

# Services as Customer-Intensive Systems

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Footnotes for this article begin on page 12.

## Introduction

Visiting the design section of a bookstore is a simple way to inventory traditional objects of the design discipline: you will find books on the design of everyday objects, furniture, houses, gardens, books, cars, clothes, posters, textiles, glass, type, ceramics, literature, logos, and, more recently, software interfaces and websites. In many ways, design seems to center around the creation of tangible artifacts, with the notable, but recent, exception of “interaction design.” By doing so, design as a discipline currently has almost no participation in the services sector, more than half of the world economy.

Service design is simply the application of human-centric ideas and methods of design to services. Its importance, needs, and methods have been addressed by a small group of researchers,<sup>1</sup> some design institutions such as the British Design Council,<sup>2</sup> and an even smaller group of practitioners such as some groups in the design houses Live | Work, 31Volts, and IDEO.<sup>3</sup>

Which types of services can be designed? Healthcare systems, government services, entertainment experiences, transportation services, retail experiences, maintenance and support systems, education, travel and tourism, telecommunication services, utilities, information services, and much more. In many ways, most of our service-related daily experiences are devoid of thoughtful design, except in their tangible aspects. Cars are designed, but not the transportation experience, seen as the interaction of people, cars, and public transportation systems; or the experience of buying cars and maintaining them. There is, however, some anecdotal evidence that the impact of good design in services can be tremendous. One of the most famous is the case of the Shouldice Hospital & Hernia Center in Toronto, Canada, where the redesign of the hospitalization services decreased patient stays in the hospital from an average of four to fifteen days, with reported gains in productivity, healthcare quality, and patient and family satisfaction.<sup>4</sup>

This realization of the need of systematic understanding of services is not limited to the design field. Similar shortcomings have led to calls for the establishment of science, management, and engineering disciplines specific to services in the so-called Service Science, Management, and Engineering (SSME) initiative.<sup>5</sup>

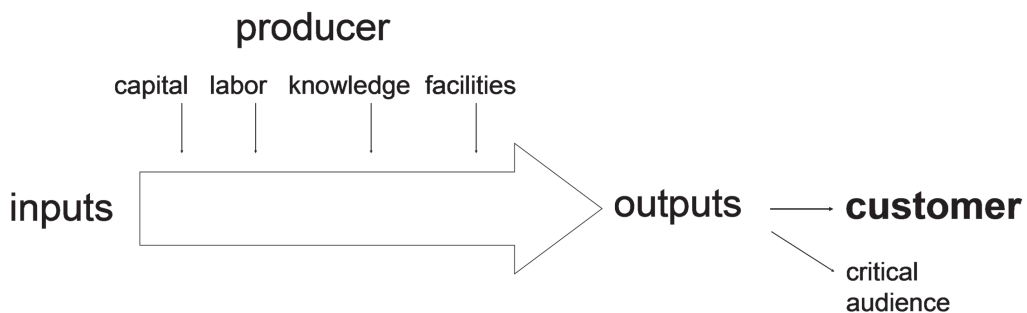
However, the ongoing controversy about what characterizes service systems<sup>6</sup> makes advancing these new disciplines a constant struggle against definitional problems. To circumvent this issue, we approach here the discussion about service design using our definition of *customer-intensive systems*,<sup>7</sup> which slightly modifies a definition proposed by Sampson<sup>8</sup> and, in different forms, also by Gadrey and Gallouj,<sup>9</sup> and Karni and Kaner.<sup>10</sup> We then argue that almost all commonly-agreed service industries deliver services through customer-intensive systems. We continue by examining ideas for representing service processes better; aiming to develop an improved language for service designers. We discuss how service design is likely to be different from current design practices, illustrating the concept with an overview of the design of the computer-human interface of online services.

### Customer-Intensive Processes and Systems

Our first step is defining customer-intensive systems as systems in which the beneficiaries of the system's processes also are part of the input to the system and, at the same time, sufficiently different to the provider system. We formally construct this definition by first defining customer-intensive production processes. A "production process" is a process in which inputs are transformed into outputs by a "producer," using the basic four means of production: capital, labor, knowledge, and facilities (see Figure 1). We define "customers" as the persons or organizations who receive most of the value created by a production process. To simplify the presentation of the ideas in this paper, we consider, without significant loss of generality, only the case in which the customer of a production process is a person, and not an organization.

