Social mimicry and small networks

George G. Vega Yon

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Part 1: Social Mimicry

We are trying to model the following behavior:

A type of behavior which is involuntary

Families were invited to a lab to eat together

Each family member was wearing a aaaa that tracked bites.

A bite consists simply in the action of taking food to your mouth

We are interested in two questions

1. Do we observe social mimicry?
2. If there is any, can we write down a model of social mimicry?

- For the first question, right now we are using a permutation test.
- But first, let's take a look a the structure of the data

A DIAGRAM GOES HERE

Formal description

Mathematically, we can describe the data as follows:

- For each individual i we observe a vector $T_i \equiv \{t_1^i, t_2^i, \dots\}$ with i's bites timestamps. You can think of this as a poisson process.
- Let n_i denote the size of T_i.
- Also, define the function $R : T_i \times T_j \mapsto T_j$ as that which returns the **leftmost close** bite of j to i, i.e. the inmediate bite of j before i took a particular bite:

$$R(t_i^n, T_j) = \begin{cases} \text{Undefined}, & \text{if } (\forall t_j^n \in T_j) \exists t_i^m \in T_i \text{ s.th. } t_i^m \in (t_j^n, t_i^n) \\ \arg\max_{\{t_j^n : t_j^n \in T_j, t_j^n \leq t_i^n\}} t_i^n - t_j^n, & \text{otherwise.} \end{cases}$$

For now we will focus on the cases where this is defined.

- A possible statistic is to take the average time gap between i and j's bite, formally, assuming $R(t, T_j)$ is defined for all $t \in T_i$, we have

$$S_{ij} = \frac{1}{n_i} \sum_{t \in T_i} (t - R(t, T_j))$$

Data

- At the dyadic level, we observe two vectors of timestamps (when the bites occurred per individual), e.g.

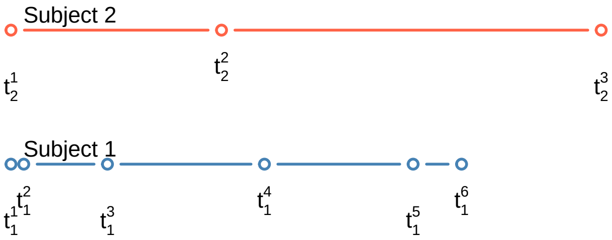

Figure 1: Simulated dyad

- For the previous example, $T_1 = \{t_1^1, t_1^2, t_1^3, t_1^4, t_1^5, t_1^6\}$, and $T_2 = \{t_2^1, t_2^2, t_2^3\}$

$$R(t_2^2, T_1) = t_1^3$$

Permuting time intervals

- Imagine we observe the followin: $T_a = \{0, 1, 3, 6\}$, then we have $3! = 6$ total permutations as what is swapped are time intervals.

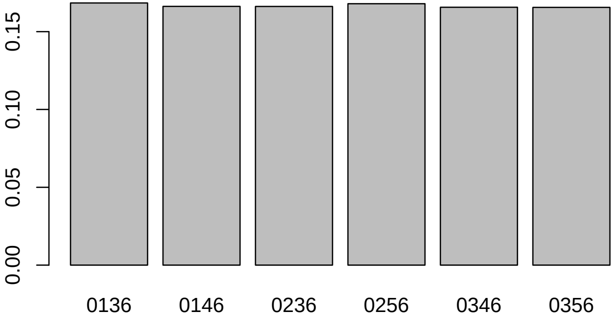

Figure 2: Distribution of permuted set (50,000 permutations).

Part 2: Small Network

- Observe small teams perfoming several tasks in a lab,
- Team members are surveyed before and after each task.
- From their responses, collective intelligence indicators were built.
- Also, they were asked about their perceptions of the social networks: leadership, advice, etc. Call this social cognition.

We are interested in the following question

- How important is, if important at all, social cognition in group performance?
- **Our problem**: Teams studied here (and everywhere) are usually very small, raging 4 to 5 members.
- Our current approach: We defined an statistic that measures some sort of correlation:

$$S_T \equiv 1 - \frac{1}{n(n-1)} \sum_{\{(i,j):(i,j)\in T, i<j\}} H(i,j)$$

  Where $H(i,j)$ is the hamming distance between i and j's perceived social structures.
- $S_T \in [0,1]$, where 1 means *perfect correlation* (all subjects have the exact same perception of the graph.)