Design of Time-Continuous Rating Interfaces for Collecting Empathic Responses in VR, and Initial Evaluation with VR180 Video Viewing

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Abstract

We design and assess interfaces for time-continuous self-reporting of empathic responses in VR, using dimensions of empathic concern and personal distress. Visual styles included Circular Rating Indicators (CRI), Color Dials (CD), and Interactive Curving Faces (Frowny). Input types included desktop knobs and VR controller touchpads. We considered the intuitiveness, effectiveness, and intrusiveness of designs with viewers of a stereo 180° video. Initial results highlight the CRI and Frowny as promising choices, calling for future examination of their effectiveness.

Index Terms: Human-centered computing—Human computer interaction (HCI)—Visualization Techniques

1 Introduction

The enhanced presence felt in VR can lead to stronger feelings of empathy in the user [1]. Empathy is a fundamental human trait that enables us to understand and share the feelings of others, learn from their pain, and know when to offer support. Measuring personal distress (PD) and empathic concern (EC) is instrumental in producing important outcomes such as effective empathy training, healthcare provider training, technology design for empathy, enhanced compassionate behaviors, research on emotional resilience, and so on [2]. By understanding and leveraging these empathic components, we can create more compassionate and supportive environments.

To understand users' empathic responses in a VR system, we want to enable them to report their felt PD and EC. When considering emotion rating interfaces, enabling time-continuous input is becoming more common as it allows for more dynamic responses to stimuli. For instance, Woodworth et al. identified an interactive face icon (Smiley) as a promising design choice for continuous emotion annotation [3]. While substantial research exists using emotion models like valence/arousal in VR [4] [5], the exploration of VR interfaces specifically for PD and EC is relatively unexplored.

This study explores novel interface designs for time-continuous, fine-grained reportings of EC and PD while users view 180° video within a VR headset. We introduce three visual styles with an exploratory preliminary study meant to guide future study directions.

2 Interface Design

The designs (Fig. 1) each represent emotion with two 1D visual gauges reflecting two inputs from controllers, for a PD-EC emotion model. Two controller types were considered: Vive Controller trackpads and Griffin Powermate knobs (Figure 1-d). Design objectives included ensuring interface intuitiveness to reduce required training/reminders and minimizing intrusiveness to enhance user focus on the VR content.

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This is an author-formatted version. Original publication: M. I. J. Ami, J. W. Woodworth and C. W. Borst, "Design of Time-Continuous Rating Interfaces for Collecting Empathic Responses in VR, and Initial Evaluation with VR180 Video Viewing," 2024 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW), Orlando, FL, USA, 2024, pp. 1041-1042, doi: 10.1109/VRW62533.2024.00317.

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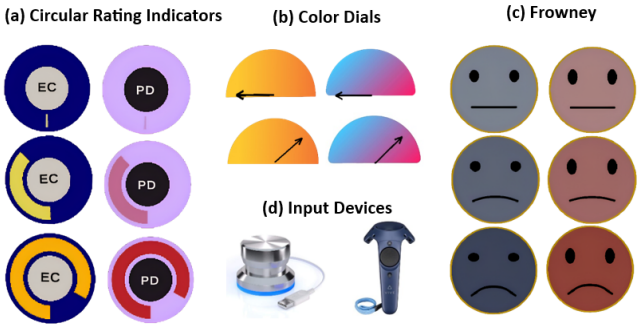

Figure 1: The three rating interfaces to annotate empathic responses. Item (d) shows two input devices that were considered for the ratings.

2.1 Visuals

Circular Rating Indicator (CRI): Two circular gauges; the left gauge has a blue background with a yellow indicator that revolves 360 degrees, showing EC level. The right slider has a light magenta background and a red indicator to reflect PD level. Color changes from light yellow to bright yellow for EC and from light red to bright red for PD, indicating the emotion's intensity. Additionally, we labeled EC and PD in the center for enhanced clarity, reducing the need for users to memorize the associations to EC or PD.

Color Dials (CD): Two semicircles with a centrally oriented arrow that rotates across their span from left to right. Each dial has a static background, with a gradient of light yellow to deep yellow for EC and blue to red for PD. The arrow's position indicates the current reported value from the controller.

Curving Face (Frowny): Inspired by the Smiley design from [3], we map PD and EC input to the mouth curves of face icons. Neutral input for PD or EC results in a straight-line mouth, while higher values induce a frown. Additionally, the PD Frowny has a light magenta hue in its neutral state, gradually transitioning to red at the highest reported PD rating. The EC Frowny is initially light lavender and shifts to dark lavender at the highest EC rating. Furthermore, the eye shape undergoes changes in accordance with EC values. This representation aims to provide an intuitive visualization of PD and EC, simplifying emotion reporting.

3D Placement of Gauges: We consider the 3D positions of gauges to be critical and also useful for reinforcing the relation of PD to the viewer and of EC to a viewed character. Depth (distance from eye) should match relevant scene elements to minimize extra eye adjustments (convergence), so it was adjusted to match the stereo video imagery. The EC gauge was positioned near the viewed character and remained static with respect to the video scene. The PD visual rotated with the viewer's head and its position remained static with respect to their view. This positioning and movement reinforces the association with the self (PD) or the other (EC).

