Investigating grouping behaviour of dancers in a silent disco using overhead video capture

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Introduction

Music plays an important role in the development of social behavior (Kirschner & Tomasello, 2009). Group dancing is shown to induce pro-social feelings and behaviour (Philips-Silver & Keller, 2012).

Silent discos provide an ecologically valid environment to investigate music-driven social interaction. Setting up a silent disco event can be done at relatively low cost compared to maintaining a motion-tracking laboratory, and allows for a greater number of participants to interact at once. *Can overhead video be used as a data source to reliably investigate the interaction of music and social behaviour?*

We presented participants with a playlist consisting of earworms, catchy tunes that run continually through a person's mind, and matched controls. *How do earworms affect grouping behaviour?*

Methods

Video data was recorded using a camera suspended above the dance floor at an angle. Audio streamed to the headphones was recorded simultaneously.

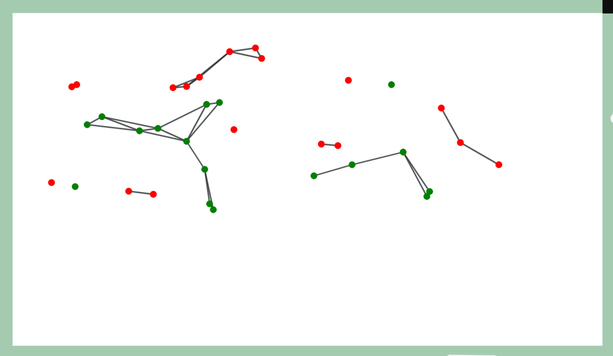
The stages of data processing are shown below.

Capture video frames, sample one in every ten frames (2.5 frames / sec.)

Mask environment features to reduce noise

Contour modelling: edge detection using Otsu's (1979) method for each colour layer

Define centres of contours



Create undirected graphs. Connect the centres whose proximity is below a set threshold.

Graph analysis

Local clustering: how interconnected are my neighbours?

Global clustering: the ratio of triangles to connected triplets.

Vertex degree: the number of connections per vertex.

Results

The presented methods yield consistent measures for multiple datasets. However, the used measures are sensitive to the number of participants present, with fewer participants the amount of noise increases.

We created a linear model with a two-level factor for group and a 30-level factor for time (approx. eight minutes per segment).

Table 1. Effect sizes (partial η^2) for local, global clustering, and vertex degree showing main effects for Group and Time, and interaction effects.

	Group	Time	Group × Time
Local	0.08	0.27	0.05
Global	0.01	0.09	0.03
Vertex degree	0.29	0.55	0.25

