

GO WITH THE FLO: A CASE STUDY OF TRANSDISCIPLINARY PRODUCT DEVELOPMENT

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ABSTRACT

The baby boomer population is approaching late life and will have different needs and expectations for their aging experience than previous generations. A team of two faculty and two graduate students at a major American university set out to develop a transdisciplinary methodology to support the design of a transgenerational toilet that would be usable by toddlers and their grandparents alike. Documented herein is their approach to this problem, and the resulting design which shifts paradigms of toilet use. In addition, this experiment represents a collaborative experience that transcends boundaries between design research and design practice.

Keywords: product design, design education, design research, design methodology

1 INTRODUCTION

One of the great challenges facing design education today is how to bridge the gap between research and practice. This paper describes a collaborative project undertaken by two faculty members and two graduate students. The primary goal of the project was to use diverse design backgrounds as a catalyst for research that would generate insights that could be utilized during the design process. In addition, this project illustrates how collaborative work between faculty and graduate students can produce both publishable research as well as a new product design concept.

The baby boomer population is approaching late life and will certainly have different needs and expectations for their aging experience than previous generations. Representing nearly 30% of the population in the United States, this generation displays marked differences in terms of education, marital status, spending habits, and technological aptitude. Noting that proponents of universal design often cite the need to accommodate elderly populations, and further noting that universal design should strive for a more cradle to grave approach in terms of the user; a team of faculty and graduate students at Arizona State University in Tempe, AZ, USA set out to design a transgenerational toilet that would be usable by toddlers and their grandparents alike. This is the story of a transdisciplinary team of four, their approach to this problem, and how the resulting design shifts paradigms of toilet use and universal design.

2 THE TRANSDISCIPLINARY TEAM

Recognizing the challenge of designing a toileting experience for users of all ages would require specialists from diverse backgrounds, four team members were recruited to participate in the product development process. Dosun Shin, Assistant Professor of

Industrial Design, specializes in the humanization of technology with a focus on assistive devices. John Takamura, Jr., Faculty Associate of Industrial Design, spent many years in professional practice and specializes in brand architecture, design management, and design methodology & theory. Dean Bacalzo, Industrial Design Graduate Student, brought a background in mechanical engineering to the group and specializes in the integration of human factors and ergonomic studies into the design process. Tamara Christensen, Industrial Design Graduate Student, specializes in design theory, and socio-cultural and historical design research that can provide actionable insights for the design process.

While each member brought a different specialization to the team, Industrial Design was a unifying interest for all. This point of overlap in education and professional practice became a common “language” that could be easily spoken by all team members, thus allowing them to bridge disciplinary boundaries that often inhibit group productivity. In addition, each member was familiar with the process of design thinking and creating that required the ability to suspend judgment, brainstorm effectively, and delay closure and premature problem resolution. The brainstorming session actually became a foundation for the transdisciplinary process that resulted in the creation of new knowledge and a new patent-pending process.

3 THE TRANSDISCIPLINARY METHODOLOGY

The methodological approach created for this project was based upon the need to generate new knowledge about toileting practices, behaviors, and designs based upon the diverse areas of specialization represented in the group. The team did not wish simply to design a more beautiful or easy-to-use toilet; rather they set out to completely reinvent the paradigm of the toileting experience to be more sustainable and more accommodating for users of all ages. This involved great flexibility on the part of the design team and much research into the evolution of the toilet as it is known and recognized today.

The research foundation of this design project focused on three primary areas: the socio-cultural climate surrounding the toilet and its use in Western cultures, the physiological needs of human users during the elimination processes (i.e. human factors analysis), and the environmental impact of current toilet design regarding water usage (including alternative toilet designs) and efficiency. A transgenerational methodology shaped the survey of toileting use beginning with new users (i.e. toilet training toddlers) and concluding with an examination of the aging baby boomer cohort and their particular needs and expectations. This research relied upon literature reviews, case studies, and empirical data.

Research Focus: Sociocultural

Social systems theory—borrowed from the social sciences and adapted for this study— informed the analysis of the socio-cultural existence of the toilet. Recognizing that the meaning of any object can be attributed as much to its physical form as to the relationships and experiences that exist around the object, both areas were explored. [1], [2], [3], [4].

