Brute Force as Input for Networked Gaming

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ABSTRACT

Bodily activities such as sports have many physical and mental health benefits. The associated physical interactions are often of an exertion character and facilitate the use of brute force and intense physical actions. On the other hand, computer interfaces so far have mainly focused on interactions that use limited force and often ignored the existence of extreme brutal interactions that can be encountered in everyday life, in particular in contact sports. We present our initial investigations on the concept of "Brute Force" interfaces in HCI and describe work-in-progress on a prototype that aims to facilitate brute force interactions. We hope with our work we can aid designers who want to leverage the physical and mental health benefits of such physically intense behaviors that people do exhibit in their lives.

Categories and Subject Descriptors

H5.2. Information Interfaces and presentation (e.g., HCI): User Interfaces.

General Terms

Design, Human Factors.

Keywords

Framework, design space, blunt force, brute force, Exertion Interface, physical, tangible, videoconferencing, sports, active, exhausting, team spirit, social, interaction.

1. INTRODUCTION

Sport has many advantages; in particular health and social contributions 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 [21][4]. From a social and mental health viewpoint, sport is believed to encourage team-building and support individual growth and community development [10]. However, not all sports are the same and offer identical benefits. One characteristic is common amongst the majority of sport activities, though: they involve participants voluntarily investing in physical exertion. In particular contact sports -sports in which the rules allow physical contact with other players- are often associated with intense physicality and "Brute Force". Sports such as American football, ice hockey, wrestling 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, despite the risks [3]. Some even say that if the sport activity did not lead to some physical hurt, it was not a good game, considering pain a basic characteristic of such a sport [23].

The wide range of physicality, from subtle to brute force, is characteristic of the complexity of sport. Human computer interaction (HCI) research has started to investigate physical interactions beyond mouse and keyboard, mainly to support participants' weight loss [8]. These approaches, however, either measure everyday moderate body movements, such as step-count, or limit the interactions to arm- or leg-movements and provide no force-feedback. It seems HCI has not yet investigated more extreme physical interactions, in particular Brute Force that can be prevalent in contact sports, in order to utilize its benefits in computer-augmented experiences. "Brute Force interactions" often involve body-to-body contact, supporting direct impact. They are associated with fear, risk, pain and are often irreversible. However, such extreme physical interactions can also facilitate emotionally rich reactions that result in unique experiences. By identifying characteristics and benefits of Brute Force in human-computer interactions, we hope to add extreme physical activities to the space HCI researchers consider when designing new experiences.

2. BRUTE FORCE

Although the term "Brute Force" is associated with a CPU intensive approach to programming when used in a context with computers, we would like to introduce the term to human-computer interaction research. By Brute Force in HCI we mean interactions exhibited by users that are deliberately very forceful, and are of brutal character or quality, and are not characterized by intelligence or reason. The definition of brute also includes terms such as "the animal qualities of humankind", "irrational", "lacking or showing a lack of reason or intelligence" and "showing lack of human sensibility" [7]. So far brute interactions with computers mostly evolved out of frustrations with "unusable" interfaces or malfunctioning hardware. The most famous example of the fact that these forceful interactions with computers can be understood and related to by users worldwide is probably the humorous hoax video of an office worker smashing his monitor, filmed from a security camera perspective [2].

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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 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.

2.1 Brute Force in HCI

People's actions can span a wide range of physical intensity, from subtle to brutal. Some of our interactions with computers are forceful, however, they are mainly caused out of frustration. These emotionally loaded interactions with computers have been explored by the area of affective computing [22]. Such approaches often aim to detect negative emotions in order to minimize frustrations. In contrast, our work focuses on the advantages Brute Force can provide, as demonstrated in many sports, in particular contact sports: many sport activities, such as boxing, martial arts, rugby and wrestling have a core element of Brute Force, which seems to make them attractive for some people. These contact sports are associated with many risks to physical health [3], but nevertheless, people participate in them. The benefits of participating must be greater for those players than the risks involved. Our work aims to tap into this area from an HCI perspective to expand the interaction space designers commonly consider.

2.2 Brute Force in Sports

The use of Brute Force in sports, in particular contact sports, is often associated with the concepts of pain, risk and danger. Contact sports are defined as sports in which contact between opponents is allowed. Of particular interest for Brute Force is a further distinction: "collision sports" are sports in which contact is necessary and integral to play, in contrast to sports in which contact only occurs incidentally [11]. We found, however, that users are generally not familiar with the term "collision sports", and therefore use the more common term "contact sport".

