Tutorial on Designing for Wearability

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ABSTRACT

At the Second International Symposium on Wearable Computing we presented a paper titled Design for Wearability [1]. In this paper we discussed a set of guidelines for designing wearable products to fit the three dimensional shapes of the dynamic human body. This paper also presented a set of wearable forms to be used as a reference tool for the creation of wearable products. In this tutorial we will share our process for both creating a wearable computer housing to fit the human body and designing the component placement on a printed circuit board to meet the complex and organic shape of the computer housing. This tutorial will focus on an iterative and interdisciplinary design process. We will present a case study application of the Design for Wearability work. We will do an exercise creating wearable shapes for computers and negotiating those shapes with the internal components of a computer.

SUMMARY

This tutorial on Designing for Wearability will address the two key components of applying the Design for Wearability work to a Wearable Computer; designing external shapes of the computer and internal placement of components. Shaping the inside and the outside of any product is an interrelated process. We will use a design case study to cover a number of steps in an iterative design process. We will then select key components of that process for hands on work. After the hands on work is completed the group will get together for discussion and a critique.

We will focus on the critical point in the product development process. This is where all the designing and shaping occurs. Where interaction between the design team and the electronics team will determine the final design of a computer. Issues of design tradeoffs will also be covered.

The objective of this workshop will be to familiarize the group with two things. The role of Industrial Design in an interdisciplinary design process and how to Design for Wearability. The intended audience for this tutorial is anyone who is managing or participating in an interdisciplinary development team designing wearable hardware. This tutorial will also be valuable for anyone who is interested the role of industrial design in the development of a wearable computer. Some knowledge of the field of wearable computing will be helpful. For the exercise, participants should be comfortable working with their hands and talking in a group.

INSTRUCTORS

Francine Gemperle has been a Design Researcher with Carnegie Mellon's Wearable Computing Group for 5 years. She holds a BFA in Industrial Design from Carnegie Mellon and is currently pursuing a Masters Degree in Interaction Design at CMU. Francine has taught and lectured at Carnegie Mellon, and Pittsburgh's Ellis School for Girls. She has also been an invited lecturer at various organizations around the U.S. including the Disney Institute, Industrial Designer Society of America and The Center for Children and Technology. Francine's published work includes *Design for Wearability* and *Digital ink* in CHI 98. She has received national and international awards and press for her design work.

Peter Seller is a Product Designer at Daedalus Excel an industrial design and engineering consulting firm in Pittsburgh PA. Peter holds a BFA in Industrial Design from Carnegie Mellon University and is an Adjunct faculty member at CMU's School of Design. Peter's work includes computer products for Medical, Industrial and Sports industries.

TOPICAL CONTENT OUTLINE

Problem Space:
Creating wearable computers that fit well on peoples bodies is not easy to do. This is because our bodies are soft organic shapes and are constantly moving. The internal components to any computer contrast that with hard rectilinear shapes. Resolving this conflict between human bodies and computer components takes some work but it can be done

This tutorial will cover designing organic humanistic shapes for wearable computers and integrating those shapes with internal computer components.

Introduction:
We will review of the Guidelines for Wearability And the Dynamic Wearable Forms. We will then cover a case study of a recent computer designed and built at Carnegie Mellon. The case study will cover step by step explanation of how the guidelines are applied. It will also cover information about how the shape is negotiated between the industrial designers and the engineers. We will explain our iterative process in designing the housing to fit people and designing the internal hardware to fit the housing.

Exercise:
Participants will work in teams of two to design the housing and circuit board for a hypothetical wearable computer.

1. Teams will draw from a hat a placement location for their hypothetical wearable computer.
2. They will then use an aluminum wire to measure the body location and map the curve on to a piece of paper.
3. Using the mapped curves as a starting point, students will create a profile.
4. Continuing to use the placement location as a reference point, teams will draw a footprint. This footprint can be any shape the team determines, but not a circle or a square.
5. Cut the footprint out of Circuit board (green cardboard) material
6. By using tracing paper teams will map the profile and footprint on to the piece of blue foam.

7. Each team will be given set of components to populate the circuit board with. Components will be color coded with placement requirements.
8. One team member will carve the foam using an Olfa knife or small saw, while the other team member will populate the board
9. Must negotiate to make allowance so that all components on the board will allow it to fit inside the housing.

When the designs are complete, each team will present their computer shape and circuit board to the group. We will then conduct a critique together with the group.

Discussion
After the exercise we will conduct a discussion and question answer period. This will allow participants to share their experiences from this exercise and past experiences. It will allow the instructor s to touch on any unanswered questions.

References

[1] Gemperle et. al *Design for Wearability* Proceedings of the Second ISWC. IEEE Computer Society Press, 1998.