The physical form of the current norm for Western toilet design has its roots in the early 1950s when new technological and scientific developments gave rise to a cult of

cleanliness. Extreme attention to hygiene resulted in toilet designs that were institutional in appearance and would expose any offensive matter. This standard has been maintained for over half of a century, with minor modifications in appearance allowing for innovations in form and color. Notably, recent legislation and innovation have also resulted in toilet designs that reduce water consumption. [5]

A comparative survey of toilet designs from Eastern cultures revealed sensitivity to the issue of water consumption, illustrated in the Japanese toilet style that includes a faucet: water that is first used to wash the hands is then used to flush away waste. This survey also revealed a paradigm for toilet use not readily found in Western culture—that of the squat toilet. Present in both Eastern and West European cultures, the squat toilet can be a frightening experience for the unsuspecting Westerner. However, once socialized to the activity, people are more comfortable with the process. The physiological benefits of this device will be explored in the following section.

An analysis of the socio-cultural atmosphere of toilet use revealed that the process of socializing a child to the toilet is quite challenging for parents who often resort to punishment and reward systems. Additional devices must be used for this activity because current toilet designs do not facilitate small users. Based upon a review of literature and analysis of empirical data collected from a survey of parents and child care providers, conclusions were drawn regarding the primary social norms addressed during the potty training process. Figure 1 is a diagrammatic representation of this analysis of socializing a new user to the toilet and the social norms and practices that are transferred during this process.

American baby boomers (those born between 1946 and 1964) represent nearly 30% of the U.S. population and have grown to expect great things from the products they purchase [6]. It has been asserted that current product offerings targeting the elderly will not be satisfactory for the baby boomer cohort; a group of people who are accustomed to aesthetically pleasing, technologically advanced, and environmentally friendly products.

Research Focus: Physiology

Western culture is witnessing a surge in appreciation for the Eastern philosophy of living. This is illustrated in the popularity of feng shui, japanimation, Japanese gardening and interactive personal electronics. Perhaps the most obvious recent adopted trends are yoga and meditation— including television programming, books, and the flood of associated products on the market. *Yoga Living*, in fact, has recently published articles encouraging the adoption of the squat posture for elimination [7]. Numerous health problems—including incontinence, hemorrhoids, appendicitis, colon cancer, and prostate cancer—have been linked to the use of the standard sitting toilet [8]. These are typically caused by one of two factors: the inability to completely empty the bowels or nerve damage due to chronic straining. The squat posture, already used by nearly 2/3 of the population, provides proper alignment of the intestines and colon.

The quintessential text, *The Bathroom*, by Alexander Kira [9] was also consulted and reports the same preferred posture for elimination. Kira even offers specific ergonomic standards for toilet height, hole shape and width, and weight distribution. Although this book was published nearly 30 years ago, it seems that the message has yet to reach the

American public. Empirical data collection of the human body in various positions—including the seated position and the squat—support the ergonomic standards set by Kira and provide the foundation for the dimensions of the Flo toilet.

Research Focus: Water Usage & Efficiency

The American Water Works Association reports that the average single family household uses 19.3 gallons of water daily through toilet use alone! [10] That is equivalent to 26% of the overall water consumption in the home. Ultra-low flush 1.6 gallon toilets can save up to 9.3 gallons per day and are now being mandated by the Department of Energy. Unfortunately, in a recent study conducted by two University of Arizona water researchers, 43% of the low-flush toilets they measured had problems—due to aging and decrease in functionality [11]. These statistics demonstrate a need and opportunity for innovation.

In addition, recent developments in countries around the world demonstrate that the toilet is an object that is undergoing redesign to improve efficiency. Waterless toilets and composting toilets represent alternatives to the standard valve system used in most American toilets. Further data collection in this area included a review of engineering specifications and patents related to the toilet and the flush mechanism. This area of research provided an understanding of the evolution of toilet designs and inspired the exploration of alternate methods of waste capture and removal.

Research Application

The team set out to use the three previously described research foci as the basis for brainstorming sessions that were held once a week for a period of six weeks. All team members were present at the sessions which provided a chance to analyze and discuss research findings from diverse disciplinary perspectives. Although the primary goals for each session evolved over the course of the project, the following issues were repeatedly addressed: form, mechanical function, technological innovation, materials, social responsibility, ergonomics, sustainability, brand identity, and cultural expectations.

The brainstorming session not only generated new ideas, but also new knowledge for the members. The most inventive breakthroughs (including the electro-magnetic ball valve) were not the product of a lone engineer, but of a group of individuals working towards an understanding of new possibilities. Following each session the members agreed upon individual tasks (or research) to be completed for the next meeting.

RESULTS OF THE CASE STUDY: FLO FEATURES AND BENEFITS

The result of this six week experiment in transdisciplinary product development is Flo, a toilet design that shifts the paradigm of toilet use and includes users of all ages. Flo offers numerous features and benefits:

Physiology

Flo is ergonomically designed to provide a healthier posture when using the toilet. It functions similarly to a squat toilet, facilitating a physiological response with its use. The low Flo seat allows users to take a squat-like position when sitting which is better for elimination.