The core of our framework relies on some recent work in services theory by Sampson,<sup>11</sup> which proposes a new unifying definition for service processes based on the level of customer intensity in the inputs to the production process. However, his definition is somewhat ambiguous about the separation between customers and producers. Our definition<sup>12</sup> explicitly states that what characterizes customers is the lack of control over the means

Figure 1  
A production process.



of production. Accordingly, a production process is a “customer-intensive process” when:

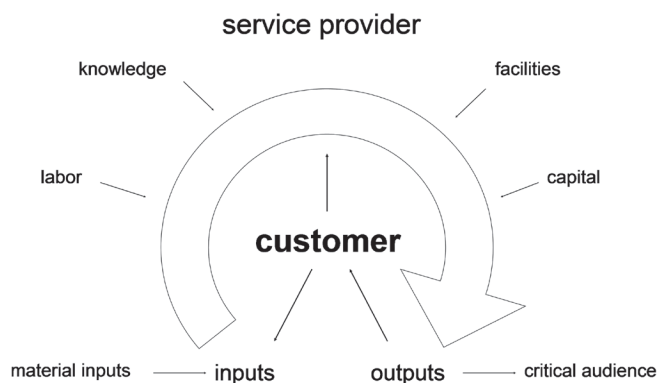
- 1 The customer does not control most of the means of production.
- 2 The customer (self, belongings, information) is a significant part of the input to the production process.

The first part of our definition states that the customer does not control the basic factors of production—resources, capital, and labor—and therefore cannot determine when and how intensively resources are used; where his or her information or belongings are stored, and who can access it; how much effort is expended on a given task or goal; and what the price of the service is, and how it changes through time.

The second part of the definition tries to differentiate between manufacturing and service production processes using Sampson’s notion of customer intensity.<sup>13</sup> Thus, the customer can be the input to the production process in different forms: as herself (body or mind), such as when the services of a doctor in a hospital are sought; as his or her belongings, such as when the customer’s car is taken to a repair shop; or her information, as when providing financial information to apply for a loan in a bank. Since the customer input is part of the production process, it is quite common that the customer also provides the means of production, commonly in the form of labor, but sometimes in the form of knowledge, capital, or facilities, for example, in home-cleaning services.

We believe that the centrality of the customer in customer-intensive processes requires a strong visual representation that clearly differentiates it from the traditional views of production processes. Figure 2 shows our proposal for the visual representation of service processes which has, as its strongest feature, the placement of the customer in the center of the process. The means of production brought by the service provider are shown in the outside part of the arrow: similarly, “means of production” when provided by the

Figure 2  
A customer-intensive process.



customer are represented in the inside part of the arrow. Notice that we do not explicitly depict the means of production provided by the customer in the diagram of Figure 2; mostly for simplicity, but also because the customer does not always provide all types of means of production in a service process. Also depicted in Figure 2 are the material inputs to the process, and the connection from the outputs to the critical audience. Since both are beyond the realm of the customer, they are positioned outside of the arrow.

Our intention here is not to echo the rhetoric about the importance of customers for the modern enterprise. Instead, we are advocating the use of a customer-centric representation of service processes because: (1) a customer-centric representation highlights the significance of the customer input and participation in a service process; (2) the use of circular instead of linear representations for a process focuses attention on the central element of the representation, and can be used to accentuate fundamental components of the customer's world such as presence, property, information, and time; and (3) because, indeed, the customer is the center of a service process.

We define a "customer-intensive system" by analogy to our definition of customer-intensive processes, in a system where: (1) the customer does not control most of the means of the production of the system; and (2) the customer is a significant part of the input to the system.

But are there service systems that are not customer-intensive? We look into this issue at the industry level, using the North American Industry Classification System 2002 as a tool.<sup>14</sup> Among the sixty-two segments listed for the service industry, only three cannot be considered customer-intensive: publishing industries (including software publishing), motion picture and sound recording industries, and broadcasting and telecommunications (in fact, only the broadcast portion). Carefully examining these three, traditional service industries, which are not customer-intensive according to our definition, we see production systems that look more like manufacturing systems than what most people would agree to call service systems. In any case, those three industries represent a very small part of the traditional services spectrum. Combined, they account for little more than one percent of all American businesses. Therefore, for the remainder of this paper, we simply ignore those industries when we are discussing service design issues.

