

Exploring Interactive Costumes

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Abstract

Interactive costumes for theater stages is an unexplored field in HCI. Examples and user studies are not known. This paper begins a basic discussion on this domain and explains the teaching approach of a student project that creates costumes for a well-known story.

1 Introduction

The evolving potential of e-textiles and wearable computing is a growing topic in HCI. Computational clothing can be found in application fields such as health care, the gaming industry, or performance arts. Nevertheless, projects making use of interactive costumes on theater stages are still rare. Theater is one of the oldest entertainment formats, and from the beginning costumes have been an element of performances. While visions of interactive theatre have emerged in the literature (Friedrichs-Büttner et al 2012; Torpey & Jessop 2009), these mainly refer to stage design and dominantly utilize visual projections.

Similarly, research on *e-textiles on the theatre stage* is still an unexplored domain for HCI. Our ongoing student project “Interactive Costumes – E-textiles made for the stage” investigates the research field of *interactive costumes*. Computational technologies that are portable and simply attached to the performer’s body are categorized as *wearables* or *wearable computing* (Buechley & Eisenberg 2009; Olsson 2005). In contrast *electronic textiles* or *e-textiles* characterizes “computational technology that is embedded into textiles” (Buechley & Eisenberg 2009, p. 134) which leads to a more “seamless integration of electronics into ... fabrics” (Olsson 2005, p. 6). The title of our student project is “Interactive Costumes – E-textiles made for the stage” – in this sense we understand *interactive costumes* as *e-textiles on the theater stage*. We think that costumes as they are worn on the stage are a specific type of working clothes, and if sensors and/or actuators are seamlessly integrated into this working garment (this means not additionally fixed to) we define it as *interactive costumes*.

In our project, students of *Computer Science and Media* (CS & Media) collaborate with students from *Media Art and Design*, and *Product Design*. We utilized several design methods to inform design and development of prototypes. Students dived into the topic by

observing a piece, getting introduced into design acting methods, bodystorming and tinkering activities, and through exploring several fabrics and handcrafting disciplines and technical systems. In this paper we discuss our approach and summarize the current state of the development.

2 Methodological Approach

As HCI projects taking place in such an uncovered area require a creative as well as a technological exploration on a balanced level, we have formed three teams within the project each consisting of two CS & Media and one design-based student. Our goal is to detect requirements and to establish design guidelines that have to be fulfilled for the creation of *interactive costumes*. As this is a novel domain for all of us, we engaged in methodologies and activities to get a deeper understanding of:

- What exactly is a *costume at theatre stages* in general and what role does it have in the performance?
- How to design and develop an *interactive costume*?
- How do *users perceive and adopt* interactive costumes?

We use a range of methods and design activities, from user study, brainstorming, bodystorming, visiting a theatre piece, to acting things out, and asking domain experts for feedback. Table 1 shows how we structured the process.

Week	Method/ Activity	Goal
1	Kick-off meeting	Create interdisciplinary teams
2	Costume observation Search for costume ideas in teams	Understand theatre costumes Start interdisciplinary process
3	Costume observation in teams Design Acting Workshop I	Understand theatre costumes Understand Acting
4	Analyze observation results Arduino/ Lilypad introduction	Definition of interactive costumes Technical intro for all
5	Discuss Story & Character Preferences Bodystorming & Tinkering	Finalize idea finding process Interdisciplinary design process
6-13	Individual team work on costumes	Interdisciplinary design process
	9 Plus: visit professional costume designer	Professional feedback
	10 Plus: midterm presentation	Shared feedback
14	Paper review on user studies Design Acting Workshop II	Conceptualize User Study Evaluation of designs
15	Final presentation	Finalize design process

Table 1: The project schedule

The active phases – bodystorming paired with tinkering, as well as the design acting workshops – seem to play an important role for the project development. Although the

workshops are very time-consuming, most of our students confirmed that it brings fun and variety. Such common experiences also have a team-building effect, helping students to get to know and appreciate each other, thereby creating synergies. Furthermore, these activities let the students experience what they are to develop. The design acting workshops consist of two-days sessions conducted by a professional freelance theatre pedagogue. In the first workshop, she introduced us to theatre techniques that might help to find costume ideas and provided students with first-hand experience of acting. We want to use the last sessions to evaluate our costume prototypes. We hope to invite real actors to test our costumes while playing theatre that can be paused by us (Vines et al 2014), or we could actively test them out by doing role-playing ourselves (Medler & Magerko 2010).

