# Time-geographical design and analysis of user interaction in virtual environments.

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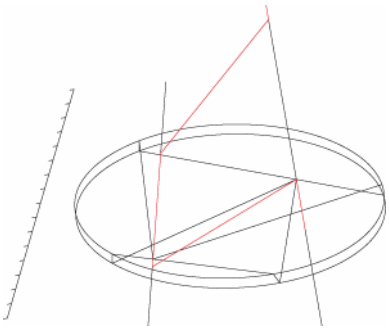
Using a method adapted from spatial sociology and regional geography, a visualization technique is presented offering powerful ways of displaying user behaviour in interactive environments, and based on these visualizations, to make improvements in design and narrative.

Time-geography was originally conceived by Swedish prof. Torsten Hägerstrand in the late 1960's. It is both a scientific method for sampling or simulating empirical material related to people's movement and activities in time-space, as well as a set of powerful visualization models to graphically represent and aid analysis of this data. Time-geography sets out to construct a perspective on the way people and objects occupy space and interact over time with each other, their surroundings and time itself. It offers a means to study and represent processes and their development within a certain space without decontextualizing them or reverting to treating them as statistical aggregates.

One basic element of the time-geographical visualization model is the individual path. This trajectory is used to represent movement between, for example, different physical and abstract locations or states in a system. The path is a continuous line that extends and grows as time flows.



Each object, including a person, is treated as a particle occupying a space-time coordinate. In other words, the movement of the particle is measured in both time and space. This means that if a particle remains at a certain physical location, its coordinates will still change along the time axis. A visualization of the particle's movement in time-space is the individual path.

By recording user movements as well as actions in the setting of a computer game or interaction with structured quanta of digital information such as a web site, a vast and highly detailed dataset can be gathered. By using the time-geographical method, this data will be temporally and spatially organized, revealing not only user navigation and the order in which user choices take place, but also the time spent between each choice. The data will tell us the amount of time spent in each state or physical location, as well as where, in the chain of events that make up user behaviour, this time is located. A visualization like this reveals the causality of the user experience and thus exposes the strengths and weaknesses of any interactive design.

Today, it is a common practice to use focus groups during development, to assess design and concepts. While this is a good method in many ways, we argue that problems arise in the gathering and analysis of the groups' feedback. Often the data produced by a focus group is either in the form of testimonies by interview or written texts, or standardized forms where users grade various components of the design and or narrative. This gives a general idea of areas where problems in for example a games design are most likely to appear. Unfortunately, this is about as precise as it gets. Because most of the data is gathered post- session, the users have to rely on how they remember and recollect their gaming/interaction experience. Details like for example causality, are often lost in the process of recollecting ones own actions.

With the method we suggest, the data is instead gathered in real time, at application level. The level of detail is highly increased, and the integrity of causality is kept intact..

In effect, valuable production time spent on iterations of prototyping, usability testing, level design and information structuring can be greatly reduced, offering a smoother and more reliable production cycle. As an analysis tool the method provides many new possible ways of understanding user behaviour.

At this point, experiments are being carried out to construct a middleware software product that gathers data from live user interaction. The software then creates visualizations using specialized versions of the time-geographical representational models.

## References

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