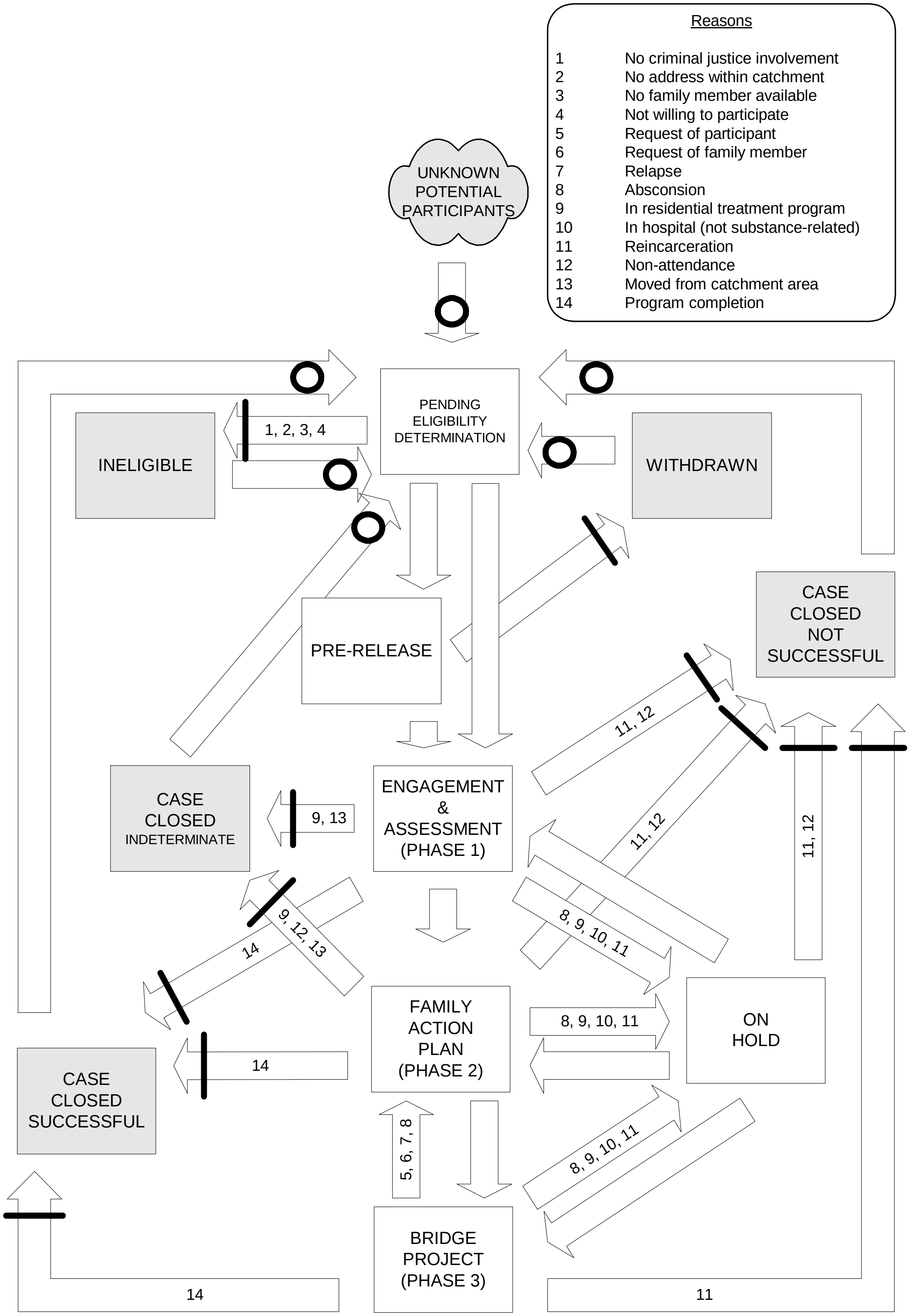

Figure 3: La Bodega de la Familia