Do Cascades Recur?

Justin Cheng, Lada Adamic, Jon Kleinberg, Jure Leskovec

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How to be skinny
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Brendan Ruby
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Samuel Oak
18 hrs ·

Not sure which starters I should give new trainers...

What do people think about Mewtwo?

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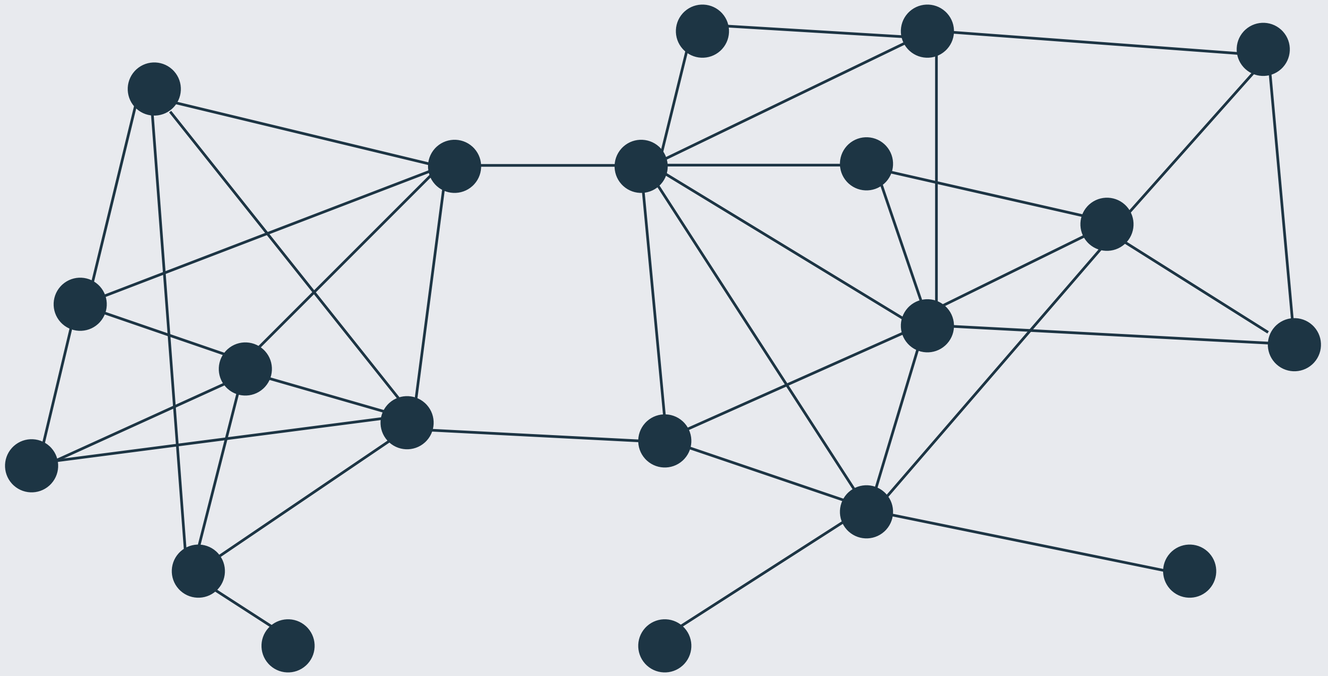

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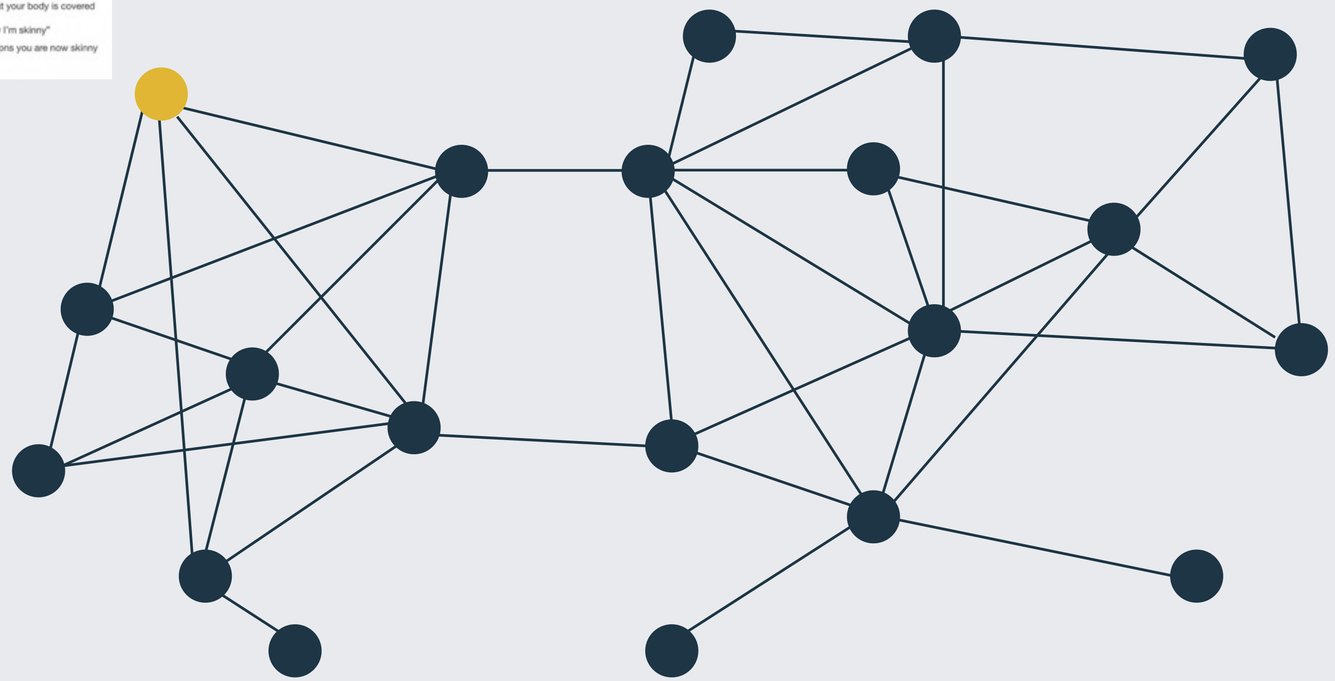
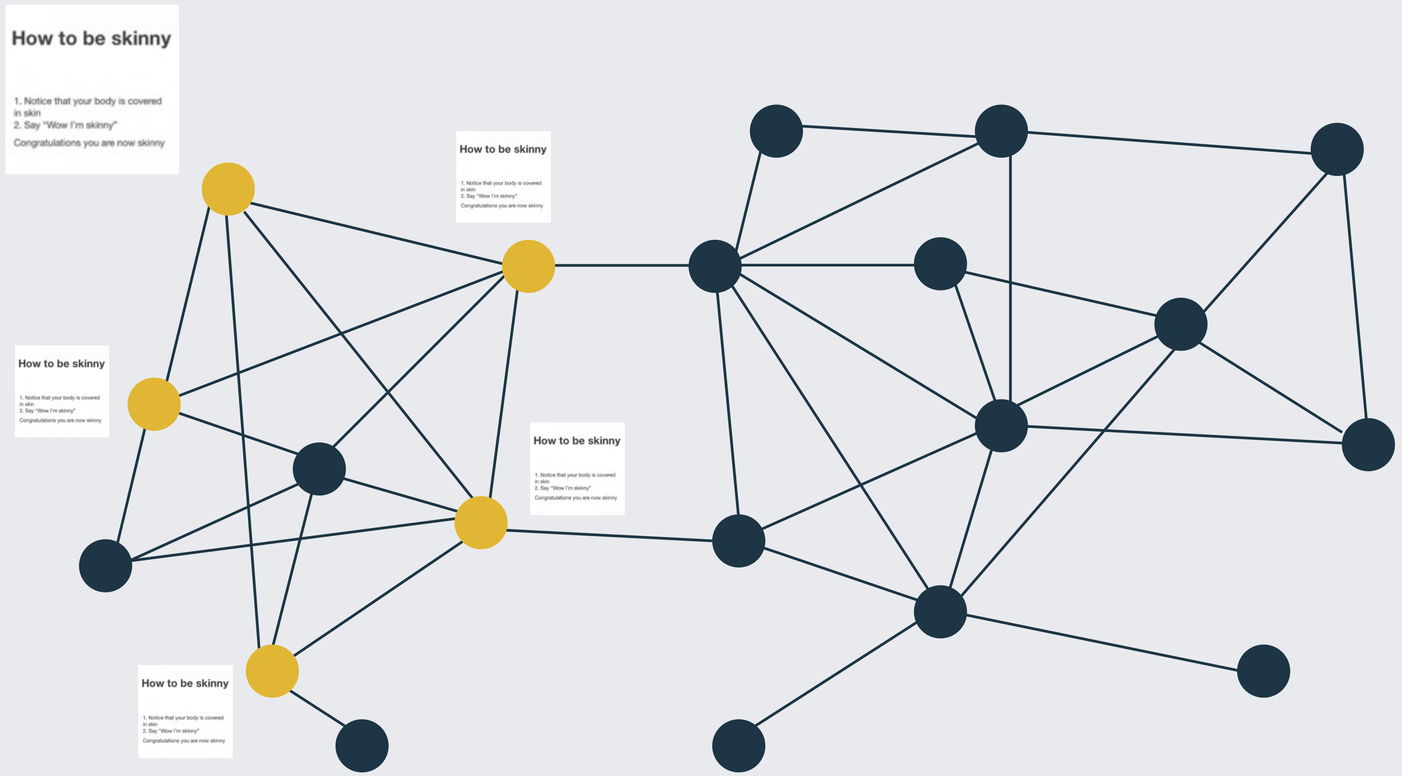
