“Routine design operates within existing paradigm, whereas inventive design proposes a new paradigm that may eventually replace the old” (Crilly, 2010, p. 60).

The role of design in society is becoming increasingly interdisciplinary and immaterial. In order to appropriately bring methods of design into new territories, one needs to consider a wide breadth of factors influencing the scenario such as; social, economical, environmental and physical systems. A strategic systems approach can be more comprehensive and will also lay the groundwork to design a systems response, avoiding oversimplified design solutions. This mode of thinking--that embraces complexity and responds accordingly--should be taught to design students so they are best equipped for the future of the industry.

This paper demonstrates how theories of systems thinking have far-reaching applications into the design process, shaping the methodology designers apply to a design opportunity. It also illustrates how systems thinking can be employed to implement consideration of the biosphere as an integrated component of the design process, resulting in a more intuitively sustainable production and use of products and services.

1. THE LANGUAGE OF SYSTEMS

In order to present the concept of systems to students, a foundation of terminology is useful to ground their understanding and introduce ideas of complexity. I have found that Donella Meadows, although a scientist and not a designer, has clearly and articulately defined the parts of a system. Her terms are paired with ideas of Actor Network Theory and additional references from within design and across other disciplines.

According to Meadows, author of *Thinking in Systems*, “A system is an interconnected set of elements that is coherently organized in a way that achieves something” (Meadows, 2008 p. 11). When a designer investigates the whole system, they experience something greater than any combination of individual elements or connections. Meadows clearly identifies components to indicate where a system is present. All systems must have three key parts; elements, interconnections, and a purpose, which are supported by social paradigms. In design, a key reason of going through the effort to identify a system is for the purpose of changing, improving or altering it in some way. It is important to understand the most effective way to impact a system. Meadows calls these ‘places to intervene’ or leverage points.

*Elements* are individual things within a system, such as a product or person. Changing *elements* within a system has the least significant impact because the structure of the system is in place and continues working toward the same goal. *Interconnections* are the relationships between *elements*, such as the structure of an organization. Readjusting the *interconnections* such as adding a hierarchy has a valuable impact but is not a total system change. The *purpose* or function of a system is its goal. Bringing the system *purpose* to function for a new goal
has more impact than adjusting *elements* or *interconnections*. All systems have a *purpose*, whether intentional or a byproduct of other actions. Therefore, goals are deduced from actual behavior of the system. This explains how we get to undesired systems, by not recognizing the functioning system *purpose*.

Paradigms are shared ideas about the way things should function in society. They are “sets of beliefs about how the world works,” (Meadows, 2008, p. 162) and often assumed or unspoken aspects of society. Because of the emotional investment inherent in paradigms, people often assume they are facts or truths about how things must be. “Paradigms are the sources of systems. From them, shared social agreements about the nature of reality, come system goals and information flows, feedbacks, stocks, flows and everything else about systems” (Meadows, 2008, p. 163). Paradigms are reinforced by attitude and purchasing power of individuals within the system. Belief systems that make up paradigms can inadvertently direct the goal for a system that may feel unintended or out of control. Discussing paradigms with students helps them to realize that no design decision is strictly material. A human aspect is inherent due to designs ability to influence social dimensions such as behavior, cultural beliefs or values.

2. THREE APPROACHES TO THE DESIGN OF SYSTEMS

I have divided the application of systems for design into three types; *Systems of Material Lifecycle*, *Product Service Systems* and *Intangible Community Flows*. Material thinking about sustainability can be categorized by the first type, *Systems of Material Flows*, that include materials and supply chains. Ezio Manzini estimates that the industrial system needs to consume 90 percent less material in the transition towards sustainability (Manzini, p. 2). Most of this reduction needs to occur in the production, not the consumer phases of the product. Tools such as Life Cycle Assessments and can provide insight to the material systems of a designs production and use. This is important because, “only 1% of material flows in US economy [...] is still being used 6 months after sale” (Thackara, 2006, p. 16). Much attention has been focused on streamlining *Systems of Material Lifecycle*, but strictly focusing on material systems overlooks potential social, environmental and economic impacts of design.

With the second type, *Product Service Systems*, design can be a tool used to craft frameworks that provide a service rather than always creating a physical object in response to every design problem. In a *Product Service System*, often a product is involved but service design solutions meet the users needs through providing a specific or ongoing service that enhances the value of the tangible products. “The transition to a light and sustainable economy means moving from an economy of transactions--selling and buying things--to an economy in which the quality of services, not the acquisition of goods, becomes our measure of well being” (Thackara, 2006, p. 208). Common examples of *Product Service Systems* include the library, car sharing services and the Laundromat.