### **How Much Different Are Service Processes?**

The main goal of our ongoing research is to better understand the differences between manufacturing and service processes, the latter understood as customer-intensive processes. Most important, customer intensity implies that a service process: (1) consumes input loaded with human values (such as hope, concern, pride, and

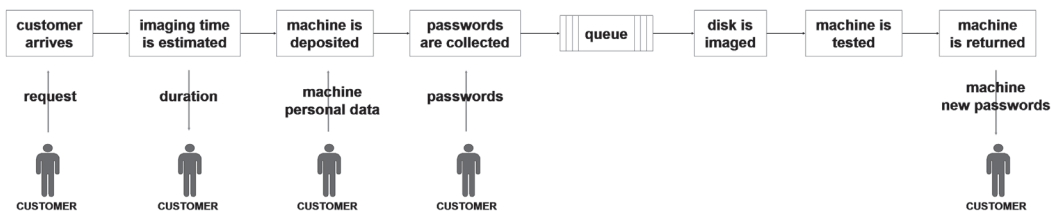
disgust); (2) is timed from a human (the customer's) perspective; and (3) is evaluated at every step the customer has access to or participates in. In services, the customer is on the conveyor belt.

In most cases, service systems tend to address this "unbearable" presence of human values in the production process by having the human values handled by people, often without explicit design and engineering. A contact center agent can feel affliction in the voice of a customer, and "bend" a procedure or rule in a way that automated voice response systems cannot. The key challenge for service engineering, in our view, is to create architectures and technology that can recognize and deal with the human perspectives attached to service inputs and processes, to allow automation and efficiency without dehumanization.

As an example, we are developing new ways to represent service processes that highlight the impact of customer centrality. To illustrate the potentials of shifting from the traditional, linear representation of processes to the customer-centric representation, we examine here the representation of a simple service process. A very common IT support service process is the procedure to rewrite the hard disk of a personal laptop computer with basic system applications and a set of standard applications. This process is called, in the IT industry, "imaging a hard-disk," and its basic sequence of steps involves the customer bringing the laptop to the IT support station; agreeing with the estimated time needed to perform the process; and providing the hard-disk and machine passwords. Often, it takes some hours for the procedure of physical imaging the disk to be performed. After imaging, the machine is tested and returned to the customer, together with a set of provisional passwords.

Figure 3 compares the traditionally used linear representation of a service process (top) with the proposed customer-centric representation (bottom) for the imaging a hard-disk service process. Notice that, for the sake of a fair comparison, we included in the linear representation explicit customer elements such as the information and property brought to the process by the customer, although the inclusion of such elements is far from usual by process designers.

Figure 3  
Linear and customer-centric representations of a typical IT support process: "imaging the hard-disk" of a laptop.



The bottom of Figure 3 shows the same service process of “imaging a hard-disk” in the customer-centric representation. The most important difference is that, in this representation, the central position of the customer makes visually clearer that the process begins and ends with the customer, and that the imaging a hard-disk process is about the customer’s machine, personal data, and passwords because they are input to the process.

Of course, it is very difficult to determine what the best representation is for a certain task. Nonetheless, we have observed in our own work that the customer-centric view, besides naturally emphasizing the fundamental customer’s role in a service process, is quite good at depicting some of most fundamental components of the customer experience: presence, property, information, and time. Figure 4 shows an enhanced representation of the imaging a hard-disk process of Figure 3, which depicts each of those experiential components in a highlighted way:

- Customer time: Time in the diagram of Figure 4 is shown not linearly, but centered in the customer, clockwise, as if the customer were the center of a clock. It is a strong visual statement that the service process is running on customer’s time.
- Customer presence: Whenever the presence of the customer (in this case, physical) is necessary to steps in the service process, the corresponding slice of time is grayed. For instance, in the service represented in Figure 4, the customer’s presence is essential in all the initial steps of the process, as well as in the last step. The diagram shows that there is a considerable span of time, from the time the machine enters the queue to the time the machine is returned, where no feedback is provided to the customer. Feedback-free long spans of time tend to increase the customer’s anxiety, often impacting customer satisfaction.
- Customer property: The temporary possession of customer’s property, physical or informational, by the service

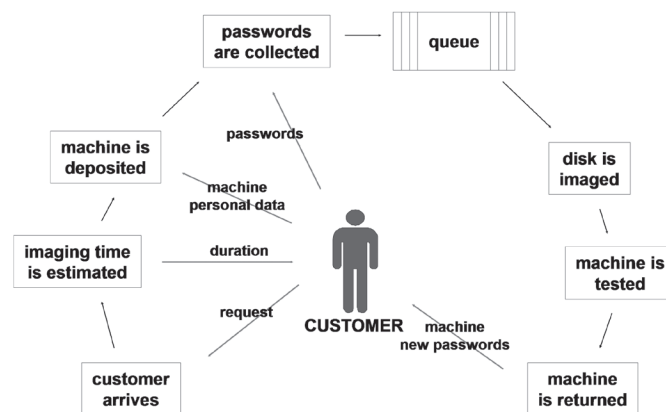


Figure 4  
Customer-centric representation of the “imaging a hard-disk” service process.

