Investigating Body Gestures as Means of Input Modalities in Microtask Crowdsourcing

Authors

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"I closely follow everything about user interface or human-computer interface: technology that makes computers closer to the way the human being actually functions." — Francois-Henri Pinault

1. Background

- Microtask workers often spend hours in front of a computer using a keyboard and mouse.
- Thus, they are prone to musculoskeletal disorders
- Exercise helps to remedy these disorders
- Low-intensity exercises can be mimicked by body movements, making them good for health.
- As a result, incorporating gesutral input into microtasking may enhance worker well-being.

2. Research Question

In terms of health benefits and usability, what gestures of the body serve as an effective form of input for crowd-sourced micro-tasks?

3. Objective

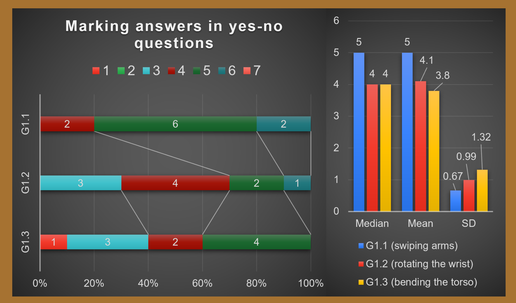
- Create a set of criteria for usable gestures.
- Discover and present gestures that are effective input in microtasking for future projects.
- Encourage projects and additional research into the use of effective body gestures as input in microtask crowdsourcing and in all HCI

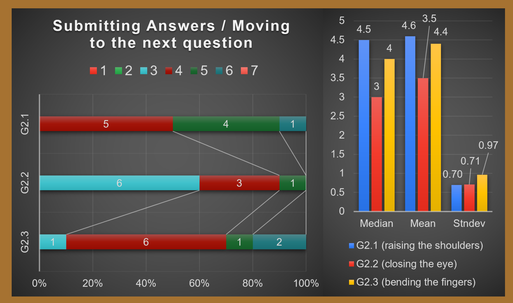
4. Methodology

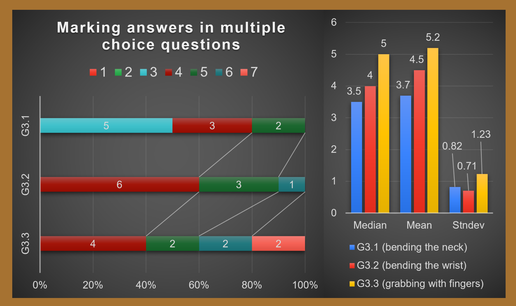
- Literature review:
  - Microtask taxonomies
  - Gesture taxonomies
  - Gesture recognition technologies
  - Health problems of computer work and their exercise based treatment
- Qualitative literature analysis:
  - To select appropriate gesture recognition technology
  - To select applicable microtask workflow elements
  - To develop criteria for suitable gestures and devise gestures that have health benefits
- Survey on the bases of literature analysis:
  - To evaluate the usability of 12 gestures for four workflow elements [1]
  - Gestures were rated on a 7-point likert scale based on three criteria: ease of use, tolerance for error, effectiveness
  - The scores were combined into an overall usability score for each gesture
  - Prolific was used to recruit participants (N=10)
  - Webcam based gesture control were employed
  - The participants were shown webcam recordings of a person performing the gestures to experience the use of gesture control in microtasking vicariously
- Finally, effective gestural input options in the form of gesture-command dictionaries were determined.

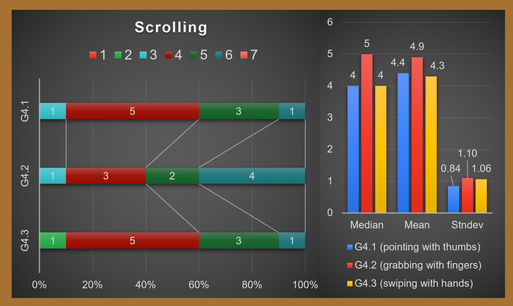
5. Results

- N=10 responses were received
- Participants aged 18-25 (80%), 25-30 (10%), 50-60 (10%) with an average of 1-2 years of experience in crowdsourcing
- Gestures were ranked and compared for each workflow element based on usability scores. See the charts for the results.









- The usability ranking of gestures
  - for answering yes or no: G1.1, G1.2, G1.3
  - for submitting answers: G2.1, G2.3, G2.2
  - for marking answers in ab MC questions: G3.3, G3.2, G3.1
  - for scrolling: G4.2, G4.1, G4.3
- Continuous gestures have been found to be more usable than discrete ones.
- Dynamically preferred over static ones.
- Gestures involving the hands, fingers, and arms are perceived to be more usable than gestures involving head, eye, and torso movements.

6. Discussion

- Since effectiveness conveys both usability and health benefits, the usability ranking is not insufficient to tell which gestures are the most effective
- Three gesture-command dictionaries were presented based on the survey results.
- Since health impacts were not quantified in this study, we assumed equal health benefits for all gestures.
- Thus, when comparing individual gestures, higher usability scores correspond to greater effectiveness
- However, by placing less emphasis on usability, gesture-command dictionaries were created to remedy a wide range of bodily discomforts.
- These combinations of gestures serve as effective input in microtasking:
  - G1.1-G2.1-G3.2-G4.2
  - G1.1-G2.1-G3.3-G4.1
  - G1.1-G2.3-G3.3-G4.3

7. Limitations

- The applicability of our results is limited to the populations of the OECD countries due to Prolific's availability
- Statistical power issues, inability to generalize results due to small sample size of N = 10
- Limited prior research on microtask workflows and taxonomies.
- Due to the lack of a true gesture control system, there is a lack of objective usability data. Participants evaluated gestures after imitating what they saw in the recordings.
- Due to time and budget constraints, no other viable gesture recognition technology was thoroughly investigated.
- The health benefits of gestures are not supported by substantial evidence.
- Since the health effects of gestures were not quantified, all gestures were assumed to be equally health promoting.

8. Future Work

- Potential advancements in this research:
  - Increase the sample size to increase statistical power
  - Quantify the health impact of gestures
  - To evaluate effectiveness, combine health impact scores with usability
  - Use real gestural interfaces to collect objective usability data on gestures and improve the reliability of subjective assessment
- The primary contribution of this study is the establishment of new research directions. We recommend exhaustively investigating the health-improving potential of gestural input not only in microtasking but in all human-computer interaction.

Terminology

Microtask crowdsourcing: the practice of decomposing a large-scale task into numerous, small, and quick microtasks that are then distributed to an unidentified, large group of workers.
Body gesture: a form of nonverbal communication in which physical movements communicate particular messages
Dynamic gesture : gesture in which meaning is conveyed through motion of body parts
Static gesture: gesture in which meaning is conveyed through the inclination or rotation of body parts
Discrete gesture: gestures that automatically associate a change in the system with the entire gesture
Continuous gesture: gestures that yield data that is mapped at each time instant to a state change in the system.

References

[1] https://docs.google.com/document/d/1NIKPzx1WwP2ZMG3kN5E28Lr-V9SF7vXnA_6gvARqp1g/edit?usp=sharing