

# Chapter 56

## Assistive Technologies for Brain-Injured Gamers

**Jason Colman**

*University of Portsmouth, UK*

**Paul Gnanayutham**

*University of Portsmouth, UK*

### ABSTRACT

*This chapter surveys assistive technologies which make video games more accessible for people who have an Acquired Brain Injury (ABI). As medical care improves, an increasing number of people survive ABI. Video games have been shown to provide therapeutic benefits in many medical contexts, and rehabilitation for ABI survivors has been shown to be facilitated by playing some types of video game. Therefore, technologies which improve the accessibility of games have the potential to bring a form of therapy to a larger group of people who may benefit. Hardware technologies which may make games more accessible for brain injury survivors are considered. Complementing these devices is the inclusion of accessibility features into games during the development process. The creation of best practice accessibility guidelines among game development practitioners is a nascent field, considered important by the authors. Play testing is common practice during game development. We consider the ethical issues involved when the play testers are brain injury survivors. Overall, the aim of this chapter is to improve the accessibility of future games, and thus their therapeutic potential, for brain injured and other disabled gamers.*

### INTRODUCTION

This chapter shows how video games can be made more accessible for people who have survived an Acquired Brain Injury (ABI). The authors show that this is important because of the many potential therapeutic benefits afforded by playing video games. Why concentrate specifically on brain injury survivors? Brain injury affects

approximately 8.5% of the population, and has been called a ‘silent epidemic’. Furthermore, this number is expected to significantly increase (Williams, 2011). The number of traumatic brain injuries is increasing worldwide, particularly in low- and middle-income countries. Stroke is a major cause of ABI, for which the survival rate has improved with advances in medical care. Many brain injured people live in rural areas,

DOI: 10.4018/978-1-4666-8200-9.ch056

where access to rehabilitation services is limited (Hyder et al., 2007). Making video games more accessible therefore widens the reach of a potential complementary form of rehabilitation. We will see examples of video game therapy for brain-injured people. There are many examples of physical rehabilitation following ABI, using video games to make repetitive motion more enjoyable and less monotonous.

In writing this chapter, the authors aim to raise awareness of how video games could provide many forms of therapy for people with an acquired brain injury. Unfortunately, many such people are prevented from playing some video games due to deficits in mobility, vision, and cognition. A range of commercially available assistive technology devices may be used to provide a usable interface. We examine some of these devices, including brain-computer interfaces aimed at the games market. Another approach to improving accessibility is to build more accessibility features into game software during the development phase. This is a discipline in its infancy, but some guidelines have emerged, which game development practitioners are encouraged to incorporate into new games. Dissemination of these guidelines is therefore another aim of the authors.

## **BRAIN INJURY**

Any brain injury which occurs after birth is called an Acquired Brain Injury (ABI). Causes of ABI include CerebroVascular Accidents (CVA, i.e. stroke), tumours, degenerative diseases (e.g. Parkinsons), demyelinating conditions (e.g. multiple sclerosis) and infectious disorders, (e.g. encephalitis) (Murdoch & Theodoros, 2001). Cerebral Palsy (CP) is also an ABI. The term covers a variety of disabilities caused by damage to the infant brain (Bax et al., 2005). CP is the commonest physical disability among children. There are many pos-

sible causes of CP, and though the damage may be sustained prenatally, perinatally, or postnatally, prenatal damage is most common (Reddihough & Collins, 2003).

A Traumatic Brain Injury (TBI) is an ABI caused by trauma such as a blow to the head, an impact with a blunt object, or penetration by a sharp object. Common causes of TBI are: motor vehicle accidents, bicycle accidents, assaults, falls, and sports injuries (Hyder et al., 2007; Lindsay & Bone, 2004; Ponsford et al., 1995). Motor vehicle accidents are the most common cause of TBI globally (Hyder et al., 2007), although for children this may be as a pedestrian or cyclist rather than passenger (Murdoch & Theodoros, 2001). There are two main types of TBI: open, where the skull is penetrated; and closed, where the meninges remain intact. Closed head injuries are much more common for civilians, although penetrating injuries are more common in wartime (Murdoch & Theodoros, 2001). In a closed TBI, the brain is subjected to compression, acceleration/deceleration, and rotational forces, causing brain tissue to be torn and sheared. The head may be crushed, but more commonly the victim suffers a brief impact to the head, (or elsewhere, such as in the case of whiplash) causing a sudden movement of the head. The brain may collide with the skull at the point of impact, resulting in a coup injury. Another contrecoup (or contra-coup) injury opposite this point may then occur as the brain rebounds (Murdoch & Theodoros, 2001).

The primary mechanism in many cases of TBI is Diffuse Axonal Injury (DAI), widespread damage caused by the shearing or rotational forces (Ponsford et al., 1995). At the microscopic level, the direction of the shear may be visible (Lindsay & Bone, 2004). DAI may be widely distributed, and occur deep in the brain, in the white matter and brain stem (Murdoch & Theodoros, 2001). Even a minor head injury where the patient loses consciousness results in some damage to neurons.

27 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:

[www.igi-global.com/chapter/assistive-technologies-for-brain-injured-gamers/126107](http://www.igi-global.com/chapter/assistive-technologies-for-brain-injured-gamers/126107)

## Related Content

---

### Using an Agent-Based Behavior Modeling for Finding Humanitarian Relief Center Location in an Earthquake Zone

Numan Celebi (2012). *Handbook of Research on Serious Games as Educational, Business and Research Tools* (pp. 1080-1096).

[www.irma-international.org/chapter/using-agent-based-behavior-modeling/64301](http://www.irma-international.org/chapter/using-agent-based-behavior-modeling/64301)

### The Learning Impact of Violent Video Games

Alice Irelandand Nathaniel Payne (2010). *Educational Gameplay and Simulation Environments: Case Studies and Lessons Learned* (pp. 312-325).

[www.irma-international.org/chapter/learning-impact-violent-video-games/40890](http://www.irma-international.org/chapter/learning-impact-violent-video-games/40890)

### The Narrative Event Diagram: A Tool for Designing Professional Simulations

Helyn Gould, Michael Hughes, Paul Mahargand Emma Nicol (2009). *Digital Simulations for Improving Education: Learning Through Artificial Teaching Environments* (pp. 101-118).

[www.irma-international.org/chapter/narrative-event-diagram/8512](http://www.irma-international.org/chapter/narrative-event-diagram/8512)

### Exploring the Design of Game Enjoyment Through the Perspectives of Novice Game Developers

Fengfeng Ke, Nilay Yildirimand Jacob Enfield (2012). *International Journal of Gaming and Computer-Mediated Simulations* (pp. 45-63).

[www.irma-international.org/article/exploring-design-game-enjoyment-through/74834](http://www.irma-international.org/article/exploring-design-game-enjoyment-through/74834)

### Uncanny Speech

Angela Tinwell, Mark Grimshawand Andrew Williams (2011). *Game Sound Technology and Player Interaction: Concepts and Developments* (pp. 213-234).

[www.irma-international.org/chapter/uncanny-speech/46794](http://www.irma-international.org/chapter/uncanny-speech/46794)