The third type, *Intangible Community Flows*, bring the service capability of a design solution one step further. These systems deal with social behavior and how we work out paradigms in community. Building on the previous system types, *Systems of Material Lifecycle and Product Service Systems*, this type of system emphasizes the intangible spaces between objects, people and technology and considers the flows of information and people in community. The role of design in shaping community systems is to build context for creating cultural significance, leading to the “emergence of shared meaning as we interact with each other in meaningful activities” (Manzini quoted in Thackara, 2006, p. 109). One aspect of community systems that is rapidly changing in recent years is
the cultural relationship to technology. As a society, we are still working out the system of ubiquitous computing and role of technology in how we both access information and relate to each other. “The crucial nature of information systems [...] is that they concern not simply the processing of data but the creation of meaning” (Currie, Galliers, & Checkland, 1999, p. 53). Although community systems can seem more theoretical, these types of solutions facilitate lasting behavior change through identifying and shaping paradigms. As designers, we have the opportunity to propose solutions that focus on behavioral systems. These systems build the future through the ‘power of socially shared ideas about the nature of our world” (Meadows, 1991, p. 1).

3. FAMILY MISE EN PLACE

This research on systems was integrated into my investigation of the North American food system in the project, *Family Mise en Place*. The resulting case study is a practical example of implementing systems thinking into the design process. Research on the large-scale system of social, political, environmental and economic aspects of the industrial food system was juxtaposed with macro-level system research how North American families interact with food on a daily basis. The phrase ‘mise en place’ is a French culinary term meaning “putting in place.” It is the practice of preparing components of a meal before the cooking begins. I have adapted the concept of mise en place to create a system that helps parents and children cook wholesome weeknight dinners together using True Food ingredients. True Food is defined in this work as a class of unprocessed whole foods or minimally processed whole foods whose nutrient properties have not been altered (Monterio, 2009). *Family Mise en Place* is a book of tri-fold meal cards that encourage collaborative interaction. It uses iconography children can understand and organizes cooking so children can contribute equally, supporting parents on busy weeknights.

The toolkit breaks the cooking experience into three stages: *Gather, Prepare* and *Cook*. The entire project revolves around what Ezio Manzini calls “planning activities whose objective is a system” (Manzini quoted in Thackera, 2006, P. 19). *Family Mise en Place* investigated systems of food and family to create a new scenario in the home, setting the stage for families to engage in the experience of cooking together. Barriers were addressed through examining multiple dimensions of the material system of food and the social system of family interactions.

3.1. INVESTIGATING THE SYSTEM

Systems thinking was first utilized in this project as a research method to better understand the context where the design would sit. Knowledge was acquired from a diverse range of sources such as a literature review, market research and participant research to understand the system from a variety of angles. Gathering data in this manner reflects the Multiple Methods approach described by Hillary Collins in her book, *Creative Research*. Collins describes how each method of data collection has limitations but “if you use a variety of data collection methods you can ‘see’ the responses from different perspectives” (Collins, 2010, p. 48). Methods for analysis included mapping and diagraming to build a comprehensive understanding of how elements were connected and contributed to goals within various system layers.
Involving parents and children as participants to the design process was key to building a system that addressed their true habits rather than perceived needs. “Observational research methods can uncover unconscious behaviors, habits, routines, attitudes and beliefs [...] illuminating the gap between what people actually do what they say they do” (Young, 2010, p. 19). Engaging participants revealed that users held the key to the solution for how design could impact how families experience of weeknight cooking.

Within this process of gathering and interpreting data, it was easy to get overwhelmed by all of the details and possible implications for design. It was important to be intentional in choosing the level of information to observe. Meadows describes how we must “choose how much complexity to look at” (Meadows, 2008, p. 28). Moving forward in the design process, filtering the system was a part of refining the parameters of the proposed design. The scope needed to be manageable in order to accomplish the project within the available time and resources. It also needed to respond appropriately to the needs of families desiring to make dinner using True Foods on weeknights.

### 3.2. DESIGNING A SYSTEMS SOLUTION

The design strategy for *Family Mise en Place* was developed with a *Product Service System* in mind. An early design iteration included the structure for a comprehensive *Product Service System* called Sprout. Due to the rigor of investigation into existing systems, I recognized that this concept was too complex to execute thoroughly. Sprout contained four modes of engagement for families to interact with True Foods through a variety of activities.
Based on participant interviews and a survey, the scope was narrowed down to focus on a singular activity—parents and children cooking dinner together on weeknights. I was able to retain values from the original concept such as the activities generating learning that was heuristic, cross-generational, multi-culturally inclusive and based on constructivist principles. The resulting project included aspects of all Three Approaches to the Design of Systems. When presenting Family Mise en Place to students within the context of systems, it is valuable to demonstrate how the three approaches are a framework that can be expanded upon and reshaped based on the opportunities within the existing system.

