Making Fashion more Trendy through Touchless Interactive Displays integrated with Mobile Devices

Franca Garzotto
Politecnico di Milano, DEIB
via Ponzio 34, Milan
franca.garzotto@polimi.it

Paolo Cremonesi
Politecnico di Milano, DEIB
via Ponzio 34, Milan
paolo.cremonesi@polimi.it

Antonella Di Rienzo
Politecnico di Milano, DEIB
via C. Golgi 42, Milan
antonella.dirienzo@polimi.it

Cristina Frà
Telecom Italia S.p.A.,
Open Innovation
via C. Golgi 42, Milan
cristina.fra@telecomitalia.it

Ayse Naciye Celebi Yilmaz
Luigi Oliveto
Politecnico di Milano, DEIB
Via C. Golgi 39, Milan
aysenaciye.celebi@polimi.it
luigi.oliveto@polimi.it

Massimo Valla
Telecom Italia S.p.A.,
Open Innovation
via C. Golgi 42, Milan
massimo.valla@telecomitalia.it

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Abstract
Our research focuses on innovative interactive technologies for the retail domain, in particular fashion. We integrate "touchless" large interactive displays, enabling full-body interaction at the distance, and personal mobile devices, to create engaging UXs that have a strong potential for advertisement and branding purposes in the fashion sector.

Author Keywords
Motion-based touchless interaction; large screens; mobile devices; mobile interaction.

ACM Classification Keywords
H.5.m. Information interfaces and presentation: Miscellaneous.

Introduction
The fashion domain is looking for innovative exploitations of interactive technologies to attract customers inside a shop, to make the experience inside the physical store richer and more memorable, and to help traditional retailers to face the growing competition with online sales. Large Interactive Displays (LIDs) are progressively being deployed in many public spaces [Ardito 2015][Cremonesi 2014],

Interaction space
Users located more than 4 meters far from the display will see a loop of videos or images presenting products and models wearing them.

Ambient zone: If users move closer and enter this area (4-3.5 meters) the system will sense their presence and display some extra contents to attract them.

Attraction Zone: When users are within 1.5 and 3.5 meters (interpreted as an intention to interact), a message appears on the display, explicitly showing that the system is aware of their presence, and inviting them to move closer.

Proximity Zone: If users are in this area (<1.5 meters) the system calculates their gender, age and ethnicity by processing their images and biometric data. This information is used to provide personalized (group) recommendations.

and make dynamic interactive digital media a relatively common feature in everyday social settings [Kuikkaniemi 2011]. Still, they have not been so popular in the fashion domain, where we believe they can have an enormous potential for promotion and advertising purposes.

The focus of our current research is a specific category of LIDs hereinafter referred to as "touchless" LIDs. These systems are characterized by the possibility for the user to control multimedia contents and dynamics at the distance, using body orientation, movements, and mid-air gestures.

Our work integrates touchless LIDs and personal mobile devices to offer new engaging user experiences in fashion shops and show rooms (see video https://youtu.be/tbH8x3WMAWU). The research has been performed in the context of a large ongoing international project that started in 2013 and has involved large IT companies, universities, and big and small stakeholders in the retail domain.

UX design: Info Architecture and Interaction

The information architecture of the multimedia contents on display has a hypertextual structure: items are hierarchically organized by categories (see Figure 2.a/c/e). The user can select a category and an item in this category; (s)he can go from the selected item to the next or previous one in the same category, return to the list of items or to the list of categories, or move to any of the "related items" (e.g., from a shirt to a piece of jewelry that can be worn on it).

Interaction has been designed accordingly to account a multiple-phases model that is partially inspired by [Muller 2010]. We distinguish different interaction phases: people "pass by" with no intent to interact (Phase 1); they notice the system and react, e.g., moving closer to the screen (Phase 2); they try a subtle interaction (Phase 3); they explore the multimedia content (Phase 4); they take more complex actions beyond content exploration (Phase 5); they perform multiple sessions with the system (Phase 6). We mapped different phases within areas in the physical space (see Fig. 1 and side bar).

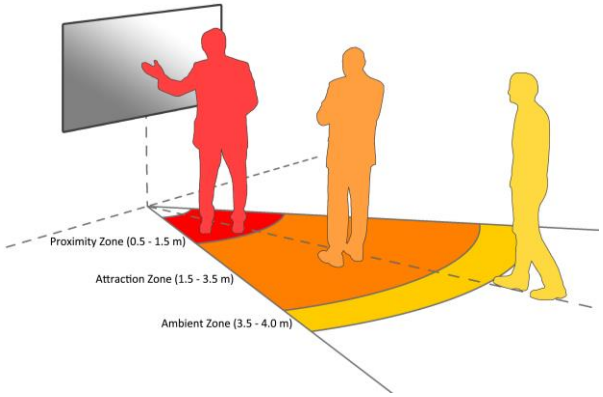

Figure 1: Interactions Zones.

The main area of interaction is the Proximity zone, where the users can explore the proposed products and the entire catalogue, or perform more complex task (e.g., gamification tasks, described in the next section) through the body language described in Fig. 3: *Swipe* (a) to browse items in the left or right, *Push* (b) for the selection of a specific item and *HandsOnHead* (c) to return to the previous category of items.