1. Notice that your body is covered in skin
2. Say “Wow I’m skinny”

Congratulations you are now skinny

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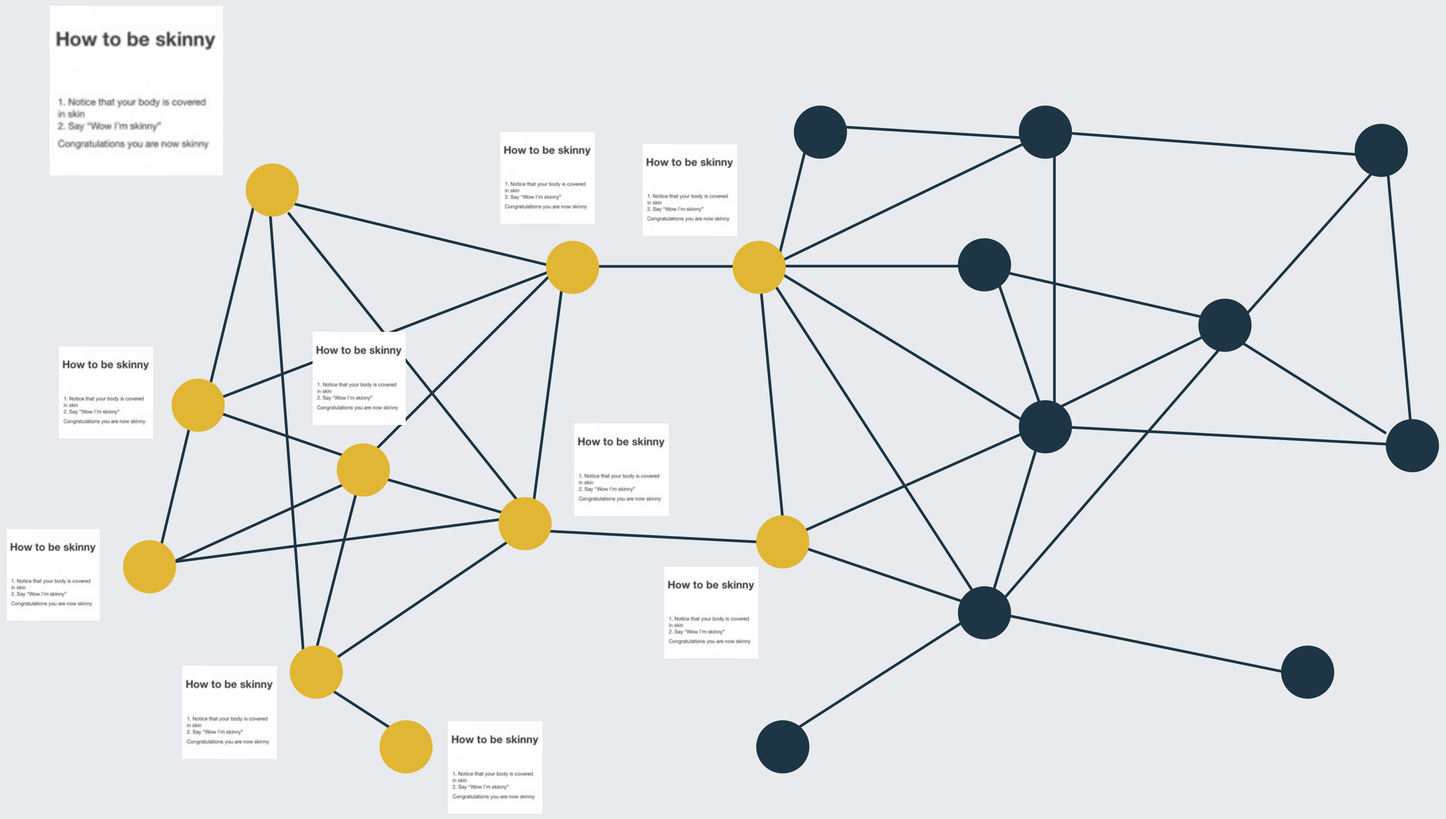