The aspects of Family Mise en Place that emphasizes True Foods most directly correlates to Systems of Material Lifecycle. Although the toolkit does not specifically address the global food system, research into industrial agriculture and cultural food trends is implicit in the design of the Meal Cards. Recipes use unprocessed food ingredients and parents are given further information in instructional Skill Cards. This enables the family to further discuss issues concerning where food originates. True Foods are also a system disrupter in the global industrial food production system. Industrial food is usually processed, it negatively impacts the environment and can be damaging to health. By cooking together with True Foods, families become part of a shift from industrial foods to food that is healthy for them and the biosphere.

The state of North American food culture is a global issue that will require a collaboration of multifaceted efforts to improve. While the complete solution for shifting food culture necessitates proper time and attention to each part of the broken system, changing family habits is one good place to intervene in the system. Alice Waters states in the documentary “Ingredients” that “eating food with your family and friends that is locally grown, sustainably farmed—this is what people have been doing since the beginning of time. This isn’t a fad. It’s a civilizing ritual that gives meaning to life” (Bates, 2009). Through focusing on families in the home, Family Mise en Place facilitates building an enjoyable habit for parents and children to explore health and experience community with one another.

The book of Meal Cards functions as a Product Service System because the objective is for the family to build new behavior patterns, not to become dependent on the product. Recipes included in the book provide a service through their structure; teaching families to gather, prepare and cook each part of the meal. The six meals included in the book help to develop skills so that eventually, the family is able to collaborate in cooking without the Family Mise en Place product. Each meal includes variations, options and suggestions so that it can be made differently each time. As families become familiar with the six base meals, they are given opportunity to expand and develop their skill set and build cooking intuition.

To accomplish this, the system of communication divides cooking into manageable chunks, helping family members at all skill levels get involved and work together (see Figure 5). This model demonstrates how “complexity can be made clear through effective organization and presentation. […] Clarity includes the focus on one particular message or goal at a time, rather than an attempt to accomplish too much at once” (Shedroff, 1994 p. 9). By focusing on one phase at a time, cooking becomes clear and accomplishable by anyone. In the final user
test, I observed that the more effective the cards are at communicating, the more they become a central focus to the meal process. The cards moved about the kitchen, were passed around and shared as the parents and each of the children took turns reading aloud instructions for the others to follow as each family member experienced the patterns of cooking as a family.

The designed system culminates in an intentional experience that influences a families weeknight rituals. This is an example of the design of an *Intangible Community Flow*. Not only is the information organized, but it also provides an opportunity for choice. Both Liz Sanders and John Thackara describe scaffolding experiences that provide frameworks for individuals to act within. Thackara describes how this is a “shift from designing completed solutions to designing contexts for people to respond within” (Thackara, 2006). And Sanders elaborates that, “if you think of products, interfaces and spaces as being scaffolds on which ordinary people can create their own experiences, the design challenge changes” (Sanders, 2001, p. 5). Structuring the instructions of cooking into a framework provides space for choice and creativity. Behavioral economists David R. Just and Brian Wansink cite choice as the highest motivating factor for a child’s change in behaviors in regards to food. “Self-attribution [is] when people feel as if they have freely and consciously made a decision, they take ownership of that decision and tend to have a greater enjoyment of the outcome” (Just & Wansink, 2009, p. 2). Subtle cues in how two options are presented can guide choices and build healthy habits.

While cooking, the actions and experiences of parents and children are primarily guided--rather than dictated--by the *Family Mise en Place* system. The flexibility of the design framework encourages parents and children to feel ownership of the system. This focus may lead to greater adoption and interest in the cooking activities. Ideally, parents and children would work together to make the meals every week. The role of children becomes a meaningful participation and will relieve the burden on the parents as the sole meal preparer. Within the home, the *Family Mise en Place* system creates a space for families to cook nutritional meals, develop new skills, learn about each other, and build a family routine that shifts their behavior towards a more positive and sustainable impact on the environment.

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**Figure 5:** Levels of Communication on Meal Card

**Figure 6:** User Flow System Map
4. CONCLUSION

Students need to be prepared to work in the complexity that arises when design expands to include material, service and social systems. Theories of systems provide foundational tools for developing critical thinking skills. These methods also build the habit for students to observe the diversity of connections impacted at all stages of the design process. Employing systems can result in design solutions that are robust, responding to the actual needs of the design opportunity. As a case study, Family Mise en Place provides an example of integrating systems thinking as a research method as well as integrating consideration of material, service and social systems within various aspects of the subsequent design. Participants were included in the process of defining the system and refining the design solution so that their actual needs for building a habit of cooking as a family were addressed. The success of the final design is attributed to the multi-faceted systems approach. As the role of design in society is broadened and redefined, a systems understanding will equip designers for new territories.

REFERENCES


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