provider is represented by plotting the property components on the outside of the sequence of steps. For instance, after the step called “machine is deposited,” the service provider has the possession of both the machine and the customer’s personal data inside it. Possession of customer property has to be dealt carefully by any service provider, given not only the legal implications, but also the level of trust required from the customer, and the high expectations about how the property is going to be kept. Scratching the cover of a laptop in a traditional manufacturing process would be handled by simply rejecting the part, while in a service process, it is hard even to predict the customer’s reaction and how to mitigate the effects of the damage.

- **Customer information:** Information and physical property are perceived in very different ways by people, so our representation differentiates them by marking in bold type any physical property that goes through the system. This is not to be viewed as a statement that physical matter is more important than information. Instead, it should be seen as an acknowledgement that flows of the customer’s physical objects and information have different characteristic and challenges. Often, physical property is unique and cannot be replaced. On the other hand, information can be easily copied, altered, and moved around, bringing high stakes to issues such as privacy and security.

Note that the diagram of Figure 4 should not be seen as a definitive proposal of what and how to represent service processes, but as an example of the richness of options available when the customer-intensive framework is adopted and we move to a customer-centric representation.

### **Implications for Service Design: An Example**

Unlike engineering, design as a discipline has always had a strong focus on the human aspects of the designed object. Our customer-centric perspective is, therefore, relatively well-aligned, at least in surface, with traditional views and methods of design.

However, there are important differences that are likely to affect how service design is and will be practiced. The first is the fact that customers (and their belongings) being part of the production process is not the traditional context of industrial or media design. Incorporating the user as input, and respecting its impact on the process and its outcome, creates fundamentally new constraints in service design that we believe is going to require new methodologies and practices.

We have looked into these issues in the context of the design of online service systems.<sup>15</sup> We advocate the customer-intensive systems framework for the design of computer-human interfaces

of online services to support a better understanding of the different issues faced by online service designers, engineers, and delivery personnel.

Similar to what we've done in this paper, it is important to carefully distinguish online service applications not only from traditional personal software applications but also from online information applications such as the ones used by news and entertainment websites, by mirroring the above definition of customer-intensive systems to online applications.<sup>16</sup> Thus, we define an online service application, or simply an online service, as a computer application in which:

- 1 The user does not control most of the means of production.
- 2 The user (self, belongings, and information) is a significant part of the input to the production process.

Part one of this definition tries to establish a difference with traditional tool applications, which tend to assume that user communications with her data, other databases, the World Wide Web, or other users is not mediated by a service provider. Note that, for the generic class of computer applications, we use the term "user" instead of "customer," but for online applications we can simply use the term "customer."<sup>17</sup>

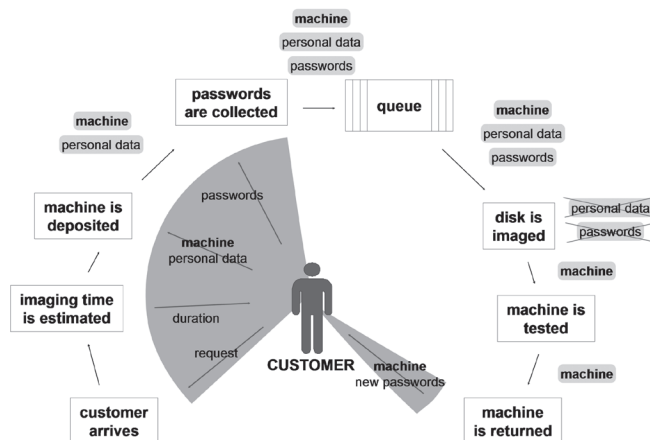
In part two of the definition, we ensure that only service-related concepts and methods are applied to online applications that actually behave as services. Following our previous discussion about services systems which are not customer-intensive, we do not consider interactive online information providers such as "CNN.com" to be true online services, since they have characteristics closer to manufacturing systems than to services.

Having made a clear characterization of online service applications as customer-intensive systems, we can then take up the task of creating a more appropriate framework, based on service concepts, for the design of its interface. Although service design often must go beyond the design of the interaction mechanisms and context, their design is a key component of the design of the service experience, both in human-delivered and computer-delivered services.

