# Entropy Measures of Human Communication Dynamics

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# What is Human communication?
## What is the difficulty in studying Human communication?

- temporal Network

- Too many representations:

- event sequences,

- interval graphs,

- time windows …

# Solution: Entropy
## Three approaches

- event sequences (ES) depicting human interactions

- probability of a node to appear as a speaker

- probability of the event occurrence

- probability of succession appearance

# First Approach

## If Speaker

$$S_1 = -\sum_{v \in V} p_1(v) ln(p_1(v))$$

# Second Approach
## If Know

$$S_2 = - \sum_{e_{ij} \in E} p_2(e_{ij}) ln(p_2(e_{ij}))$$

# Third Approach
**succession**

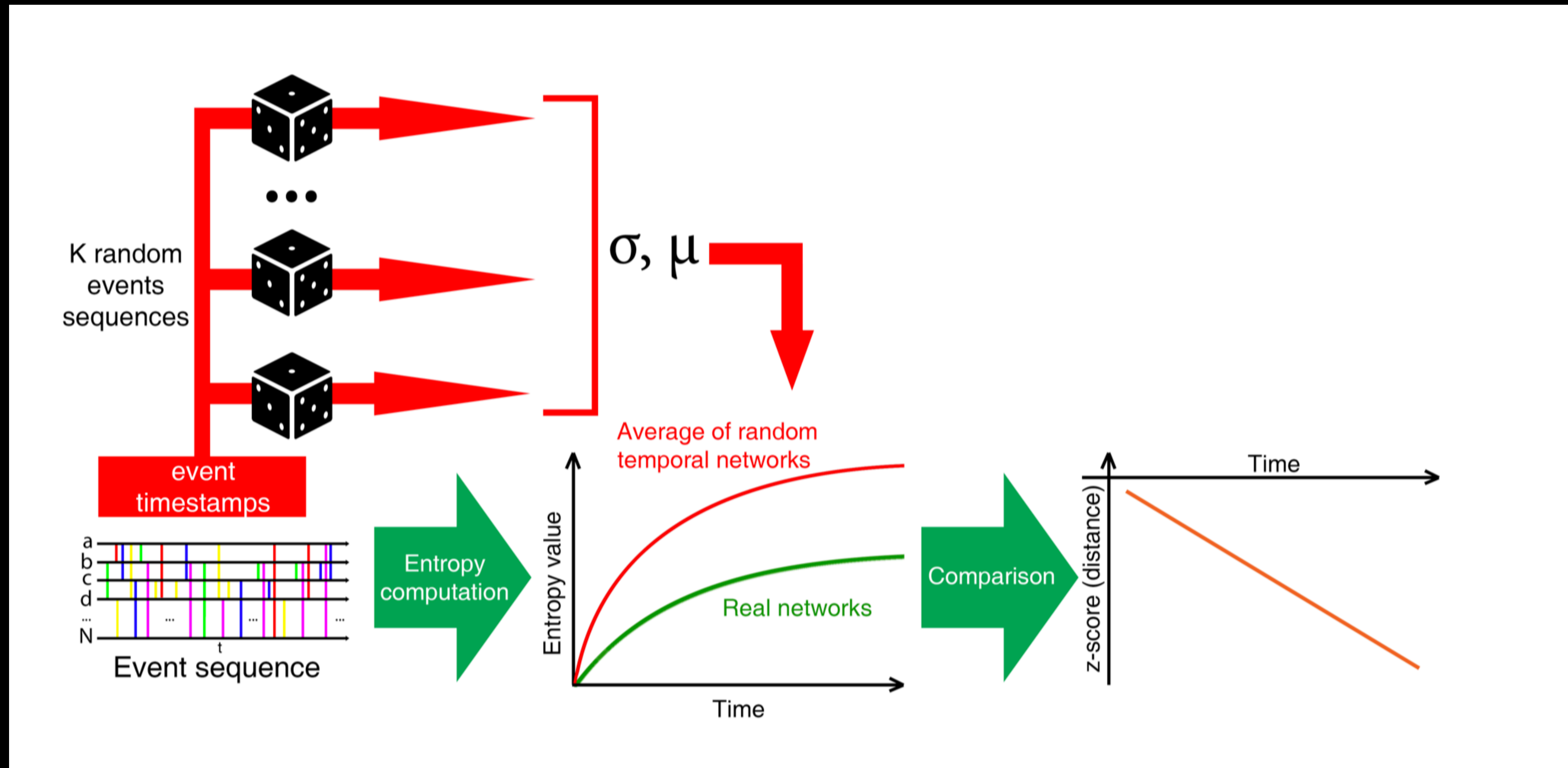$$S_3 = -\sum_{sc \in SC} p_3(sc) ln(p_3(sc))$$

