

Digital Tools for Physically Impaired Visual Artists

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ABSTRACT

We present work-in-progress that is exploring the potential for visual artists with physical impairments to use new non-intrusive mid-air gesturing sensors to enhance and extend their practice. We highlight the key results from an initial informal user evaluation with two disabled and two non-disabled visual artists examining use of the Leap Motion sensor as an artistic tool. Future work will explore how related technologies can be better utilized to support disabled artists in their practice.

Categories and Subject Descriptors

H.5.2 [Information Interfaces and Presentation]: User Interfaces - Ergonomics, Evaluation/Methodology, Input devices and strategies, Screen design, User-centred design

General Terms

Design, Human Factors

Keywords

Assistive Technologies; Digital Accessibility; Disabled Artists; Physical Impairment; Mid-Air Gesturing; Disability Arts

1. INTRODUCTION

Visual art is an activity that presents many opportunities for people with physical impairments such as providing a creative outlet, encouraging social inclusion, raising self-esteem, aiding with rehabilitation, and supporting general well-being. However, disabled artists with physical and motor impairments still have significant difficulties when working on their craft often resulting in a tedious and frustrating experience that requires huge patience and perseverance.

Perera et al. [1] observed a group of disabled artists and found that they typically used a range of assistive devices such as head wands, mouth sticks, and specially designed grips for holding devices. Whilst these tools can help make the production of artwork more accessible, they also involve repetitive unnatural movements which can result in additional issues (e.g. neck strain). The authors also observed the essential role of carers who are required for setting up canvases, paints, brushes, and any further adjustments that are required after the initial setup. This lack of

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independence and reliance on support staff can be particularly frustrating for disabled artists and can hinder their creative process.

New technologies can potentially overcome some of the issues that disabled artists experience, yet little work to date has explored how digital tools can support the production of their artwork. To address this lack of work we are currently investigating the potential of mid-air gesturing using the Leap Motion sensor [2] to help visual artists with physical impairments. This sensor can detect mid-air finger gestures performed by users in a three dimensional space (e.g. swipe, grab, brushing motions). It can also detect a single physical pointer such as a brush, pencil, head wand, mouth stick, or other assistive devices.

This technology can be particularly useful for people who have difficulty in holding traditional tools and applying pressure to a canvas. Different mid-air gestures can be used to provide disabled artists with much more control over their canvas, selection of brushes and paints, and can give them access to a broad range of tools they may normally have difficulty in using. A digital application can also be designed and trained to support people with specific disabilities - for instance, the brush strokes of an artist with cerebral palsy and tremor could be dynamically smoothed out. Furthermore, this type of approach can reduce the amount of support required from carers as it provides artists with more independence.

We are aware of no existing work exploring the potential of mid-air gesturing as an assistive tool for physically impaired visual artists and as such it remains unclear how people will respond to this type of approach. How do disabled artists feel about the use of hands and fingers as a substitute for traditional tools (e.g. brushes)? Do they prefer using tangible objects such as performing painting gestures with a "physical" brush in mid-air? It is also unclear what the general interaction issues with mid-air gestures are for disabled artists and how the interface should be tailored for different types of disability. Moreover, how should the interface adapt for people with degenerative diseases (i.e. the tools required in the early stages of a condition are likely to be significantly different from later stages)?

This paper provides an overview of work in progress that is exploring the potential of mid-air interactions for disabled artists. We present the results of an evaluation of three Leap Motion applications conducted with disabled and non-disabled artists and highlight some of the key interaction issues that need to be addressed.

2. LEAP MOTION APPLICATIONS

We wanted to test a selection of Leap Motion applications that allow users to create digital art using mid-air gestures. As such,

we decided to test the following three different applications available on the Leap Motion application store [3]:

Photoshop Ethereal [4]: This application allows users to interact with Photoshop using mid-air gestures and has some unique features developed specifically for the Leap Motion sensor (e.g. digital brush pressure control via mid-air gestures)

Freeform [5]: This is a 3D sculpting and modeling application that allows users to create different objects using mid-air gestures.