Our approach<sup>18</sup> is to consider the six basic characteristics of services, as traditionally defined in services theory. We compiled and fused service characteristics listed by different authors,<sup>19</sup> producing a "compromise" list of basic service characteristics which we believe most would agree with: customer-as-input, heterogeneity, simultaneity, perishability, coproduction, and intangibility. We then derive from these characteristics a list of fifteen different issues that we believe are very important for the design and evaluation of the human-computer interface of online services: trust, privacy, and security; personalization, service recovery, and quality consistency; performance consistency and fairness; demand management and



Figure 5  
Important issues for interfaces  
of online services.



marketing; customer empowerment and training; service expectation, process satisfaction, and anger/frustration management; respectively. The precise definition and relevance to online services of these fifteen issues is discussed in detail elsewhere,<sup>20</sup> and it is beyond the illustrative argument we are making here.

Moreover, we also have observed that the interactions between service providers and customers are often long-term relationships. In our customer-intensive systems framework, we can argue that the need for relationships stems from both the users' lack of control of the means of production, therefore forcing them to connect to another entity, the service provider, and establish a relationship; and from the fact that, in most cases, there are a multitude of competing service providers, so it is also interesting for the service provider to seek long-term relationships. In fact, in examining the collection of fifteen issues identified as most relevant to online service interfaces, it becomes apparent that most of them are core issues to establish and/or maintain a relationship.

Figure 5 summarizes the fifteen important issues for interfaces of online services, and highlights the key aspect of an online service interface: being inductive to establish and maintain relationships. Note that our view of interfaces as relationship maintainers sharply contrasts with traditional understanding of software tool interfaces, which have been regarded as agents for conversation,<sup>21</sup> action,<sup>22</sup> direct manipulation,<sup>23</sup> or representational action.<sup>24</sup> Furthering the understanding of the relationship aspect of services and online services, in particular, is currently a key part of our research efforts.

### Coda

The main goal of this paper is to propose a new framework based on the notion of customer-intensive systems to better address the design of services. Although we believe that this notion is an

important advance from previous characterizations of services, we are still not totally satisfied with it, especially the importance placed on the ownership and control of the means of production. Nevertheless, we have shown here that our definitional stance can advance the discussion about better representational methods for service processes, a fundamental issue for service design in our minds. We also have illustrated how an appropriate framework for services can guide the understanding of the fundamental issues faced in the design of services, as discussed in our example of the design of online service interfaces.

We end by observing that service design, due to its customer-intensive nature, but especially in the case of labor-intensive service delivery systems, is likely to require design to go beyond its traditional focus on artifacts and into the design of human-to-human interactions as its centerpiece. In that sense, a service designer is likely to need to resemble more a theater director than a traditional visual or industrial designer. Designing a service often includes the design of the personnel (casting), their training (rehearsal), what they say to the customer (scripting), how they talk to the customer (characterization), and how they move in the space (staging). Maybe this is the opportunity to bring the theatre “types” back to the design schools, who have been largely absent since the time of Oskar Schlemmer at the Bauhaus, but this time with the larger mission of setting up the foundations of service design.

1 In works such as B. Mager, *Service Design: A Review* (Köln, Germany: International School of Design, 2005); S. Holmlid and S. Evenson, “Bringing Service Design to Service Sciences, Management and Engineering” in *Service Science, Management and Engineering: Education for the 21st Century*, B. Hefley and W. Murphy, eds. (New York: Springer, 2008), 341–346; L. S. Cook et al., “Human Issues in Service Design,” *Journal of Operations Management* 20 (2002): 159–174; S. M. Goldstein et al., “The Service Concept: The Missing Link in Service Design Research?” *Journal of Operations Management* 20 (2002): 121–143; J. Meis, “Service Design and Service Management with the Service Blueprinting Methodology” in *Proc. of 17th International Conference on the Applications of Computer Science and Mathematics in Architecture and Civil Engineering, 2006*, Weimar, Germany.

2 See B. Hollins, *What Is Service Design?* 2006 ([www.designcouncil.org.uk/en/About-Design/Design-Disciplines/Service-design-by-Bill-Hollins/](http://www.designcouncil.org.uk/en/About-Design/Design-Disciplines/Service-design-by-Bill-Hollins/)). Accessed on July 24, 2008.

3 As commented by R. M. Saco and A. P. Goncalves, “Service Design: An Appraisal,” *Design Management Review* 19:1 (2008).

