

Annotations of Maps in Collaborative Work at a Distance

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Abstract

This thesis inquires how map annotations can be used to sustain remote collaboration. Maps condense the interplay of space and communication, solving linguistic references by linking conversational content to the actual places to which it refers. This is a mechanism people are accustomed to. When we are face-to-face, we can point to things around us. However, at a distance, we need to recreate a context that can help disambiguate what we mean. A map can help recreate this context. However other technological solutions are required to allow deictic gestures over a shared map when collaborators are not co-located. This mechanism is here termed Explicit Referencing.

Several systems that allow sharing maps annotations are reviewed critically. A taxonomy is then proposed to compare their features. Two field experiments were conducted to investigate the production of collaborative annotations of maps with mobile devices, looking for the reasons why people might want to produce these notes and how they might do so. Both studies led to very disappointing results. The reasons for this failure are attributed to the lack of a critical mass of users (social network), the lack of useful content, and limited social awareness. More importantly, the study identified a compelling effect of the way messages were organized in the tested application, which caused participants to refrain from engaging in content-driven explorations and synchronous discussions.

This last qualitative observation was refined in a controlled experiment where remote participants had to solve a problem collaboratively, using chat tools that differed in the way a user could relate an utterance to a shared map. Results indicated that team performance is improved by the Explicit Referencing mechanisms. However, when this is implemented in a way that is detrimental to the linearity of the conversation, resulting in the visual dispersion or scattering of messages, its use has negative consequences for collaborative work at a distance. Additionally, an analysis of the eye movements of the participants over the map helped to ascertain the interplay of deixis and gaze in collaboration. A primary relation was found between the pair's recurrence of eye movements and their task performance.

Finally, this thesis presents an algorithm that detects misunderstandings in collaborative work at a distance. It analyses the movements of collaborators' eyes over the shared map, their utterances containing references to this workspace, and the availability of 'remote' deictic gestures. The algorithm associates the distance between the gazes of the emitter and gazes of the receiver of a message with the probability that the recipient did not understand the message.

Keywords: Computer-Mediated Communication, Computer-Supported Cooperative Work (CSCW), Deictic Gestures, Eye-Tracking, Human-Computer Interaction (HCI), Location-Based Services, Map Annotations, Remote Deixis, Spatial Cognition.

Riassunto

Questa tesi studia come le annotazioni di carte geografiche possano essere utilizzate per favorire il lavoro collaborativo a distanza. Le mappe condensano l'interazione dello spazio e della comunicazione, risolvendo in tal modo i riferimenti linguistici attraverso la congiunzione di contenuto comunicativo ai siti ai quali questo si riferisce. Questo è un meccanismo divenuto familiare. Quando siamo faccia a faccia, possiamo indicare gli oggetti che ci circondano, ma quando interagiamo a distanza, dobbiamo ricreare un contesto nel quale disambiguare le nostre intenzioni comunicative. Una carta geografica può aiutare a ricreare questo contesto, ma altre soluzioni tecnologiche sono necessarie per consentire a dei collaboratori distanti di potersi scambiare dei gesti dimostrativi su una mappa condivisa. Un tale meccanismo viene qui definito come Riferimento Esplicito.

La tesi analizza diversi sistemi che consentono di condividere le annotazioni di mappe. Uno schema tassonomico è quindi proposto per compararne le loro caratteristiche. Due osservazioni sul campo sono state condotte per investigare la produzione di annotazioni collaborative di carte geografiche attraverso dispositivi mobili. Si sono così cercate le ragioni per le quali possibili utilizzatori possano voler produrre tali note e come. Entrambi gli studi hanno condotto a risultati deludenti. Le ragioni di questo insuccesso sono state attribuite alla mancanza di una massa critica di utilizzatori, alla mancanza di contenuto utile e ad una limitata esposizione sociale che l'applicazione consentiva. In particolare, lo studio ha rivelato un effetto di sopraffazione relativamente alla maniera nella quale i messaggi erano organizzati nell'applicazione testata, che ha impedito ai partecipanti di esplorare i messaggi del sistema in base al loro contenuto e di avere discussioni in tempo reale.

Quest'ultima osservazione qualitativa è stata raffinata in un esperimento di laboratorio dove partecipanti, interagendo da stanze differenti, hanno dovuto risolvere un problema in collaborazione, utilizzando strumenti di discussione testuale che differivano nella possibilità offerta da taluni di poter collegare un messaggio alla mappa condivisa. I risultati hanno indicato che le prestazioni di gruppo sono state migliorate grazie al meccanismo di Riferimento Esplicito. In particolare, quando questo è implementato in una maniera che disturba il filo della conversazione, disperdendo visivamente i messaggi, il suo utilizzo ha conseguenze negative per il lavoro collaborativo a distanza. Inoltre, un'analisi dei movimenti oculari dei partecipanti sulla mappa ha consentito di verificare l'interazione dei dimostrativi utilizzati e lo sguardo nella collaborazione. Una relazione fondamentale è stata individuata tra similarità dei movimenti oculari dei partecipanti e le loro prestazioni.

Infine, questa tesi presenta un algoritmo che rileva possibili fraintendimenti nel lavoro collaborativo a distanza. L'algoritmo analizza i movimenti oculari dei collaboratori sulla mappa condivisa, i messaggi scambiati contenenti riferimenti a questo spazio di lavoro, e la produzione di gesti dimostrativi tramite il Riferimento Esplicito. L'algoritmo associa la distanza tra i movimenti oculari del mittente e del ricevente di un messaggio con la probabilità che il ricevente non lo abbia compreso.

Parole chiave: Comunicazione Mediata dall'ordinatore, Lavoro Cooperativo Assistito dall'ordinatore, Gesti Dimostrativi, Movimenti Oculari, Interazione Uomo-Macchina, Annotazione di carte geografiche.

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