Bubble Keyboard: A Gesture-Based Mid-Air Text Entry Method Designed for Minimized Motion and Increased Speed Utilizing Microsoft Kinect

# ABSTRACT

In this paper we describe the formatting requirements for SIGCHI Conference Proceedings, and offer recommendations on writing for the worldwide SIGCHI readership. Please review this document even if you have submitted to SIGCHI conferences before, for some format details have changed relative to previous years. These include the formatting of table captions, the formatting of references, and a requirement to include ACM DL indexing information.

## Author Keywords

Bubble Keyboard, Text Entry, Mid-Air, Gesture, Kinect, Trigram, Trie.

## ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

# INTRODUCTION

Recent progression of Mid-Air Platforms such as Microsoft Kinect and Leap 3D has brought forth a need for text entry systems that function along with these platforms. Currently these Text Entry programs are utilized for typing small phrases or keywords for search in applications from social media networking such as Twitter to Entertainment such as XBOX Live or Netflix as these applications are commonly used in a living room setting without an actual controller. Text Entry on these platforms currently employs basic gesture techniques for character selection. The general text entry structure used in the industry is best described by that of Evoluce, whose keyboard includes a display QWERTY keyboard and a pointer which is controlled by the position of your hand and a forward gesture to select letters. However, other non-standard keyboards have been created by members of the public, many of which can be seen on YouTube.

However, the systems currently used in the industry do not use the greater potential of gesture based analysis. Little research has been done on the potential of more gesture dependent text entry systems in contrast with more position dependent text entry systems. Also, a combination of prediction algorithms when used in conjunction with these more gesture dependent systems can further improve their potential. This research demonstrates the possible improvements that could be made for mid-air text entry systems if we utilized more gesture dependent text entry systems. The potential of more gesture dependent text entry systems could yield inputs with minimalized, faster, and simpler motion. Furthermore, current methods offer difficulty for users with fine motor control impairments as locating and maintaining a hand position is exceedingly difficult.

This paper presents the Bubble Keyboard, a new keyboard designed by us with the specific intention of using these gesture based systems and prediction algorithms to minimalize speed and increase motion, in contrast to a model of the industry standard. The Bubble Keyboard consists of two concentric rings of letters equidistant from a center point where the outer ring is a static representation of the entire alphabet and the inner is a variable representation of the most probable letters. Selection of letters is done by passing the cursor, which is controlled by the user’s hand, over the desired bubble in a wave rather than placing the cursor over the letter and making a selection gesture as done in the industry model. Other functions, such as Backspace and Shift, are done through gestures rather than button selection. The letters displayed in the inner ring are calculated through a trigram algorithm composed with a Trie (or prefix tree) auto-completion algorithm. The end result being a fluid system that feels natural to the user and minimalizes motion and increases speed.

Our research demonstrates empirical results showing that the Bubble Keyboard produces text faster with a lower error rate than the conventional on-screen QWERTY keyboard. Furthermore, we can also see that … [INSERT RESEARCH RESULTS HERE].

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The first set of keywords will be used to index the paper in the proceedings. The second set are used to catalogue the paper in the ACM Digital Library. The latter are entries from the ACM Classification System [4]. In general, it should only be necessary to pick one or more of the H5 subcategories, see http://www.acm.org/class/1998/H.5.html

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Use a numbered list of references at the end of the article, ordered alphabetically by first author, and referenced by numbers in brackets [2,6,7]. For papers from conference proceedings, include the title of the paper and an abbreviated name of the conference (e.g., for Interact 2003 proceedings, use *Proc. Interact 2003*). Do not include the location of the conference or the exact date; do include the page numbers if available. See the examples of citations at the end of this document. Within this template file, use the References style for the text of your citation.

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Headings for sub-subsections should be in Helvetica 9-point italic with initial letters capitalized (Heading 3).

# FIGURES/CAPTIONS

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| Objects | **Caption – pre-2002** | **Caption – 2003 and afterwards** |
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Place figures and tables at the top or bottom of the appropriate column or columns, on the same page as the relevant text (see Figure 1). A figure or table may extend across both columns to a maximum width of 17.78 cm (7 in.).

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* Use unambiguous forms for culturally localized concepts, such as times, dates, currencies and numbers (e.g., “1-5- 97” or “5/1/97” may mean 5 January or 1 May, and “seven o’clock” may mean 7:00 am or 19:00). For currencies, indicate equivalences – e.g., “Participants were paid 10,000 lire, or roughly $5.”
* Be careful with the use of gender-specific pronouns (*he*, *she*) and other gendered words (*chairman*, *manpower*, *man-months*). Use inclusive language that is gender-neutral (e.g., *she* *or* *he*, *they*, *s/he*, *chair*, *staff*, *staff-hours*, *person-years*). See [7] for further advice and examples regarding gender and other personal attributes.
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# Conclusion

It is important that you write for the SIGCHI audience. Please read previous years’ *Proceedings* to understand the writing style and conventions that successful authors have used. It is particularly important that you state clearly what you have done, not merely what you plan to do, and explain how your work is different from previously published work, i.e., what is the unique contribution that your work makes to the field? Please consider what the reader will learn from your submission, and how they will find your work useful. If you write with these questions in mind, your work is more likely to be successful, both in being accepted into the Conference, and in influencing the work of our field.

# ACKNOWLEDGMENTS

We thank CHI, PDC and CSCW volunteers, and all publications support and staff, who wrote and provided helpful comments on previous versions of this document. Some of the references cited in this paper are included for illustrative purposes only.

# REFERENCES

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**The columns on the last page should be of approximately equal length.**

1. Note that the items in this bulleted list were formatted using the Bullet Style (in this template file). [↑](#footnote-ref-1)