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# Dissolution dynamics and durations

Building intuition

# Relational durations

- Imagine a world in which all relationships have a constant daily hazard of dissolution, 1%. (The formation process might be quite complex, but the dissolution process is simple).
- Q1: What would be the mean duration that a relationship lasts in this world?

# Relational durations

- Now imagine that you enter this world one day, and are able to interview all couples who are in on-going relationships at that point. You ask them how long their relationship has lasted up until that point (relational “age”)
- Q2: What would the mean answer be?

# Relational durations

- Now imagine a world in which all relationships last exactly 100 days before ending.
- Once again, you are able to show up one day and interview all couples who are in on-going relationships at that point. You ask them how long their relationship has lasted up until that point (relational “age”)
- Q3: What would the mean response be?

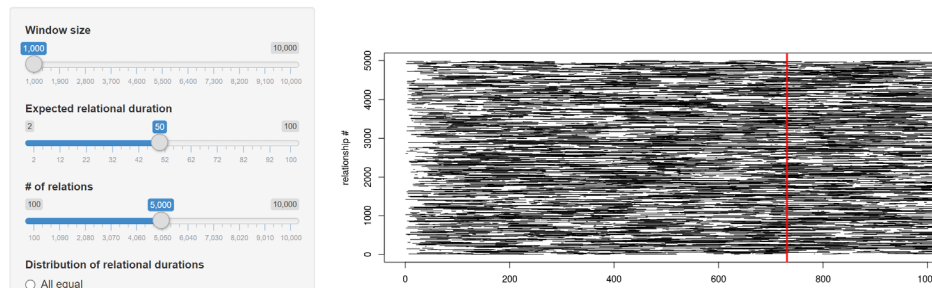
# Relational durations

- We've built a little Rshiny app to let you play with this process

## Relational duration and age of extant ties tool

This app helps demonstrate the connections between relational duration and relational age for different distributions of relational duration. By relational duration, we mean the amount of time that a relationship lasts before it ends. By relational age, we mean how old an ongoing relationship is when it is observed at a specific time point. This app simulates a user-specified number of relationships, each beginning at a random time point across a user-specified window. Relationships have a user-specified mean duration, with a distribution selected from a menu of options. The app then selects an observation day randomly (although not too close to the edges of the window, to avoid dealing with boundary issues), and calculates the mean relational age on that day (time to the left of the observation day), the mean time remaining (time to the right of the observation day) and their sum (total duration for relationships extant on the observation day), and compares each to the mean duration for all relationships.

## RShiny app



- Try modifying the parameters
  - For the observation window size
  - The expected duration
  - The sample size (number of relations)
  - The distribution of duration

# One cross-section + duration info

- Exponential/geometric durations suggests a memoryless processes – one in which the future does not depend on the past

- Imagine a fair, 6-sided die:

1/6

- What is the probability I will get a 1 on my next toss?

1/6

- What is the probability I will get a 1 on my next toss given that my previous 1 was five tosses ago?

6

- On average, how many tosses will I need before I get my first 1?

6

- On average, how many more tosses will I need before I get my next 1, given that my previous 1 was 8 tosses ago?

Geometric	
Parameters	$0 < p \leq 1$ success probability (real)
Support	$k \in \{1, 2, 3, \dots\}$
Probability mass function (pmf)	$(1 - p)^{k-1} p$
Cumulative distribution function (CDF)	$1 - (1 - p)^k$
Mean	$\frac{1}{p}$

# One cross-section + duration info

- Now, let's imagine this fairly bizarre scenario:
  - You arrive in a room where there are 100 people who have each been rolling one die; they pause when you arrive.
  - You don't know how many sides those dice have, but you know they all have the same number.
  - You are not allowed to ask any information about what they've flipped in the past.
  - The only information people will give you is: how many flips after your arrival does it take until they get their first 1?
  - You are allowed to stay until all of the 100 people get their first 1, and they can inform you of the result.
- Given the information provided you, how will you estimate the number of sides on the die?

# One cross-section + duration info

- Simple: when everyone tells you how many flips it takes from your arrival until their first 1, just take the mean of those numbers. Call it  $m$ .
- Your best guess for the probability of getting a 1 per flip is  $1/m$ .
- And your best guess for the number of sides is the reciprocal of the probability of any one outcome per flip, which is  $1/(1/m)$ , which just equals  $m$  again.
- Voila!



# One cross-section + duration info

Retrospective relationship surveys are like this, but in reverse:

Dice:



Relationships:

