Abstract - Optimization for Digital Workspace: The Planetary Map

Group Member: 1007522968 Phyllis Wu | 1012454988 Lynn Li

This paper presents the ***Planetary Map***, an innovative visualization system designed to diagnose digital workflow inefficiencies and guide workspace optimization.

In the contemporary digital age, professionals rely on flexible digital workflows that necessitate constant navigation across applications and information sources. This flexibility comes with hidden cognitive costs. Interruptions, especially those occurring at inopportune moments, impose significant cognitive penalties and hinder productivity (Züger & Fritz, 2015). The real challenge is that human attention is invisible and difficult to measure, yet understanding it is key to creating more effective digital work habits. Existing tracking tools, such as Apple Screen Time, quantify time spent in applications but fail to reveal how attention shifts or where friction occurs during transitions.

Process mining emerged as a field focusing on analyzing end-to-end workflows by extracting knowledge from event logs to discover, monitor, and improve processes (van der Aalst, 2012; Miksch et al., 2024). However, it is process-centric and emphasizes system performance rather than individual human cognitive flow or attention (van der Aalst, 2012). In parallel, research in workplace psychology has examined the link between environment and productivity, yet this remains limited to physical factors and tends to apply a one-size-fits-all approach (de Sousa et al., 2018).

This study aims to answer: How can human attention be effectively visualized and quantified within a digital workspace to reveal inefficiencies and cognitive costs associated with context switching? Situated at the intersection of Human-Computer Interaction, Process Mining, and Information Visualization, this work adopts an individualized, human-centred perspective on the digital workspace.

The methodology involves developing the ***Planetary Map***, a prototype visualization system inspired by Time Curves (Bach et al., 2016). It processes user event logs into an attention-centric model that quantifies where a user's focus is directed, intentionally differentiating itself from system-performance-focused techniques. The map visualizes workflow as a path through a prescriptive "planetary system" of digital tools (see Figure 1 for an example), where concentric orbits define tool importance, planet size represents relative time spent, and path texture visualizes the "Cognitive Friction" of each context switch. The primary contribution is this visualization technique itself, offering a rich, qualitative view of digital work previously hidden in raw data and providing actionable guidance for optimizing workspace efficiency. Validation will involve expert evaluation through case studies to assess interpretability and the ability to generate actionable insights.

We acknowledge key limitations. The methodology is constrained to a single-device workspace, intentionally excluding external interruptions from physical engagement or other devices. The primary risk is potential user misinterpretation of the visualization; therefore, refining the visual language for clarity will be a key focus of the user study, establishing a foundation for future work in more complex, multi-device environments.

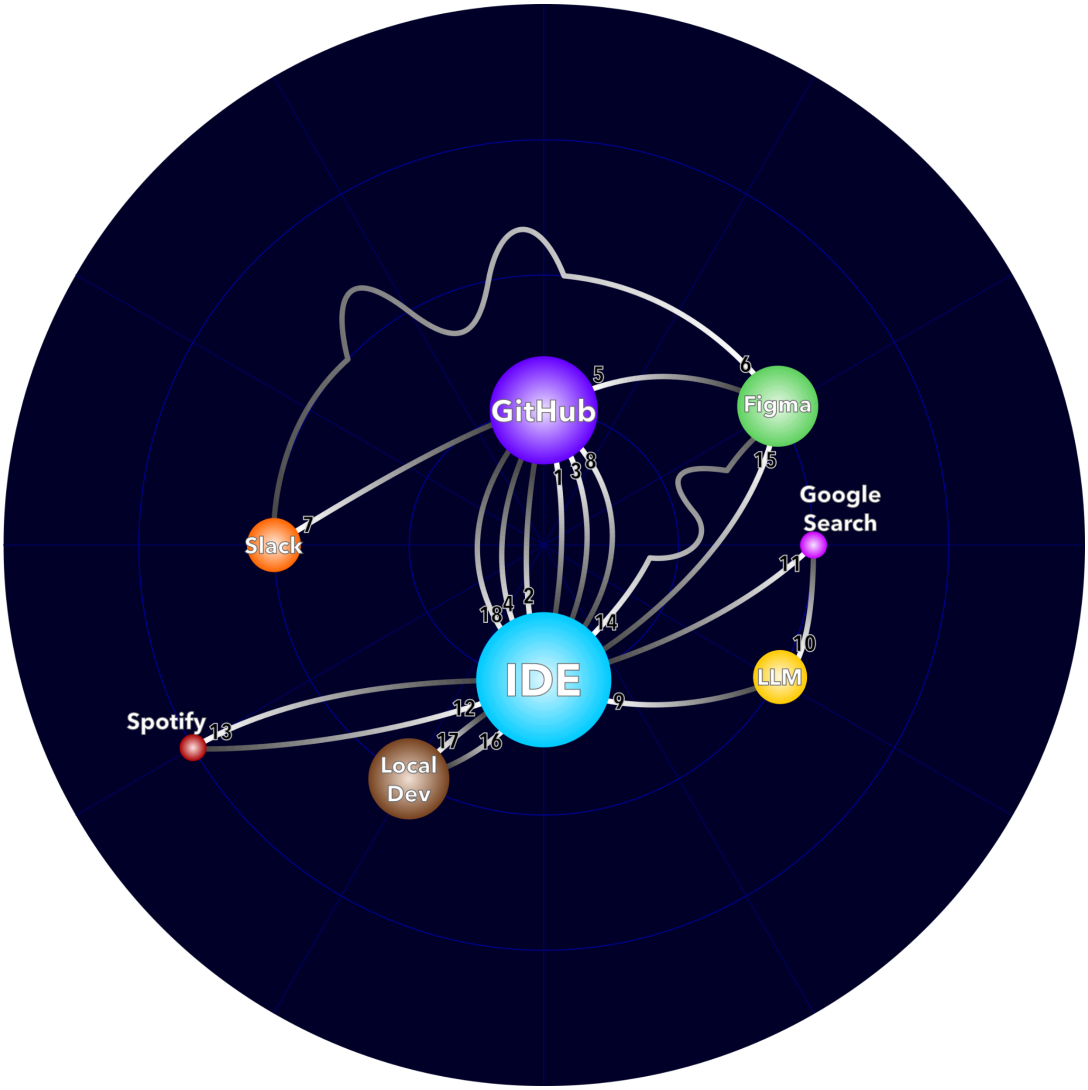

Figure 1. Planetary map of the mock data for a frontend engineering task

References

1. van der Aalst, W. (2012). Process mining. ACM Transactions on Management Information Systems, 3(2), 1–17. https://doi.org/10.1145/2229156.2229157
2. Miksch, S., Di Ciccio, C., Soffer, P., & Weber, B. (2024). Visual analytics meets process mining: Challenges and opportunities. IEEE Computer Graphics and Applications, 44(6), 132–141. https://doi.org/10.1109/mcg.2024.3456916
3. Züger, M., & Fritz, T. (2015). Interruptibility of software developers and its prediction using psycho-physiological sensors. Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems, 2981–2990. https://doi.org/10.1145/2702123.2702593
4. de Sousa, Alexandra & Paradise, Caroline & Proulx, Michael & Jicol, Crescent & Esenkaya, Tayfun & Hynes, Ruth. (2018). The psychology of workplace design.
5. Bach, B., Shi, C., Heulot, N., Madhyastha, T., Grabowski, T., & Dragicevic, P. (2015). Time curves: Folding time to visualize patterns of temporal evolution in data. IEEE transactions on visualization and computer graphics, 22(1), 559-568.