

User evaluation of the effectiveness of geoprocessing tools for football data visualization

by JOEL SALAZAR



Geovisualizations offer a powerful way to capture the dynamic nature of football games through spatiotemporal analysis and visualization [1][2], enhancing the perception and understanding of tactics in football. Nevertheless, geoprocessing tools such as Nearest Distance calculation, Voronoi diagrams, and Convex Hull have mainly been used in football research for data analysis rather than visualization.

Therefore, when these tools are used for visualization, the question is: *How effective are geoprocessing tools on football understanding in users with football knowledge and non-football knowledge?*

METHODOLOGY

To answer this question, I designed four animations showing a counter-attack football event of 30 seconds from a real game [3]. Three animations used one of the geoprocessing tools considered (Nearest Distance calculation, Voronoi diagram, and Convex Hull), and one was a raw animation for comparison (see Figure 1).

To evaluate the visualizations, I designed a user experiment that collected information from each participant. The tool selected was an online survey divided into five sections. The first three consisted of informed consent, demographics (sex and age), and a football knowledge section to filter the participants into knowledge and non-knowledge groups. The fourth section was training to familiarize the participants with the stimuli. The evaluation section consisted of a specific questionnaire for each of the animation. Based on the literature review, I selected six parameters to evaluate the users' understanding of football tactics: playing formation, dominant region, playing space, attacker-defender distance, the relative distance for a defender to intercept a shot, and the distance between teammates.

RESULTS

The survey collected data from 109 participants. Participants with football knowledge represent 64% of the sample (n=70). The sample remaining 36% (n=36) represent participants with non-football knowledge. The effectiveness criteria were the difference between correct answers from the animation with the geoprocessing tool and the raw animation. Results show that the Nearest Distance calculation is