Leap Motion Orientation: This application is included with the sensor and provides the ability to create basic and simple brush strokes using mid-air gestures.

3. EVALUATION

We conducted an evaluation with two disabled and two non-disabled artists. One of the disabled artists has arthrogryposis and the other is in the early stages of multiple sclerosis. The session lasted three hours and started with an overview of the technology. We then tested the Leap Motion applications - the artists were asked to share their thoughts as they used the technology using a think-aloud protocol. The Leap Motion sensor was placed on a table in front of a wall where the applications were projected (Figure 1). There were several key findings:

- The hand structure of the artist with arthrogryposis resulted in multiple points being detected by the sensor (as opposed to a single finger) which created a frustrating interaction experience as the cursor would jump around the screen. A rolled up piece of paper was used as a makeshift brush which the artist could hold and use more effectively.
- Determining the firmness of stroke was problematic and it was felt that some form of calibration for setting the firmness would help. The digital canvas also had no depth or movement which felt strange to the artists (thickness of canvas has implications on the artist's strokes).
- Navigation of the (Photoshop) interface was an issue and attempting to select different tools was often frustrating due to the size of icons and attempting to perform the "click" mid-air gesture. It was also difficult for all artists to get a sense of where the brush was located on the screen (especially when starting a new session).
- Continuous line drawing and brushing was challenging - the brush would often come away from the canvas which would result in unintentional blank spaces. Painting with mid-air gestures on a digital canvas also lacked the pencil and brush reactions you would get on paper or a traditional canvas (i.e. the process of mid-air painting *felt* strange).
- One of the disabled artists found that using opacity control could simulate brushwork via the use of mid-air gesturing, but commented that it was not nearly as responsive as using a Wacom or Intous tablet.

In discussions with the artists they made several suggestions about what an application would need to make it more usable for themselves and other disabled artists:

- The interface design used in mobile and tablet drawing applications could be more appropriate for Leap Motion software as they tend to focus only on essential features and have a more simplistic and minimalistic design.

- Voice commands to set and control different tools would help to create a more fluid interaction and avoid the cost of having to navigate to specific tools with a cursor.
- Brushes and erasers need to have lots of options that are easily accessible via mid-air gesturing to create a more complete tool.
- Disabled users with physical impairments need to have a simple operating system (the Photoshop interface was too complex).
- The range of motion (brush strokes) needs to be adapted (e.g. the ability to flick paint or dabbing of a paint brush).

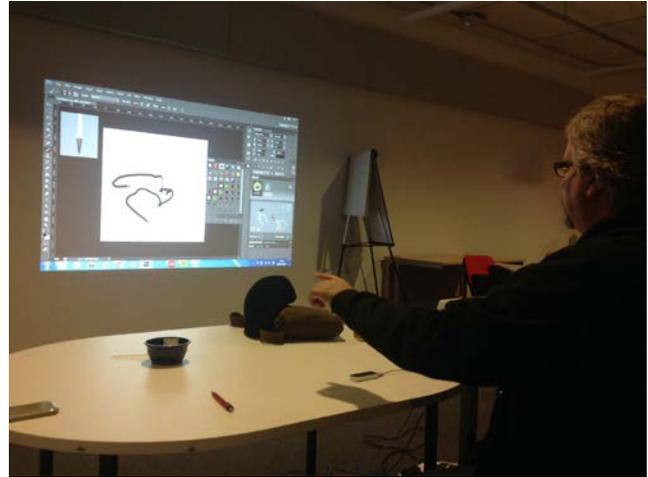


Figure 1. Disabled artist using the Photoshop Ethereal application

4. CONCLUSION

It is clear from the evaluations that the current design of the Leap Motion applications tested are not well suited for artists with physical impairments. Photoshop, for instance, had too many options and it was difficult to select different tools due to the small size of icons and difficulties in performing the appropriate selection gestures. New interface designs and specialist applications are required to help support disabled artists using mid-air gesturing tools for artistic purposes. Our work in this field is ongoing and we are currently exploring novel design approaches and developing new tools that better support disabled artists which we will evaluate in longitudinal user studies.

5. ACKNOWLEDGMENTS

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