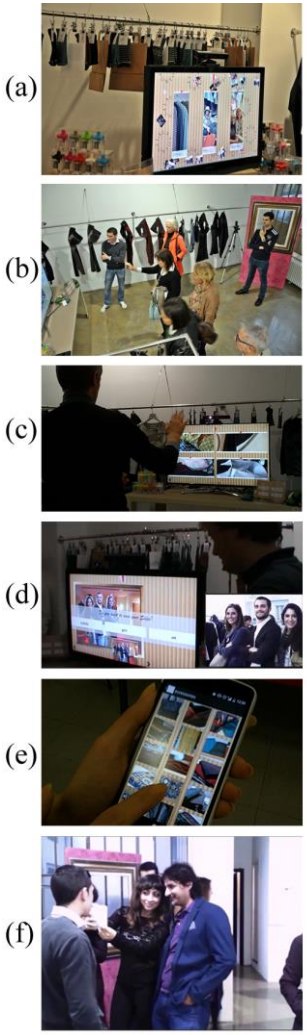

Figure 2: Ux design and interaction.

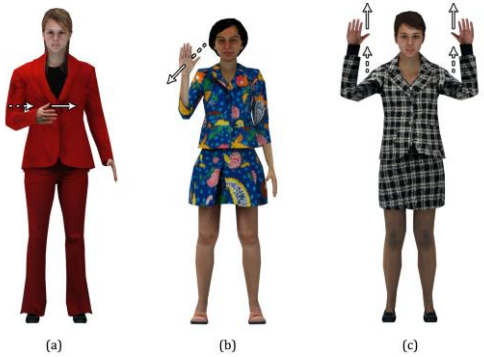

Figure 3: Body language.

Interaction control is performed by a single user only. When multiple users are in the Proximity Zone, the control is issued by the user who is closer to the screen. Different users can take the control simply by exchanging position.

UX design: Gamification features

Gamification features are intended to make the experience with the LDIs more engaging and fun. The "Selfie" game (Fig.2.d/f) allows users in the Proximity zone to take pictures of themselves, immersing their body images in a virtual world of their choice. User can select one of the available backgrounds (e.g., different show rooms, fashion event spaces, the interior of a VIP limousine), playact in front of the screen, and confirm the shooting. Selfies taken in front of the screen are automatically stored in the photogallery, can be downloaded on users' personal devices (see next section) and posted in the retailer's social space (Facebook) if users decide to share and make their images public.

UX design: blending touchless and touch interaction

Users who are interested on a specific product on display can scan the product QR-Code in order to download the shown item on their personal device. In addition, users can install a mobile app to have the entire catalogue and the dynamically created photogallery at their fingerprints. Furthermore, they can share the pictures taken by their mobile device with the LDI application, and make them appear in the photogallery of the large display. (Fig. 2f)

Technology

The general software architecture of the system is depicted in Figure 4. The Screen Application (Sapp) component includes the Core Module and the Sensing Module. Microsoft Kinect is used to detect and collect data about users' presence, movements and actions. During game activities, the Sapp is responsible for images composition, removing background information from the image of the users in front of the display and placing user's body images on the selected background. To estimate users' gender, approximate age and ethnicity, the Image Analysis Web Service exploits an external web service (http://www.betaface.com/).The Recommender System (RS) exploits two recommendation algorithms of different nature: collaborative filtering and content-based. The Content Delivery Platform stores and manages the multimedia content. The Central Controller ensures the control and coordination of the different modules.

Preliminary Evaluation

Our application has been launched and used for the first time in a public setting during the "New Collection Vernissage" of a small fashion brand (see Fig. 2), an

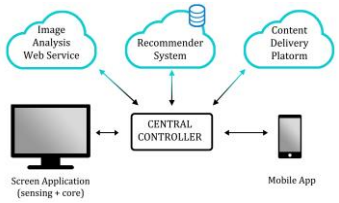

Figure 4: General software architecture.

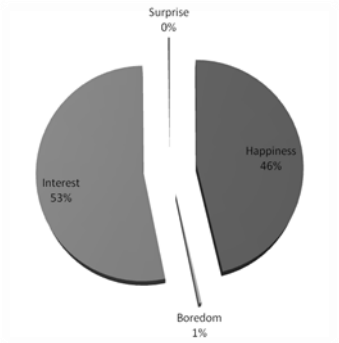

Figure 5: Duration Percentages of Emotions.

event devoted to present the retailer's Autumn-Winter new collection. Two LIDs were installed in the showroom and two cameras per display were placed to capture the users' body movements and actions from two different angles (perspectives): the frontal view recorded users' behavior while they interacted with the display, whereas the back view captured the user perspective, i.e., the on-screen content along with the corresponding user's actions. We recorded 6 hours of video with 52 users interacting with the system.

The video analysis of this material has focused on the emotions that users manifested during the UX. The emotional aspects of interaction have received increased interest not only in HCI but also in marketing. The term "emotional branding" has been coined to express the new dynamic that exists now between brands and people, pinpointing how effective consumer interaction needs to be about senses and feelings, emotions and sentiments. In particular, this paradigm is crucial in fashion branding, which is largely about emotional, hedonic, non-functional dimensions of products. In our study, we considered the emotions manifested by means of *facial expressions*, which are acknowledged as being one of the most universal means for emotions externalization. Specifically, we considered happiness, interest, boredom, and surprise. According to some emotional branding theories [Gobe 2010], these are the emotions that have the strongest impact on the "brand image" (the set of mental constructs that a person associate to a brand).

Figure 5 presents a snapshot of our study results, showing (in percentage) the duration occurrence of *emotion* signals detected during the whole event. It pinpoints the predominance of signals of *interest* (53.10%) and *happiness* (46.27%) compared to *boredom* (0.39%) and *surprise* (0.24%), regardless users' age, gender and technological knowledge. Still, users who had more than one session were significantly happier than users who had one session. We can interpret these data, which certainly require validation in further studies (ongoing), as indicators of the potential of our system to create engagement and positive feelings, which is even stronger if the user has a prolonged interaction.

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