Proposal for establishing: The Center for Wearable Product Design

Proposal Prepared by: Karen LaBat, Professor, College of Design

Proposal Collaborators: Elizabeth Bye, Associate Professor; Lucy Dunne, Assistant Professor; Marilyn DeLong

Type of Center:

The Center for Wearable Product Design is proposed as a Collegiate Center within the College of Design:

*A Collegiate Center is an entity established to support and advance research, education, or public engagement that includes mostly members from the same college. From: UMN Administrative Policy, Creating & Evaluating Interdisciplinary Centers (http://www.fpd/finop.umn.edu/groups/ppd/documents/policy/interdisciplinary.cfm)*

The center will be established to advance research and education that is being conducted by several College of Design faculty in separate established laboratories and studios. The Center will unite and further promote thriving, successful programs of research and study and will further facilitate interdisciplinary work that is being conducted by the investigators who are proposing the center. The investigators also believe that the center will lead to further engagement with and funding from government and industry.

The Center for Wearable Product Design is composed of these units and directors:

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<thead>
<tr>
<th>The Center for Wearable Product Design</th>
<th>Director: K. LaBat</th>
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<td>Human Dimensioning© Lab</td>
<td>Wearable Technology Lab</td>
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<td>(Director: K. LaBat)</td>
<td>(Director: L. Dunne)</td>
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<tr>
<td>Location: McNeal 355</td>
<td>Location: McNeal 340</td>
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<td>(Director: M DeLong)</td>
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<td>Location: McNeal 336</td>
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<td>Location: McNeal 355 &amp; 336</td>
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The mission of the Center for Wearable Product Design (CWPD) is to collaborate on the exploration of the theory and practice of designing products that humans wear, what Susan Watkins calls, “The Portable Environment.” Wearable products range from traditional apparel, to protective clothing, to wearable computing and medical monitoring devices. The CWPD brings together expertise and facilities to address all facets of wearable product design.

Karen LaBat will serve as the director for the CWPD. She will have administrative responsibilities and coordinate projects for the Center.
The Human Dimensioning© Lab (HDL), established in 2004 with a National Science Foundation grant visualizes, assesses, and measures the human body to better understand methods of providing physical and psychological “fit” of wearable products. Examples of recent cross-campus interdisciplinary projects in the HDL include space suit design with physiology and psychology through the Laboratory for Human Performance in Extreme Environments, body satisfaction intervention with psychiatry and psychology funded with an Institute for Advanced Studies grant, and amputee limb volume assessment with physical medicine and rehabilitation working with a prosthetic student from Century College who is now a graduate student in the UMN Medical Devices Center. Since its inception the HDL has employed 6 research assistants and one research associate (a physical medicine and rehabilitation physician). The HDL serves as an educational center for undergraduate and graduate students in apparel design who are interested in the latest technologies in body imaging and apparel modeling. Karen LaBat is the director for the HDL working with a team of researchers from the College of Design and other University colleges and programs to coordinate research and teaching programs.

The Wearable Technology Lab brings a new element to the College of Design incorporating the research of assistant professor, Lucy Dunne, with collaborative connections to Mechanical Engineering, Computer Science, and Electrical Engineering. The research interests of this lab focus on translating the theoretical potential of smart clothing and wearable technology into products that function within the constraints of the everyday world: for specialized applications like pervasive medical monitoring as well as mass-market applications like device interface, sports and fitness. Recent research in the Wearable Technology Lab investigates the intersection of technology and clothing/worn products in traditional garments through the development of a “smart wardrobe” garment tracking and recommender system, in virtual worlds through exploration of emerging virtual clothing and fashion design in Second Life, and for future smart clothing development in investigation of garment-integrated wearable body sensing.

The Experiential Laboratory addresses research relating the materiality of wearable product design to an individual’s perception of the product and how he or she values the product in terms of preferences, knowledge, and experience. This research involves consideration of the context of the wearable product, that is, its relation to the historical moment, to the culture and trends that surround and influence the wearable product and its use. Recent research investigates the intersections of wearable products to models of consumer value, of perceptions of sustainability in the apparel we wear, and how the apparel industry is perceived in terms of present and future responsibility, how design communicates its sustainability, and finally, how the consumer values products that are recycled, reused, and repurposed. The Experiential Lab also incorporates and expands the ground-breaking research on aesthetics related to apparel by Marilyn DeLong and
detailed in her well-known book, *The Way We Look* and in her continued published works. Marilyn DeLong would serve as the director for the Experiential Lab.