Straub et al. have found that contact sport athletes can tolerate pain significantly longer than non-contact athletes [23]. Pain is sometimes considered part of a common athletic experience [9] [1]. Contact sport is also associated with aggressiveness: a relationship between contact level in sport and aggression has been identified earlier [11]. According to the Cathartic model, the expression of aggression in a controlled sport environment is an acceptable forum for the release of accumulated aggressive energy. Sports are considered a safe and socially acceptable outlet for pent-up aggression, some researchers say [14]. However, others disagree and propose that successful, unchallenged aggressive acts lead to further aggression, as explained in the social learning theory [quoted in [12]].

To conclude, Brute Force is often associated with contact sports in which body contact is integral to play. It can have positive as well as negative effects. However, our work does not focus on contributing to the discussion of the pros and cons of contact sport. It does rather acknowledge the use of Brute Force in specific sports and the popularity of these sports. Many people participate in these sports despite the risks. Some are *only* attracted to these kinds of sports. We believe the potential for augmentation makes Brute Force an activity area that deserves consideration in HCI.

3. RELATED WORK

Perhaps the earliest example of a networked Brute Force interface is the "telephonic arm wrestling" from 1986 [24]. Two players arm-wrestle a mechanical device that measures and applies force across a dedicated phone line. Other researchers have investigated the convergence of computing technology and intense physical activities: related work derived recently from a CSCW perspective, and the term *Computer Supported Cooperative Sports* [18] has been coined. Advanced prototypes exist in research labs, but they have rarely been evaluated. A networked gym system is *NetAthlon* [19], which allows riders of exercise bicycles to race against other remote riders, represented by three-dimensional avatars. The *Virtual Fitness Center* [15] uses a similar approach with exercise bicycles positioned in front of a video screen. The physical movements conducted on the exercise bicycle are used as input to modify the representation of 3D virtual environments. Reversely, the map information affects the pedaling efforts. *Tug-of-War* can also support Brute Force; a networked version has been demonstrated: two teams of high-school students were involved in a tug-of-war 13 miles apart from each other [20]. The move by Nintendo away from a traditional game pad as input device for their latest console signals that the entertainment market might consider more sportive activities: the console comes with a controller that contains accelerometers and infrared sensors. In order to hit the virtual tennis ball, the player uses the controller like a racquet [25].

4. OBJECTIVES

Based on initial investigations of situating the concept of Brute Force in HCI, we had several objectives for our prototype:

4.1 Intriguing for contact sport fans

Based on personality traits as well as opportunity costs some people favor contact sports whereas some prefer non-contact sports. "Sports over a distance" examples already exist that fall into the realms of non-contact sport [17], we are now aiming to offer contact sport fans an adequate activity that facilitates comparable engagement.

4.2 Playable over a distance

Our main argument for augmenting sports activities with computing technology is to offer an increased benefit to the experience. In particular, our work aims to support the ability to exercise with remote friends but also distant strangers. We want to expand this benefit and offer a distributed aspect in Brute Force interactions.

4.3 Provide health benefits

One of the main reasons for sports participation is the potential physical health benefit, which we aim to retain in our example. Sports can also contribute to mental health and facilitate social interactions. We would like to see our approach offer similar benefits to the users.

4.4 Stress relief

Brute Force, when applied to non-critical objects, can serve as stress relief, and we are aiming to provide this characteristic in our demonstrator.

5. APPLICATION

In order to demonstrate the feasibility of our Brute Force Interface approach, we are currently building a networked game that was designed with the outlined principles in mind. Our focus is on demonstrating that our theoretical groundwork has practical applications and can support the creation of successful designs. We are hoping that other designers and developers are able to apply our framework, learn from our prototype, and combine these findings to create increasingly more sophisticated systems.

5.1 Challenges

The main challenges we faced when trying to apply our theoretical concepts to a demonstrator were:

- If Brute Force has distinct advantages in terms of stress relief and physical and mental health, how can we create an interface that facilitates and encourages such activity and how do we know we succeeded?
- If the use of Brute Force is expected from participants, how can we ensure the user does not damage any equipment nor injures him/herself?
- If Brute Force is common in contact sports and can lead to desired benefits, such as physical and mental health, can we design for similar positive experiences although augmenting with computing technology? Can we achieve additional benefits?