3 Work-in-progress: Designing Interactive Costumes

After the first get-together, we put students in interdisciplinary teams of three. We asked them to search for a piece the entire group is interested in. It could be anything as long as it has potential to be played on a theatre's stage. They were then to decide on a character for whom to create an interactive costume. They finally chose the story *Twenty Thousand Leagues under the Sea* by Jules Verne. The teams are developing the costumes of *Captain Nemo*, the *Diving Suit* of the *Nautilus Crew*, and the *Octopus Sea Creature*.

Additionally we introduced the *Arduino* platform. A few students started with *Lilypad* (*Arduino* version for textiles).

3.1 Definition and Requirements of 'Interactive Costumes'

In parallel to the initial idea finding process, we visited a local theatre to watch two different pieces. Students were to observe one character per team and to follow the development of his/her costume during the play. When we analyzed and discussed the observation results of every team it became clear that *interactive costumes are e-textiles that support either the expression and behavior or the motions and movements of an actor on stage*. The observation method enabled us find an appropriate definition for our research interest object.

In the first design acting workshop, we learnt some theatre techniques. This two-days session was intended to support team-building, and students should get to act out ideas for a story and a character instead of just talking about these. As they were not far enough with the idea finding at this time the workshop turned out to be a pure acting course. Nevertheless, it had a positive effect: First-hand experience of acting helped students understand what this activity implies, and beyond that, we wanted to find answers on why and how a theatre costume has to support its wearer. The discussions after the observation and first design acting workshop revealed that most students now have a more concrete idea of what a theatre costume requires. This can be adopted for *interactive costumes – they have to be robust enough to be worn multiple times, and to be dressed or undressed quickly. They have to be visible for all audience members, support the actor's/actress' role instead of limiting him/her. The appearance has to fit metaphorically into the character played*. This list is not finished, but

gives a good overview of the characteristics of interactive costumes. Furthermore, it makes clear that interactive costumes for the theatre may differ from those for other occasions as e.g. carnival or live action role-play. For an actor, interactive costumes play a minor and supporting role. In contrast, carnival costumes play a major role as presenting the clothes is more important than the character and his/her actions.

3.2 Low-Fidelity Costume Prototypes

After the first few weeks, students were ready to define what costumes they want to create. We ran a bodystorming session where students played with materials. They constructed low-fidelity prototypes of their costume ideas and checked out what kind of clothing might fit best to the characters' needs. As a result of tinkering these lo-fi prototypes, students could figure out how they could integrate interactive elements best into the costumes.



Figure 1: The Octopus – Lo-Fi Prototype (left) and Design Sketches (middle, right)



Figure 2: Diving Helmet – first (left) and advanced Design Sketches (middle), cardboard mock-up (right)

For instance, the octopus shall be able to move his arms in all directions and during the practical session we determined to hide the technical construction for this under a kind of cape (see figure 1). Otherwise, the lo-fi prototype of the diving suit enabled the students to imagine wearing a helmet and inspired them towards the idea of constructing it to be retractable (see figure 2).

3.3 Next Steps

Meanwhile, the phase of individual teamwork has started. The three student teams develop their costumes in an intense and individually managed processes coordinated by regular supervision with us. Students are elaborating the needed materials and fabrics. They are completing their research with tests on different physical phenomena and technical components in order to explore specific solutions. For instance, the captain's costume has lots of wool tentacles in the shoulder area. They should be able to glow and move. Figure 3 shows how the students have quickly installed a vibration motor that partially moves the shoulder area. The test revealed that this effect is hardly visible and they therefore decided to insert a second textile layer that moves the whole surface.



Figure 3: Nemo's Costume – first Costume Design (left) and Test with Vibration Motors (right)

Furthermore, we have been invited to a professional costume designer at a theatre house. Besides getting insights into her daily work, we had the chance to present our costume project. Based on her knowledge and working routines, this expert could give us some useful hints that may improve the further development of our costumes.

A user study with real actors is planned at the end of the semester after finishing the high-fidelity prototypes. As some of our students are novices in HCI, a small literature review will assist in preparing this evaluation.

4 Conclusion

We presented a student project that is still work-in-progress. We gave an initial definition of *interactive costumes for theatre stages* and outlined a few requirements for that type of working garment. As we are exploring a new HCI research field, we believe that our teaching approach supports students in their understanding of theatre and costumes. Furthermore, the sessions of getting physically active helped to figure out costume ideas and explore specific design solutions for e-textiles on the stage.

Future research on interactive costumes needs to emphasize the distinction to or integration of wearable computing into theoretical discourse. Additionally, further investigations have to be made about the users and for demonstrating if interactive costumes can enhance theatre performances. User studies with actors as expert users can answer how users adopt interactive costumes. Evaluations including other theatre professionals or the audience may give us information about the outer perception.

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