

# Using Glyphs to Visually Analyse Spatio-Temporal Patterns in Non-Verbal Behaviour Dynamics

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## Abstract:

Understanding non-verbal behaviour (NVB) has significant implications for disciplines such as social sciences, psychology and education. In the context of educational research, computer-supported collaborative learning (CSCL) has emerged as a promising approach to improve the analysis of student engagement and learning outcomes (Paneth et al., 2023). Many important aspects of NVB, such as body movements and gestures or space usage in general, are spatio-temporal phenomena, and visual analysis offers a methodology to study these patterns and dynamics.

We utilise visual analytics to investigate the dynamics of group interaction in a CSCL environment. Using state-of-the-art computer vision techniques (see Lugaresi et al., 2019), we extracted high-resolution time series of 3D faces, hands and body landmarks from video recordings of small student groups during group work. Applying various data transformation and aggregation methods, we obtained, for example, gaze directions, the overall head movement, as well as hand and pose configurations including the individual translational and rotational components as signals of interest. To facilitate the visual analysis of the multidimensional temporal patterns, we explore different glyph designs that contain multiple visual variables and are arranged on a quasi-2D temporal grid. The glyphs can aggregate data over dynamic, user-controlled time intervals and offer the possibility to analyse the signals at different temporal resolutions. Figure 1 demonstrates this approach by analysing the participants' viewing directions to each other and to the computer.

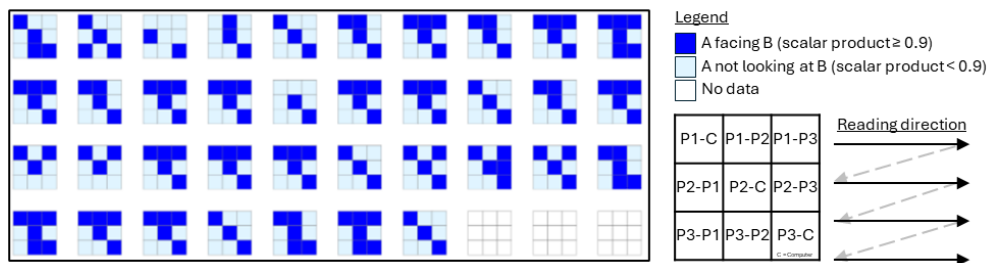


Figure 1. Abstract 3x3 square glyphs to represent the direction of participants' gaze. Aggregation into 1-minute intervals using mean as statistical parameter.

First results show the effectiveness and limitations of different glyph-based visualisations in analysing the complex spatial and temporal dynamics of non-verbal behaviour in CSCL environments. We find that it is important to interdisciplinary discuss visual analysis techniques to improve the understanding of group interactions and support educational research.

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## References

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