# Experiment
## Datasets

- face-to-face meetings at HyperText conference

- text messages exchanged between students for 6 semesters (NetSense)

- email communications in the manufacturing company

- face-to-face interactions between patients and hospital staff members.

# Experiment
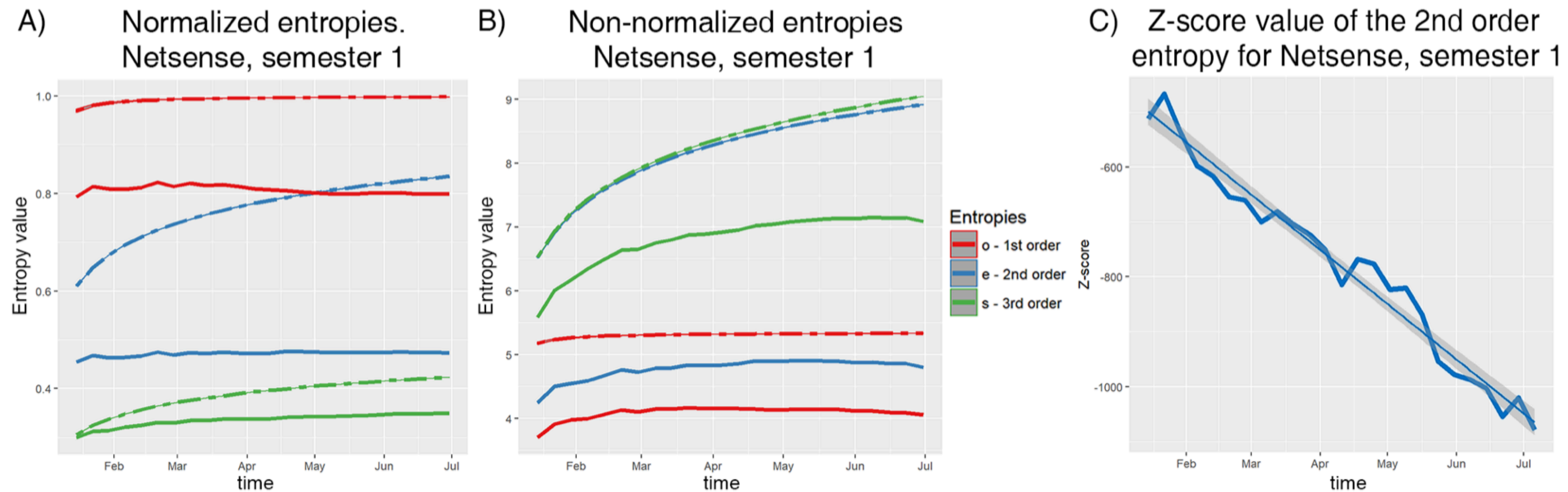## Random & Realtime

# Experiment
## Real & Random Comparison



**Figure 2.** The NetSense dataset, the 1st semester. A) Values of normalized entropies. Solid lines refer to the original event sequence and dashed ones present the average value for the baseline – random sequences. B) Values of non-normalized entropies. C) Z-score for non-normalized second-order entropy with the computed trend and marked standard deviation (gray area).

# Second Approach