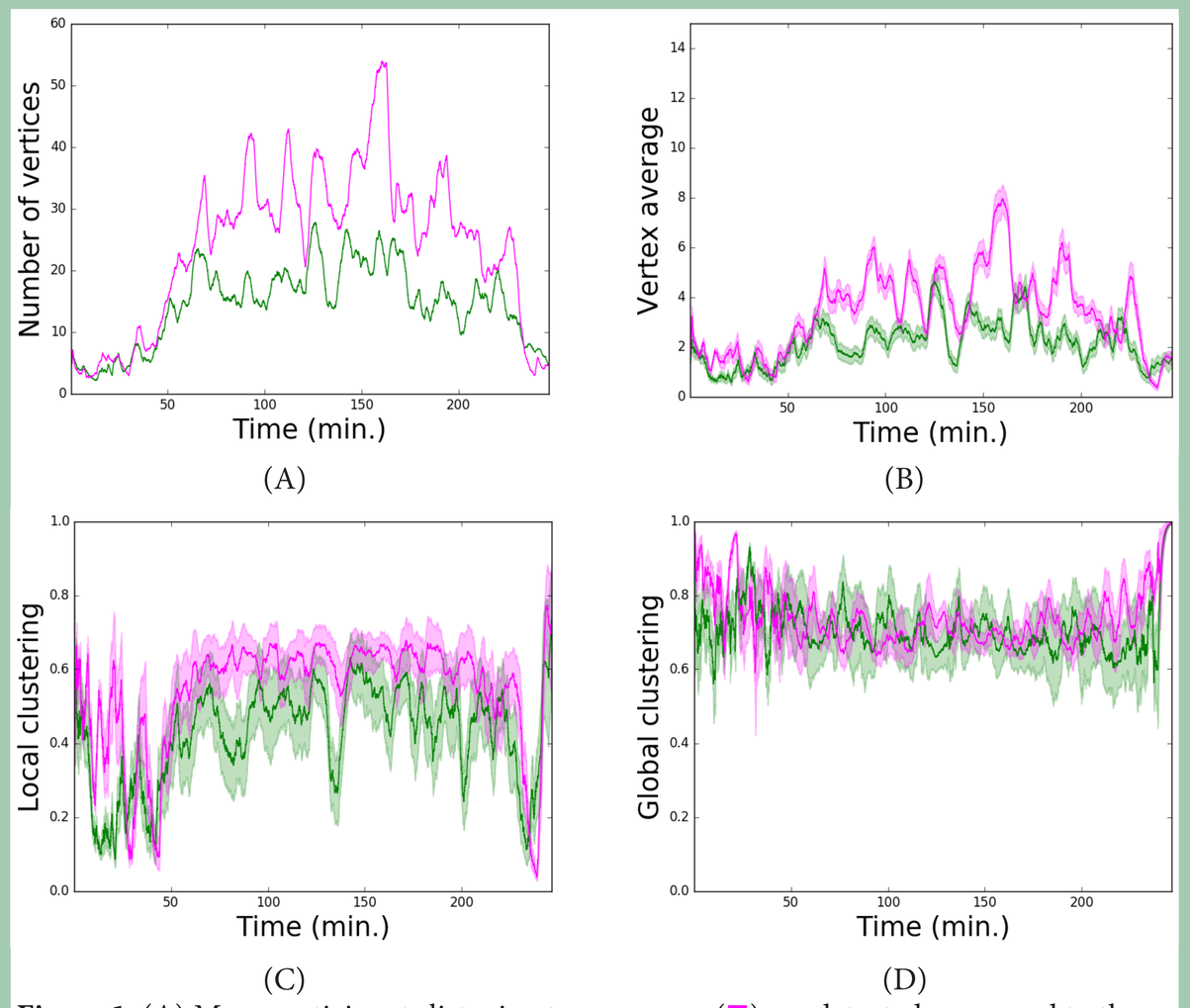


Figure 1. (A) More participants listening to earworms (■) are detected compared to the control group (■). Additionally, the earworm group is more connected (B) and locally clustered (C) compared to the control group. Global clustering (D) is less stable and shows different trends over time.

Conclusion & Discussion

The presented methods allow us to investigate grouping behaviour in a musical environment. Local clustering shows stability over time and has been used to describe social networks. Participants listening to earworms are more grouped than those listening to matched controls, this could be explained by the memorability of earworms.

Possible improvements include using music as a guide to times of interest (eg. transitions between songs) and integrate (meta-) musical features, constraining segment length in statistical analysis, and correcting for the number of participants. Further development will also allow for more detailed investigation of grouping, individual movement and channel switching behaviour.

References

Kirschner, S., & Tomasello, M. (2009). Joint Drumming: Social Context Facilitates Synchronization in Preschool Children. *Journal of Experimental Child Psychology, 102*(3), 299–314.

Otsu, N. (1979, jan). A Threshold Selection Method from Gray-Level His- tograms. *IEEE Transactions on Systems, Man, and Cybernetics , 9* (1), 62–66.

Phillips-Silver, J., & Keller, P. E. (2012). Searching for Roots of Entrain- ment and Joint Action in Early Musical Interactions. *Frontiers in Human Neuroscience, 6*, 1–11.