

# Conversations in time: interactive visualization to explore structured temporal data

by Earo Wang, Dianne Cook

**Abstract** An abstract of less than 150 words.

## Introduction

- An ensemble of graphics
- Accelerate the exploratory data visualization process

## Background and motivation

### Interactive visualization systems with linking views

- {ggobi} and {xggobi}
- {cranvas} and {cranvastime}
- [crossfilter.js](#) & [dc.js](#)
- {crosstalk} and html widgets

### Tidy temporal data and workflow

The [tsibble](#) package extends the `data.frame` and [tibble](#) structure to represent temporal data in tidy format [cite]. A tsibble consists of *index*, *key*, and other measured variables in one data frame. The *index* column holds time-based indices. The *key* column(s) uniquely identifies a collection of related observational units during a period of time defined by *index*. They are “sticky” columns to a tsibble over the course of transformation.

The [feasts](#) and [fable](#) packages, part of the [tidyverts](#) suite, aim to make time series analysis easier. They provide analytical and forecasting tools for the tsibble data structure, generating tsibble-centered workflow. Functions, such as `features()` and `model()`, summarise a sequence of indexed values down to a single statistic or model by every observational unit. The output is a normal table, where each row corresponds to an observational unit denoted by “key”. In the context of relational databases, the “key” acts like a foreign key in a reduced form of tsibble, while the index and key together operates like a primary key.

At the early stage of exploratory temporal data analysis, time series plots and scatterplots goes hand by hand. (insert figures below)

### Shared temporal data for coordinated views

- Symbolic formula to express structural specifications among keyed units, using / and \* from Wilkinson notation (10.2307/2346786) for nesting and crossing.
- Nesting variables generate hierarchical tree, hence `plotly_key_tree()`. Overview and navigation made easier.
- One-to-many linking: marking a single point of interest highlights all other points that share particular data values (connect-type)
- Lists of key values, and json
- R6 subclass of `SharedData` from {crosstalk}

### Slicing and dicing time

- Time wrapping: absolute time to relative time, grouped by corresponding lower-resolution time. `date-times -> hours, by dates`

- Transform and send newly-transformed data via server, without updating anything else (e.g. layout and graphical elements), to avoid completely redrawing.
- A shiny module: slider and plot

## Case study: monthly domestic tourist trips in Australia

## Conclusions and discussions

*Earo Wang*  
*The Univeristy of Auckland*  
*line 1*  
*line 2*  
[earo.wang@auckland.ac.nz](mailto:earo.wang@auckland.ac.nz)

*Dianne Cook*  
*Monash Univeristy*  
*line 1*  
*line 2*  
[dicook@monash.edu](mailto:dicook@monash.edu)