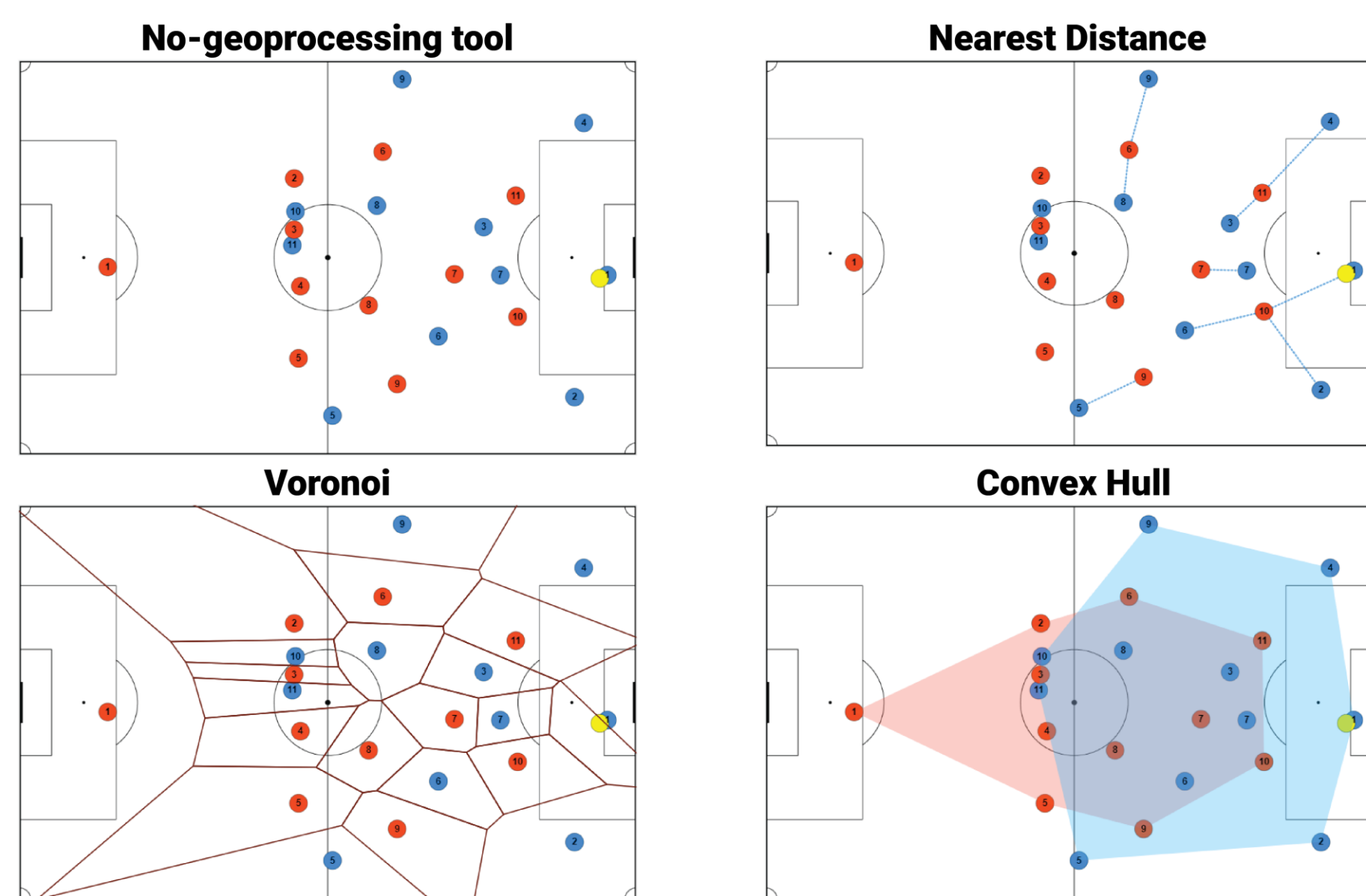


Figure 1. Examples of the animations used for the evaluation. Follow the QR code to see the motion animated geovisualizations.

more effective in visualizing a team's playing formation and the players' attacker-defender distance. The Convex Hull is more effective for visualizing the playing space of a team. The Nearest Distance calculation is ineffective for visualizing a defender's relative distance to intercept a shot. The remaining parameters, such as the dominant region and the distance between teammates, show variations in results, either positive or negative effectiveness, in each group.

Figures 2 and 3 shows the results for each football knowledge group. The parameters considered that had positive effectiveness in both groups were the playing formation and the attacker-defender distance of players when using the Nearest Distance tool. The Convex Hull is more effective for visualizing the playing space of a team.

Football knowledge group Percent correct

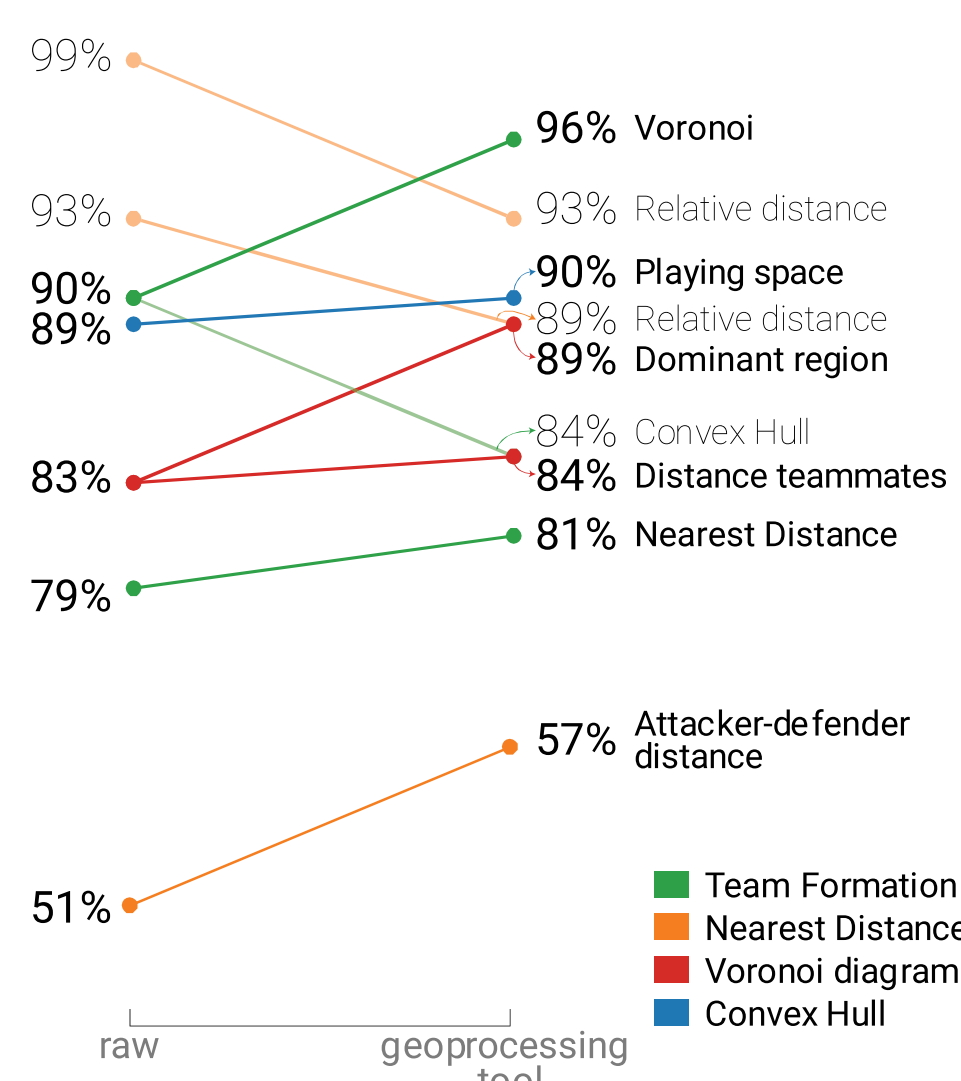


Figure 2. Results for the football knowledge group (n=70). Positive improvement in correct answers are highlighted.