Our latest prototype, "Remote Impact", aims to address these items in the following way:

- If stress relief is associated with Brute Force, we facilitate the use of Brute Force through a dedicated hardware platform that supports a gameplay that allows for a competitive playful experience, similar to most contact sports.
- In order to encourage users to participate in physical activity, we offer the possibility of exercising with partners in geographically remote locations, providing a social approach to facilitate motivation.
- To prevent users from accidentally damaging any equipment, we have focused in our design on hiding technical components from the user by placing them in non-accessible places and designing our hardware platform in a way that the electronics are minimally accessible and hidden from the user. In order to protect the user from injury, we have chosen specific hardware material that can further reduce the potential of physical harm.
- If Brute Force is regarded in a positive light when used in sport, we aim to leverage these experiences by offering a similar sport experience, in particular modeled on the characteristics of contact sport, in which Brute Force is often exhibited.

6. REMOTE IMPACT

In order to demonstrate the feasibility of our work on Brute Force, we are currently designing a prototype named "Remote Impact" that aims to facilitate Brute Force interactions. We envision the gameplay for the distributed participants as follows:

6.1 Gameplay

Two players in two geographically different locations 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 slightly different shade of grey. These shadows appear to be created by a light source behind the players, i.e. if the players get closer to the interaction area, their shadows increase in size. If the players face the interaction surface, it appears as if the other person is standing next to them, because the shadows show the silhouettes of two people. The interaction area covers both body shapes from head to toe, spanning a complete surface area of 2.10 x 2.50 meters. The players can also hear each other through an echo-canceling videoconferencing-quality speakerphone.

Once the game starts, both players try to hit each other's shadow. They can hit any area of their partner's body, and administer hits with their hands, feet, arms, legs, or their entire body. Depending on the intensity of their hit, they receive more points, which are displayed at the top of the screen, visible to both parties. If a hit is within the shadow area of the remote person, a visual indicator is displayed on the impact region and a sound effect is played to indicate for both players that a successful hit occurred. If the player misses, a different visual appears, indicating that no points are added to the score. The player with the most points wins the game.

7. DESIGN DECISIONS

We have opted for a competitive game because most contact sports are of competitive nature and we wanted to support Brute Force interactions similar to the ones exhibited in these sports. We implemented an intensity measurement system that is open-ended, i.e. we imposed no limit on how many points a player can score with a hit except determined by his/her strength. The audio conference allows for social interactions between the remote participants to facilitate a bond across the distance. In contrast to Breakout for Two [17], this game does not support the illusion that the other player is on the other side of a glass wall, but rather supports the notion that the players are standing next to one another, with both players looking forward. Although this approach does not allow for a visual frontal representation of the remote player, it can have other advantages: we postulate that the players can experience their own body actions within the space while simultaneously achieving a sense of how it is perceived on the remote end. In Breakout for Two, the local player can see which side of the game blocks the remote player is targeting, however, because of the conical shape of the viewing area of the camera, (peeking through a hole in the projection surface) he/she cannot determine the exact location the remote player is aiming at. Furthermore, the player can try to snatch away a point by hitting the appropriate block faster, however, the player cannot see the entire trajectory of the remote person's ball, which makes it difficult to prevent the other player from achieving their goal, hindering a defensive playing style. In our latest prototype, the player can act offensively by charging towards the other player, trying to administer many hits applied with strong force to increase the score quickly, or the player can chose to duck and dodge the hitting attempts from the remote player, and strike only occasionally, creating a low-scoring game that is characteristic of a defensive playing style.

8. FUTURE WORK

We are planning on evaluating our Brute Force interface by observing users interacting with the system. We intend to interview the participants after the experience to gain insights into their understanding and use of Brute Force in the competitive environment. A particular focus will be on the physical and mental benefits and how the use of a body contact-focused interaction can facilitate social rapport between participants.

9. CONCLUSION

We have presented work-in-progress on the concept of Brute Force in HCI. Extreme brutal force is generally considered to be avoided, however, it is believed its use can provide mental and health benefits and function as stress relief, as valued in contact sports. We are currently building a demonstration system that is designed with our theoretical work in mind to demonstrate the feasibility of our approach. The prototype offers the advantage of supporting distributed participants through the use of augmented computing technology in a competitive gaming environment. Our design aims to facilitate Brute Force hitting actions as well as extremely powerful movements such as throwing the entire body at the surface, similar to what one might see in contact sports such as wrestling. An evaluation of the players' experiences with the system will shed light on the use of Brute Force in computer-augmented interfaces. With our results, we aim to start a dialogue around these ideas in the HCI community. We hope this work can excite other researchers and designers about the potential of using Brute Force Interfaces in their applications.

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