The Wearable Innovation Studio provides equipment and space for collaborative development of wearable prototypes using current and developing technologies. The basic equipment for prototype production was acquired with the HDL *National Science Foundation* grant and is housed in the HDL and in an adjacent materials test space. The goal of the studio is to use practice-led research to address issues at the intersection of formation and performance of prototypes. A current project, supported by an *Imagine Fund* grant, is to explore and evaluate ultrasonic welding technology for applications that extend beyond its traditional use in low cost medical and industrial applications. A past project, currently under patent application, uses an adaptation of Shibori, a traditional method of pleating fabric to create surface texture. This concept was transferred to improve the fit of a personal protective suit for pesticide application. Materials testing and formation research complement the activities in the other labs in the CWPD. The director for this studio is Elizabeth Bye whose creative production focuses on combining traditional and advanced materials and processes.

**Supporting the Mission of the College of Design**


Researchers in the HDL received the *Lectra Innovation Award for Faculty Research* in 2007. By establishing this center we will provide a venue for continued success and collaboration and will continue our efforts to establish linkages with colleagues locally, nationally, and internationally. The CWPD will also provide a network and structure for developing and evolving the College of Design Interdisciplinary Product Design Program and researchers willing to collaborate with the in-coming product design assistant/associate professor. Although this person will not be focused on wearable product design, a network of established researchers in the center can help guide a new researcher in the college, and perhaps provide a space for collaboration and brain-storming on research and teaching.

The Goldstein Museum of Design offers the opportunity for research with its extensive archive of historic dress. The breadth and scope of this Museum offers a unique opportunity as a
university collection and archive. The historic perspective is essential in understanding
developments and transitions in apparel design, technology, and production.

Center Connection to Land Grant Mission of Teaching, Research and Outreach

Teaching

Researchers in the Center contribute to the teaching mission of the University. In the past 4 years
the HDL has provided the newest technologies and mentoring to doctoral students who are now
on faculty in U.S. and international colleges. A goal will be to attract graduate students of
excellence from a range of disciplines. Bye, Dunne, and LaBat are adjunct faculty in the
proposed Human Factors doctoral program and Dunne in Electrical and Computer Engineering
offering opportunities to link research in the CWPD with related graduate programs. The HDL
has experimented with teaching methods that have potential of changing apparel design and
technology education. Technologies in the HDL have been used to teach undergraduate apparel
design students about designing for real body shapes and sizes and for considering designing for
the body using 3-dimensional modeling. The umbrella structure for the separate labs and studios
will provide opportunities to develop multi-disciplinary teams addressing a range of problems.
The Center will provide incentives to develop new teaching and learning strategies that will
expand the definition of apparel design.

Research

Researchers at the University of Minnesota are recognized as leaders in apparel fit and sizing
with research initiated almost 30 years ago. Researchers have developed theory and methods to
improve technologies. Collaboration with University of Minnesota partners from other units
(mechanical engineering, electrical engineering, computer science, psychology, physiology,
psychiatry, medicine and more) is a typical working mode to develop projects that have real
world applications. Researchers have a working relationship and common research interests with
researchers in the Center for Design and Health. Researchers also work with industry (Optitex,
Target, Nike, and more) to remain relevant in producing research results. The HDL also works
with the Cornell University apparel human factors lab, sharing data, results, and expertise to
advance knowledge. The NC 170 multi-state research project that is carried on with researchers
throughout the USA is an excellent collaboration that will result in improved protective gear for
first responders.

Outreach

Researchers currently participate in many outreach endeavors. Sherri Gahring has been an active
partner in providing outreach opportunities within the state of Minnesota. A successful, multi-
phase, multi-year project, SunSmart, is an example of an award winning research to outreach
program that has educated well over 20,000 students throughout the state of Minnesota on the
importance of and method of ensuring sun safety. CWPD researchers have also developed
pesticide safety programming for Minnesota pesticide applicators as part of the FDA-sponsored Multi-State Research Project, NC-170. This project demonstrates the potential of linking all CWPD units with elements of new designs for pesticide protection incorporating fit and motion, technology, innovative textiles and apparel structures, and perceptions of the user. Other outreach efforts currently under development include a collaboration with the Bakken Museum of Electricity to teach sew-able electronic textiles to girl scouts and high school students.