2.2 Input Systems

VIVE Controller Trackpads: Vertical position input on VIVE controller trackpads was tested for the interfaces. For CRI and CD, this maps to neutral at the bottom and increases to the top of the trackpad.

	Training	Phase 1			
	MP	**MP**	**MI**	**ME**	**MD**
CRI	5	4	3	5	0
CD	1	0	0	0	6
Frowny	1	3	4	2	1

Table 1: Summary of training and phase 1 results, indicating the number of times an interface was rated most preferred (MP), most intuitive (MI), most effective for reporting PD and EC (ME), and most invasive/distracting (MD).

For Frowny, the input starts at neutral in the middle of the trackpad and concludes at the bottom to match the direction of the frown.

Griffin Powermate knobs: We also tested desktop knobs for input. For CRI and CD, clockwise knob motion corresponds to intensified emotion. For Frowny, anticlockwise motion increases frowning.

3 Preliminary Study

We collected feedback from 7 participants on the three visual designs and two input device types. They viewed a 60-second stereoscopic 180° video of an infant crying in a VIVE Pro Eye headset.

Training: Participants were briefed on personal distress and empathic concern concepts. Following this, a training video explained how to provide PD and EC responses simultaneously, using knobs. Subjects then tried all rating interfaces in an empty VR environment (6 combinations: 3 visual styles and 2 device types). Order was randomized per subject with the constraint that the first three used one input type and the other three used the other input type. Initial impressions were collected of the most preferred visual style.

Phase 1: Participants viewed the video three times, giving PD and EC responses, using three visual styles in random order, with one fixed input type (random). They then exited VR and provided feedback on the three visuals.

Phase 2: Participants re-entered VR to try each visual style with the other input system, for the same video. They then completed a final questionnaire that asked about all 6 combinations (considering both Phase 1 and Phase 2 experiences).

4 Results

Table 1 summarizes results from the Training and Phase 1 portions. After the empty VR environment training phase, 71.4% of participants favored CRIs, with only one participant expressing a preference for CDs and another one preferred Frowny faces. However, opinions diverged after completing Phase 1. Then, 57.1% of subjects favored CRIs, while 42.9% preferred Frowny faces. When queried about intuitiveness, similar results were produced (57.1% for CRIs, 42.9% for Frowny faces). In terms of effectiveness in capturing responses, the proportion was about 3 to 1 for CRIs and the Frowny faces, respectively. Notably, 85.7% of participants identified CDs as the most distracting interface while watching video content.

Table 2 summarizes results of the final questionnare. 57.1% of participants identified CRIs with Powermate Knobs as the most intuitive. 28.6% of participants considered the Frowny faces with VIVE controllers to be the most intuitive. Regarding rated reporting effectiveness, 71.4% of participants favored CRIs with Powermate Knobs, while the remainder chose the Frowny faces with VIVE controllers. In terms of invasiveness, all participants rated CDs with VIVE controllers as the most invasive, with CRI with Powermate Knobs, Frowny faces with VIVE controllers, and CRI with VIVE controllers reported as progressively least invasive. In the broader context, 85.7% of participants expressed a preference for the Powermate knobs for input.

Based on followup comments from participants, we speculate that findings related to CDs could indicate that the absence of labels, or some other indicator feature, makes users consider it more difficult

Phase 2: Considering Input Devices						
		MP	**MI**	**ME**	**MD**	**LD**
CRI	VC	0	0	0	0	1
	PK	5	4	5	0	5
CD	VC	0	0	0	6	0
	PK	0	0	0	0	0
Frowny	VC	2	2	2	0	1
	PK	0	1	0	1	0

Table 2: Summary of phase 2 results, indicating ratings when considering the input devices Vive Controller (VC) and Powermate Knobs (PK), and considering choice for Least Distracting (LD).

to discern which visual gauge represents which emotional dimension. Additionally, the interfaces occupy a considerable amount of space, proving distracting during the viewing of the video character. Some participants noted difficulties in controlling the arrow with the input system, hindering precision. Also notably, participant preferences for interfaces are influenced by the choice of the input system, with a significant number favoring the Frowny faces when using VIVE controllers.

5 Conclusion

This study provides initial insights into the design and user preferences for continuous rating interfaces in VR for empathic response. The findings underscore the importance of considering both visual elements and input systems. More detailed studies could assess variations of the gauges (such as labels on/off), other input devices or combinations (such as Frowny with physical vertical slider controls as input), or the success of our 3D placement approach at disambiguating EC/PD. Assessment should also consider quality of the EC/PD ratings given with such interfaces more objectively, and not just with user preferences.

A fundamental problem for time-continuous and multi-dimensional rating interfaces is that they may distract from the focus on environment content. Future work should compare the tradeoffs, in terms of rating quality, when doing simultaneous PD and EC ratings instead of separated runs, or time-continuous ratings instead of other approaches like periodic ratings.

Acknowledgments

This material is based upon work supported by the National Science Foundation under Grant No. 1815976.

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