4 As described in a business case developed by James L. Heskett, “Shouldice Hospital Ltd.,” *Harvard Business Publishing* 18 (1983).

5 See J. Spohrer et al., “Steps toward a Science of Service Systems,” *IEEE Computer* (2007): 71–77; *Service Science, Management and Engineering: Education for the 21st Century*, B. Hefley and W. Murphy, eds. (New York: Springer, 2008), xxvi, 384; and J. Spohrer and D. Riecken, eds., *Communications of ACM: Special Issue on Services Science* 49:7 (2006).

6 For a short history, see S. E. Sampson and C. M. Froehle, “Foundations and Implications of a Proposed Unified Services Theory,” *Production and Operations Management* 15:2 (2006): 329–343.

7 See C. Pinhanez, “Service Systems as Customer-Intensive Systems and Its Implications for Service Science and Engineering,” *Proceedings of Hawaiian International Conference on System Sciences, HICSS-41* (Big Island, Hawaii, 2008).

8 See S. E. Sampson, *Understanding Service Businesses* (Hoboken: John Wiley & Sons, 2nd ed., 2001), 512; S. E. Sampson and C. M. Froehle, “Foundations and Implications of a Proposed Unified Services Theory,” *Production and Operations Management* 15:2 (2006): 329–343.

- 9 See J. Gadrey and F. Gallouj, *Productivity, Innovation, and Knowledge in Services: New Economic and Socio-Economic Approaches* (Cheltenham, UK and Northampton, MA: Edward Elgar, 2002), xxviii, 307.
- 10 R. See Karni and M. Kaner, "An Engineering Tool for the Conceptual Design of Service Systems" in *Advances in Services Innovations*, D. Spath and K.-P. Fähnrich, eds. (Berlin/Heidelberg, Germany: Springer, 2007), 65–83.
- 11 See S. E. Sampson, *Understanding Service Businesses*, 512 or, more concisely in S. E. Sampson and C. M. Froehle, "Foundations and Implications of a Proposed Unified Services Theory," *Production and Operations Management* 15:2 (2006): 329–343.
- 12 As proposed in C. Pinhanez, "Service Systems as Customer-Intensive Systems and Its Implications for Service Science and Engineering."
- 13 See S. E. Sampson, *Understanding Service Businesses*, 512.
- 14 Described in *North American Industry Classification System: United States, 2002* (Lanham, MD: Bernan, National Technical Information Service, 2002), 1419.
- 15 Discussed in detail in C. Pinhanez, "A Service Science Perspective on Human-Computer Interface Issues of Online Service Applications." (To appear in *International Journal of Information Systems in the Service Sector*, 2009); C. Pinhanez, "Service Systems as Customer-Intensive Systems and Its Implications for Service Science and Engineering."
- 16 Ibid.
- 17 Ibid.
- 18 Ibid.
- 19 Including V. A. Zeithaml, M. J. Bitner, and D. D. Gremler, *Services Marketing: Integrating Customer Focus across the Firm* (Boston: McGraw-Hill/Irwin, 4th edition, 2006), xxvii, 708; J. A. Fitzsimmons and M. J. Fitzsimmons, *Service Management: Operations, Strategy, and Information Technology* (Boston: McGraw-Hill/Irwin, 2004); S. E. Sampson, *Understanding Service Businesses*, 512; C. H. Lovelock and J. Wirtz, *Services Marketing: People, Technology, Strategy* (Upper Saddle River, NJ: Pearson/Prentice Hall, 5th edition, 2004), xviii, 652.
- 20 See C. Pinhanez, "A Service Science Perspective on Human-Computer Interface Issues of Online Service Applications." (To appear in *International Journal of Information Systems in the Service Sector*, 2009); and C. Pinhanez, "Service Systems as Customer-Intensive Systems and Its Implications for Service Science and Engineering."
- 21 See, for example, J. Walker, "Through the Looking Glass" in *The Art of Human-Computer Interface Design*, Brenda Laurel, ed. (Reading, MA: Addison-Wesley, 1990).
- 22 As in D. A. Norman, *The Psychology of Everyday Things* (New York: Basic Books, 1988).
- 23 Presented in B. Shneiderman, *Designing the User Interface: Strategies for Effective Human-Computer Interaction* (Reading, MA: Addison-Wesley, 1987).
- 24 In the celebrated Brenda Laurel, *Computers as Theatre* (Reading, MA: Addison-Wesley, 1991).