Non-Football knowledge group Percent correct

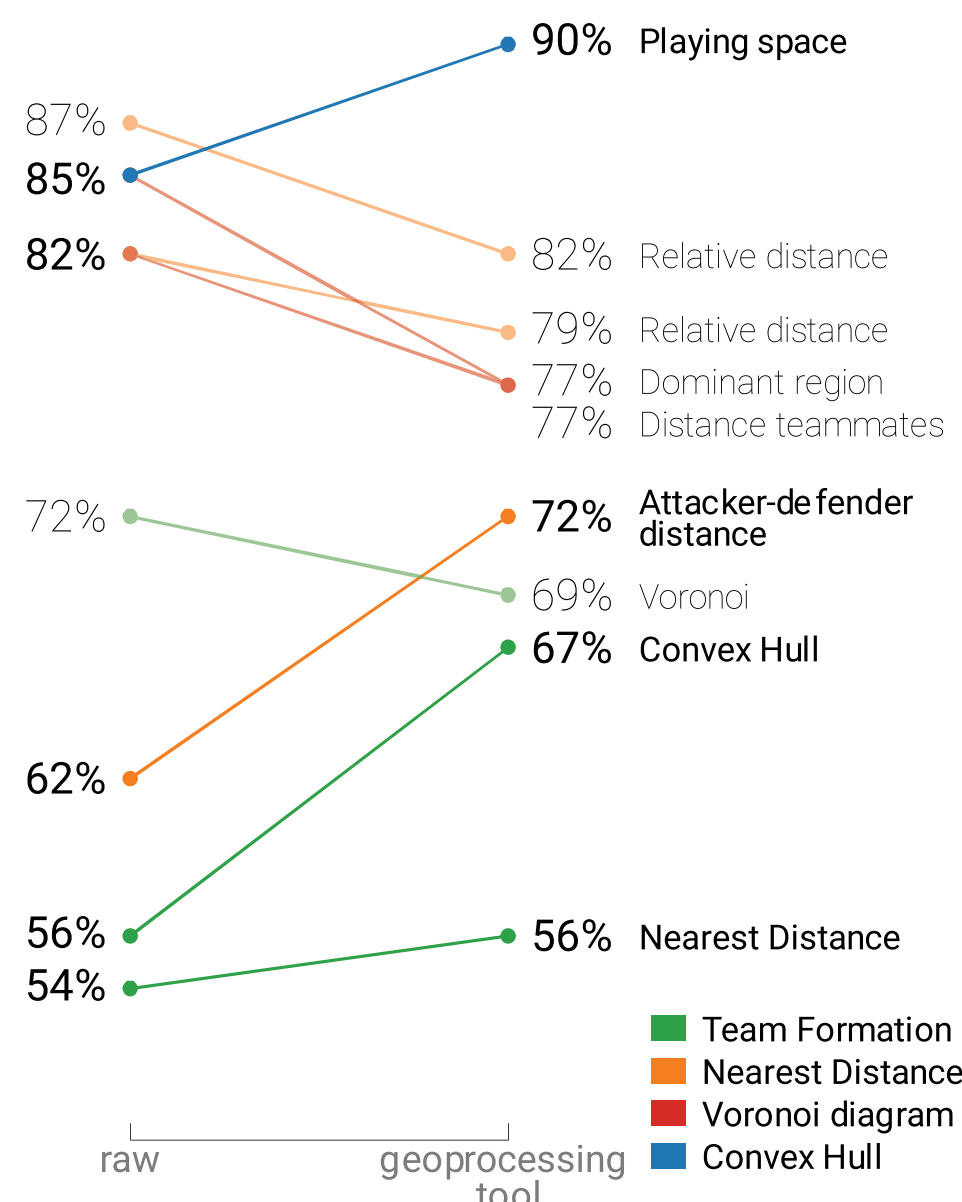


Figure 3. Results for the non-football knowledge group. The graph shows the percent of correct answers compared between the raw and the geoprocessing tool animation.

CONCLUSION

Results show differences between groups analyzed when visualizing football tracking data with specific geoprocessing tools. Each geoprocessing tool analyzed proved effective for specific football understanding parameters and a specific knowledge group. Therefore, when considering using a geoprocessing tool for visualizing football data, it is necessary to consider the football understanding parameter that will be depicted. Further implementations can explore a user interface to provide users with more interaction and pseudo-manipulation of data. These results close the gap between cartography and football data analysis and serve as a reference for further cartographic visualization research.

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KEYWORDS

Geovisualization, Football data, Nearest Distance calculation, Voronoi diagram, Convex Hull



To see the animations follow the QR code

REFERENCES

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