International outreach opportunities occur with the various cultural exchanges with South Korea and now one being planned with China’s, Donghua University. These programs are mutually beneficial to our Asian counterparts as well as our own undergraduate and graduate students. Other outreach opportunities for the Center are such projects as Fashion Practice, Journal of Design, Creative Process and the Fashion Industry. This is a journal, international in scope that offers a link to international outreach and strives to bring together the cutting edge research from around the world

Timeline:

Year 1:

- Create and establish identity
- Explore collaborative project and funding opportunities
- Develop strategies to attract graduate students
- Apply for grants to fund projects

Year 2:

- Recruit graduate students
- Continue to write grant proposals
- Initiate collaborative research/outreach projects

Year 3:

- Continue to develop research projects/write grant proposals
- Disseminate research results through appropriate conferences/journals
- Recruit graduate students
  Evaluate research programs, goals, reposition if necessary
Resource Requirements:

Current facilities, faculty, staff, and graduate students meet the minimal needs of the center. Additional funding will help to provide additional assistantships and staff time. The Center Director and Lab/Studio directors will apply for release time from teaching through such venues as research grants that provide funding for course release.

Lab/studio locations are established including:

McNeal 355, the Human Dimensioning©Lab: Was adapted with NSF funds to house a full body scanner, dressing rooms for use by subjects, prototype production equipment, computers used to manipulate scan data, and meeting space.

McNeal 340, the Wearable Technology Lab: Remodeled with CDes funds to accommodate two motion capture systems, a Cyberquins Running Mannequin, electronic circuit design and prototyping equipment, and a biological data acquisition system. The Wearable Technology Lab also houses an extensive range of textile testing equipment including an Instron tensile tester (acquired with the HDL NSF grant), a Taber Abraser, and a fume hood.

McNeal 336, the Experiential Lab: Space to organize projects and receive participants and collaborators working on preferences, knowledge, and experience related to wearable products.

McNeal 355 & 336, The Wearable Innovation Studio: The spaces for this studio are dual use, and include adaptable space in the HDL with prototype production equipment and space for ideation and collaboration; and space in 336 for materials testing.

Sources of Funding:

New technologies are expensive. The Human Dimensioning© Lab and the Wearable Technology Lab have been funded with some department funds and with grant monies, both internal and external. Researchers realize that external grant funding will be essential in maintaining the labs and studios. The formal establishment and naming of this center will provide enhanced opportunities for grant acquisition from outside funding agencies such as NSF, NIH, foundations, and industry.

Annual maintenance agreements for hardware and annual license fees for software have been paid with some base DHA funding and with portions of grant awards. Each grant award includes
an amount of funding for these recurring costs. Researchers in the CWPD will collaborate on
strategies to plan ahead in funding these recurring costs.

Evaluation Benchmarks:

1. Center personnel will evaluate its goal achievements by:
   - Continuing to obtain funding from current funding sources
   - Obtaining funding from additional sources
   - Continuing to present findings at national and international conferences
   - Having papers accepted for publication in refereed journals as well as providing
     opportunities for other research to be published in journals edited by Center
     researchers.
   - Expanding influence in new methods in apparel design/production/and use

2. The Center will be evaluated according to its strategic plan and internally with feedback
   from the College via the Associate Dean for Research and Outreach.

3. We do not see that the Center will become obsolete anytime in the near future. The
   current independent research areas are leading research efforts in fit and sizing, wearable
   technology and new and innovative approaches to apparel design education and practice.

Exit Strategy:

The CWPD will be evaluated annually with an assessment of viability occurring at year 4 after
the center is officially established. The center will be reviewed by the College of Design deans
and the DHA department head. If the center is not meeting objectives of enhanced visibility,
collaboration across the labs/studios within the center, and established ties with colleagues across
campus, the center will be dissolved over the following 2 years.

References: