

Automated multi-subject dynamic models

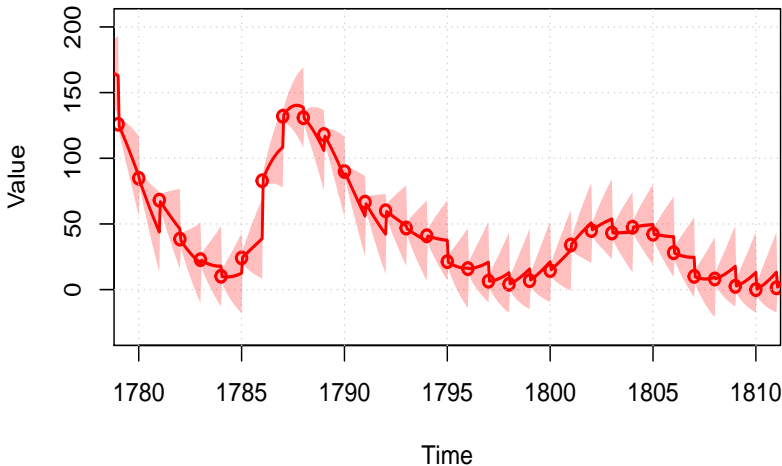
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Charles Driver



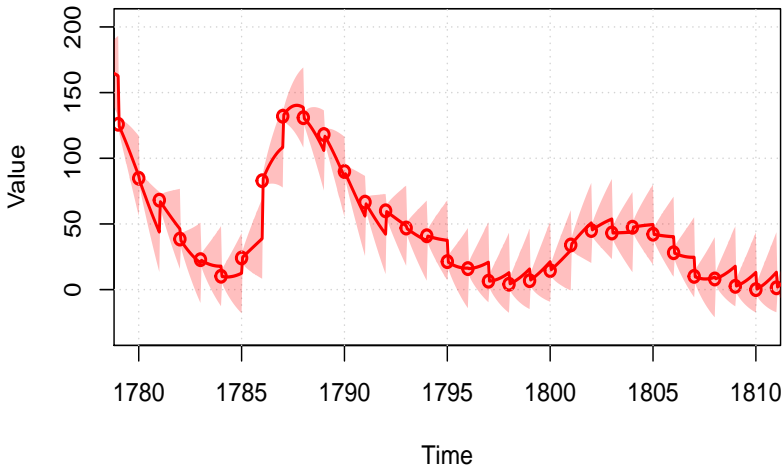


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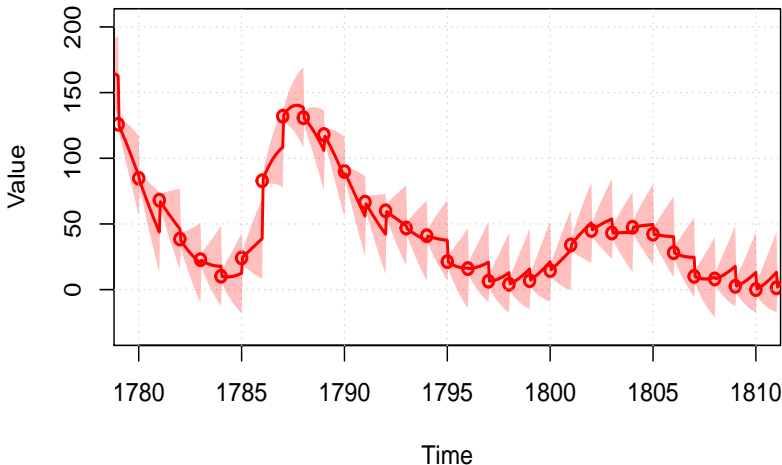


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- More complex - multivariate higher order stochastic differential equation





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 - Understand how constructs change with time
 - Get 'closer' to causality with purely observational data
 - Examine shapes of change due to an event or intervention



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- Psychology has little such history - experimental psychology has tended to focus only on aggregates, and the sub-fields where dynamics have been of interest only recently have the technological capacity for gathering substantial longitudinal data.
- Psychological data can also comprise multiple indicators of uncertain constructs, and be very heterogeneous across subjects.
- So not only do we lack some expertise, we have hard problems.



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- Neglecting stable between subject differences, and or persistent trends.



Why is misspecification a problem?





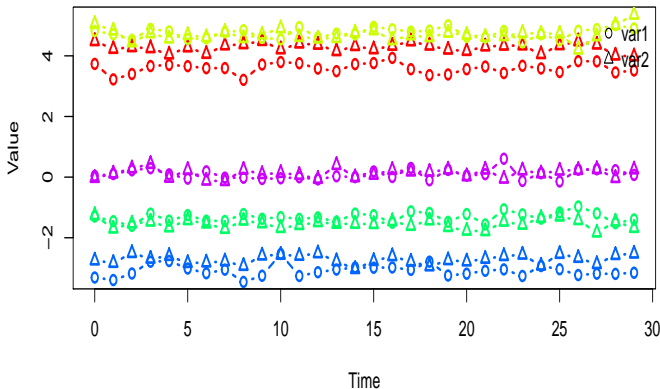
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- Distinct from some fields, psychology is interested in interpreting the parameters - model may not be perfect, but we nevertheless assume (and sometimes find) that differences in the model parameters reflect something interesting.
- In such cases, misspecifications can generate entirely spurious effects





Reducing misspecifications in practice





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- Such automation already exists, but so far as I am aware, is either limited by:
 - Only fitting univariate single subject data (e.g., `auto.arima`)
 - or assuming only first order processes (e.g., `gimme`)



Automated dynamic modelling - general concept





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- Possibly try different model search paths, and summarize the most plausible models.



Difficulties - model search space





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- Practically, some sort of guided model search and comparison is achievable - but how best to implement?
- Some model components, e.g., stochastic dynamics, are more flexible than others - adding least flexible first should help avoid overfitting with most flexible components.





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- This will be too slow to fit in a model search procedure, so adding priors on the frequentist optimization will probably be helpful / necessary to avoid convergence problems.



Possible related writings





- Interpretation of continuous time dynamic models.



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- Causal inference and the misspecification of dynamic models - what sorts of misspecification are likely to be most problematic?
- Interpretation and prediction comparison from different automated approaches.

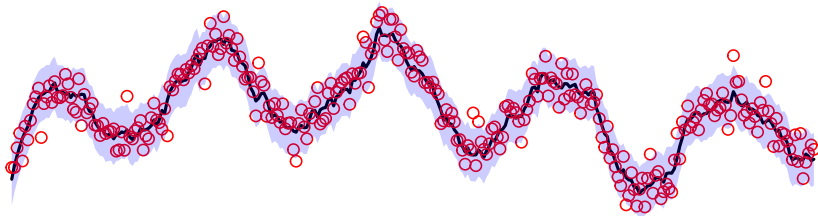


Summary



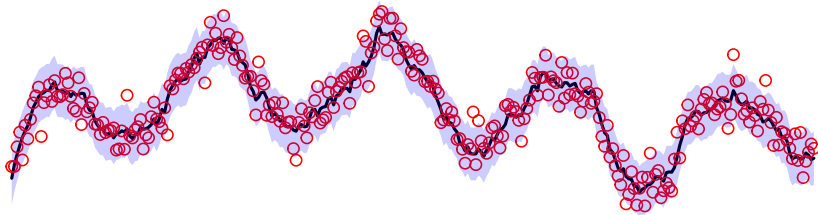


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 - Since hypotheses regarding specific dynamic model structure are relatively rare, provide a more formalised and automated approach to exploration and model selection.
 - By making more complex, more 'adequate' models accessible, hopefully encourage more thought about model specification.

