Brute Force Interface: Leveraging Intense Physical Exertion in Whole Body Interactions

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Abstract
People use a wide range of intensity when interacting with artifacts and one another in whole body interactions, spanning from subtle to brute force. However, computer interfaces so far have mainly focused on interactions restrained to limited force and do not consider extreme physical and brutal interactions, such as those encountered in contact sports. We present preliminary investigations on "Brute Force" interfaces that aim to aid designers who want to leverage the physical and mental health benefits of such forceful interactions. In order to demonstrate that augmenting Brute Force with computing technology can be beneficial, we have designed and evaluated "Remote Impact", a Brute Force prototype that supports distributed participants. We hope with our work we can encourage designers of whole body interactions to include these physically intense behaviors that are exhibited in many activities in people's lives.

Keywords
Design space, blunt force, brute force, Exertion Interface, physical, sports, social interaction.

ACM Classification Keywords
H5.2. Information interfaces and presentation (e.g., HCI): User Interfaces.

Introduction

Sport has many advantages; in particular health and social have been attributed as major benefits. From a physical health perspective, sports can contribute to a healthier body, reducing the risk of obesity, cardiovascular disease, diabetes, and more [9]. From a social and mental health viewpoint, sport is believed to teach social skills, encourage team-building and support individual growth and community development [5]. However, not all sports are the same and provide identical benefits. For example, contact sports, sports in which the rules allow physical contact with other players, are often associated with intense physicality and brute force. Sport activities such as American football, ice hockey and boxing are characterized by their explicit support for body collisions that facilitate brute force, and although these sports can be dangerous for the participants' health, they are very popular and many players enjoy participating, besides the risks [3]. These extreme physical interactions can also facilitate emotionally rich reactions that result in unique experiences. By identifying characteristics and benefits of Brute Force in Whole Body Interactions, we hope to add extreme physical exertion activities to the Exertion Interface space [7] HCI researchers consider when designing new experiences.

Brute Force Interface

We want to introduce the concept of "Brute Force Interface" to have a common terminology for researchers and designers when they talk about these forceful interactions. Furthermore, by scientifically investigating these interactions, considering them equally as part of the many behaviors humans exhibit, we want to point out the value these interactions potentially have. Thirdly, we aim to create awareness that people use brute interactions in their daily lives, for good and for bad, and that these interactions can be augmented with computing technology.

Related Work

Perhaps the earliest example of a networked Brute Force Interface is *Telephonic Arm Wrestling*, an installation created in 1986 [10]. Two players arm-wrestle a mechanical device that measures and applies force across a dedicated phone line. Recent instances of this approach are now available in public museums, allowing to arm-wrestle another person on the other side of the country [1]. Other researchers have investigated the convergence of computing technology and extreme physical activities. Martial arts activities have benefited from Ubicomp technologies [4]. Related work derived from a CSCW perspective, and the term *Computer Supported Cooperative Sports* [8] has been coined. The *Virtual Fitness Center* [6] supports extreme physical exertion through exercise bikes that react to changes in the virtual environment displayed on a screen if front of the cyclists. *Tug-of-War* can also support Brute Force; a networked version allowed two teams of high-school students to be involved in a tug-of-war 13 miles apart from each other [2].

Remote Impact

Figure 1. Remote Impact.

In order to demonstrate the feasibility of our work on Brute Force, we designed and developed *"Remote Impact"* (Figure 1). Our prototype of a Brute Force interface supports two participants, located in two geographically different locations. The gameplay of *Remote Impact* is as follows: The two remote players enter the identical interaction spaces. They are facing a sensitive playing area, on which the shadow of the remote person is projected. In addition, their own shadow is also displayed, in a different shade of grey. The interaction area covers both body shapes from head to toe. The players can also hear each other through a speakerphone.

Once the game starts, both players try to execute impacts on each other's shadow. They can target any area of their partner's body, and administer hits with their hands, feet, arms, legs, or their entire body. They can hit with a flat hand or use their fists. An impact on the remote person's shadow area is considered a successful hit. The higher the intensity of the hit, the higher the points scored. If a hit is placed within the shadow area of the remote person, a visual indicator is displayed on the impact spot and a sound effect is played to indicate for both players that a successful hit occurred. If the player missed, a different visual appears, indicating that no points were added to the score. The player with the most points wins the game.

Evaluation

We were interested in the opinions of users when exposed to Brute Force such as supported by *Remote Impact,* and chose observations and interviews as rich methods to gain qualitative data. With this particular evaluation, we hope to provide other researchers with insights that lie in the realms of Brute Force, physical activity, gaming and social interactions, possibly informing their future design choices.

49 invited visitors were exposed to the Brute Force interface as part of an open house event. Participants were invited to interact with the system in an unstructured manner for as long as they wanted. Most participants started by gently touching the surface, and, upon encouragement, continued with soft hits. The first strong hits often occurred when by-standers were looking elsewhere; people seemed more comfortable exhibiting strong force when feeling unobserved. It seems that in the initial stages of being exposed to and trialing a Brute Force interface, users are very self-conscious about their abilities, especially when exposed to others.

Many participants praised the opportunity to use the system as stress relief and would like to see such a

system installed in their offices to "fight the boss". They said they liked hitting the surface regardless whether it resulted in points or not. "They are not many objects you can hit during your daily life", they observed, and said it was a welcomed change. This could mean that the game might be perceived differently if 'misses' have an impact on the score, for example if they would subtract points. Currently, a miss is visualized, but not penalized. If designers want to facilitate stress relief with a Brute Force interface, they could follow a similar approach, because penalizing 'wrong' hits could affect the stress relief benefit negatively.

One participant made an interesting point in regards to the social character of related physical body experiences such as martial arts: Although martial arts is not traditionally regarded as team sport, the "technical augmentation turns it into a more social experience, extending its traditional role".

Conclusions

In order to demonstrate the feasibility of our approach to Brute Force in Whole Body Interactions, we have designed a demonstrator called *Remote Impact.* It allows two players in geographically distant locations to play together, in which the intensity of the exertion interaction affects the game significantly. We hope our investigations can serve to begin a new dialogue around these ideas in the HCI community. We also hope this work can excite other researchers and designers about the potential of using Brute Force Interfaces in their applications.

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