Sustainability

Flo is designed to use a minimal amount of water in the disposing of waste. Based on a reservoir system, the Flo reuses water from hand washing. The tanks are also unique

because there are two; tank one for flushing after urination which uses only 0.5 gallons of water and tank two for flushing after defecation which uses 1.0 gallons of water.

Invention

The core technology of the Flo is based on the electromagnetic ball valve (patent pending) which uses electromagnets to release (flush) water from the tanks to the toilet. The electromagnetic ball valves are also used in the control of water flow to each tank from the reservoir tank. The electro-magnetic ball valves are powered by a mica capacitor that is charged by microhydro turbines that build electric charge whenever water passes through them. The use of electromagnetic ball valves makes the Flo toilet fully self-sustaining and fully independent from the electric power grid.

Health

Flo incorporates a bidet function which is used to maintain hygiene. This feature also reduces the need and usage of toilet paper making it as economically friendly as it is environmentally friendly.

Amenities

Flo incorporates a sink for hand washing that is controlled by infrared sensors. Infrared sensors also control the flushing switches so that the user need not make contact with any part of the Flo other than with the ergonomically designed Flo squat seat.

Materials

Departing from the cold, hard, white porcelain of the current western toilet the Flo is made from a natural polymer known as Tenite[®] cellulocics produced by the Eastman Chemical Company. The key feature of this material is that specific agents can be encapsulated in the plastics to reduce mold, mildew and calcium build up as well as to provide long lasting antimicrobial protection. This material is available in many colors.

CONCLUSION

“In order to create a meaningful material culture, functional products must be created in such a way that they are congruent with or informed by higher understanding”[12]. Based upon extensive research, the Flo toilet is offered as a solution to the many challenges facing toilet innovation. The aesthetic treatment of form and materials is a step towards challenging cultural standards, yet it relies upon design paradigms that have already proven pleasing in countless products. The Flo toilet represents an object that can be used in the first years of life and into the twilight years, all the while contributing to the physiological health of the user. The Flo toilet represents a need for conscious discretion in water usage and an appreciation for the transparency of this act.

The collaboration between specialists in diverse fields facilitated the creation of a transgenerational toilet which offers a new paradigm in toilet use. Truly universal design can be created by transdisciplinary teams willing to cross boundaries in pursuit of innovation.

REFERENCES

- [1] Ackoff, R.L. and F.E. Emery. "Structure, Function and Purpose" in ed. F.E. Emery. *Systems Thinking*. Middlesex: Penguin Books Limited, 1981, pp. 373-98.
- [2] Bertrand, Alvin. *Social Organization: A General Systems and Role Theory Perspective*. Philadelphia, PA: F.A. Davis, 1972.
- [3] Lidz, Theodore. *The family and human adaptation*. New York: International Universities Press, 1963, quoted in Ralph Anderson and Irl Carter. *Human behavior in the social environment: A social systems approach*. 1990. New York: Aldine De Gruyter, p.158.
- [4] Parsons, Talcott. *The System of Modern Societies*. Englewood Cliffs, NJ: Prentice-Hall, 1971.
- [5] Horan, Julie. *A Social History of the Toilet*. Citadel Press, 1997.
- [6] Mature Market Institute. 2003. *A Demographic Profile of American Baby Boomers*. Prepared for MetLife. Accessed August 1, 2005 from <http://www.metlife.com/WPSAssets/19506845461045242298V1FBBoomer%20Profile%202003.pdf>
- [7] Isbit, Johnathan. Health benefits of the natural squatting posture. *Yoga Living* July/August 2001. Accessed March 8, 2005 from <http://www.yogaeverywhere.com/eNews/june2001.htm>
- [8] Balukian, Lucille. In praise of squatting. *Alternative Therapies* Vol. 8, 2002, pp. 1-24.
- [9] Kira, Alexander. *The Bathroom*. New York : Viking Press.1976.
- [10] American Water Works Association. *Water Conservation around the Home*. Accessed August 1, 2005 from <http://www.awwa.org/>
- [11] Harrison, Jeff. (2000) UA Study Shows Leaks in Conservation Theory Behind Low-Flow Toilets. *University of Arizona News*. Accessed August 3, 2005 from <http://uanews.opi.arizona.edu/cgi-bin/WebObjects/UANews.woa/wa/MainStoryDetails?ArticleID=2525>
- [12] Walker, Stuart.. Beyond Aesthetics: Identity, Religion, and Design. *The Design Journal* Vol. 4, Issue 2, 2001, pp. 30-41.