

Time Flies Like an Arrow: Layers of Time in Geographic Information Science

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“Time flies like an arrow” is a sentence famous for having more than one reading. This keynote borrows that ambiguity as a way of reflecting on different meanings of time in Geographic Information Science.

Read one way, it invites us to look back at how quickly time has passed. Thirty-five years have passed since GISA was founded, and ten since IAG’i began. Looking back on these years from a personal perspective, I reflect on how GIS in Japan has changed, often in response to major disruptions; natural disasters and the COVID-19 pandemic have repeatedly changed the questions we ask of geographic information, while pushing us toward finer temporal resolution and more immediate observation and response.

Read another way, the arrow draws attention to how we represent and transform space and time. Today, dense streams of space-time data can describe human activities and geographic phenomena at increasingly finer temporal scales. Yet finer spatial and temporal resolution does not necessarily make change easier to understand. Revisiting old topics on space-time data transformation, I use COVID-19 data to show how different transformations can reveal different aspects of change, including directions, trends, and cycles. The point is not simply that space and time should be transformed, but that GIScience needs a more systematic understanding of such transformations: how they can be organized and chosen, and what each transformation reveals, preserves, or obscures.

Finally, geographic time extends far beyond the high-frequency data of the present.

Geographic processes unfold across very different temporal scales, from minutes and days to decades and centuries, while historical and geographic sources often refer to time and space only approximately, incompletely, or ambiguously. New computational methods, including GeoAI, are expanding our ability to reconstruct long-term change and connect information across these different temporal layers. At the same time, they make questions of temporal scale, reference, uncertainty, and representation increasingly important.

Time may fly like an arrow, but geographic information contains many forms and layers of time. Understanding how they should be represented, transformed, and connected remains a fundamental challenge for Geographic Information Science.