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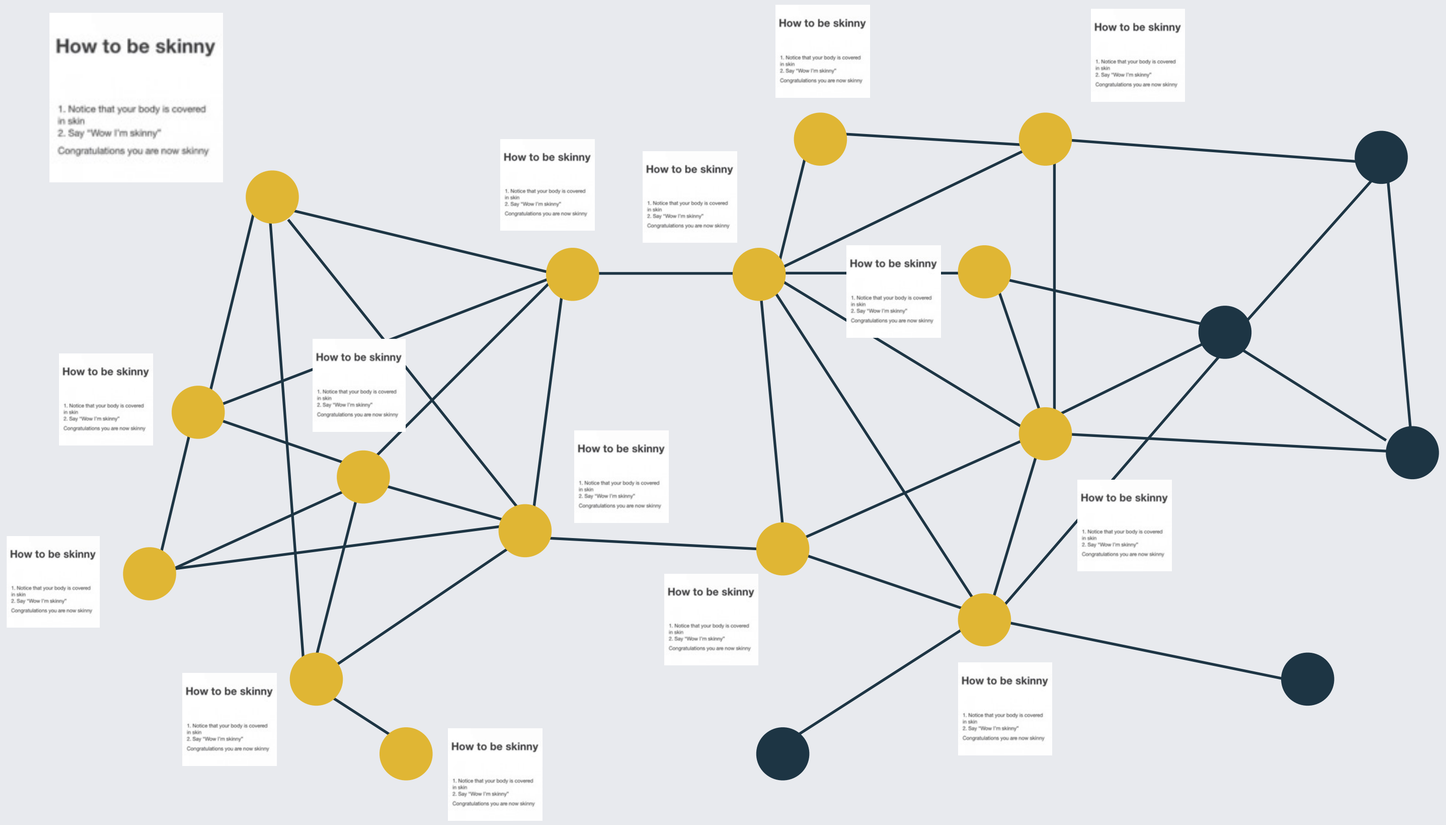
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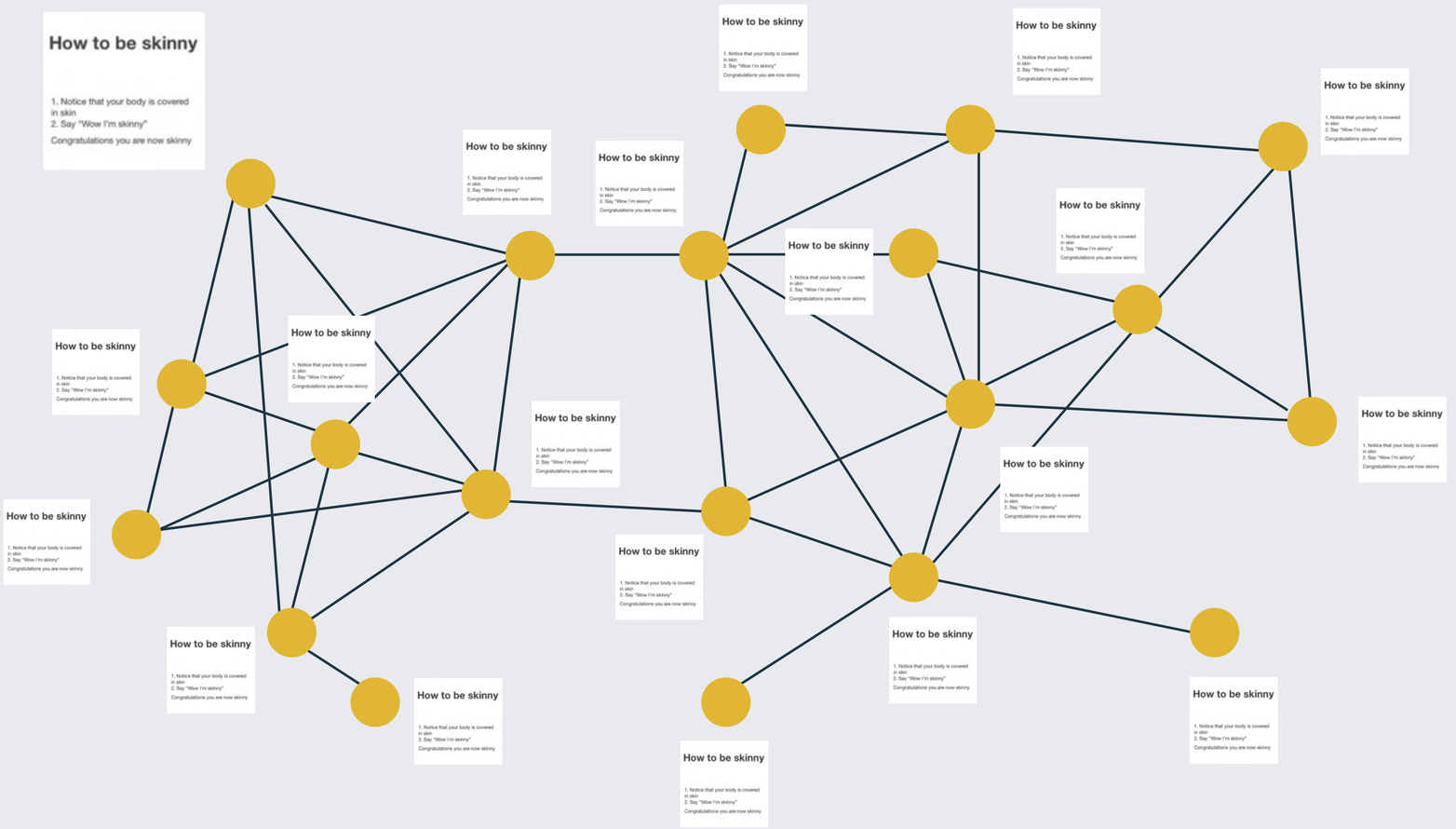
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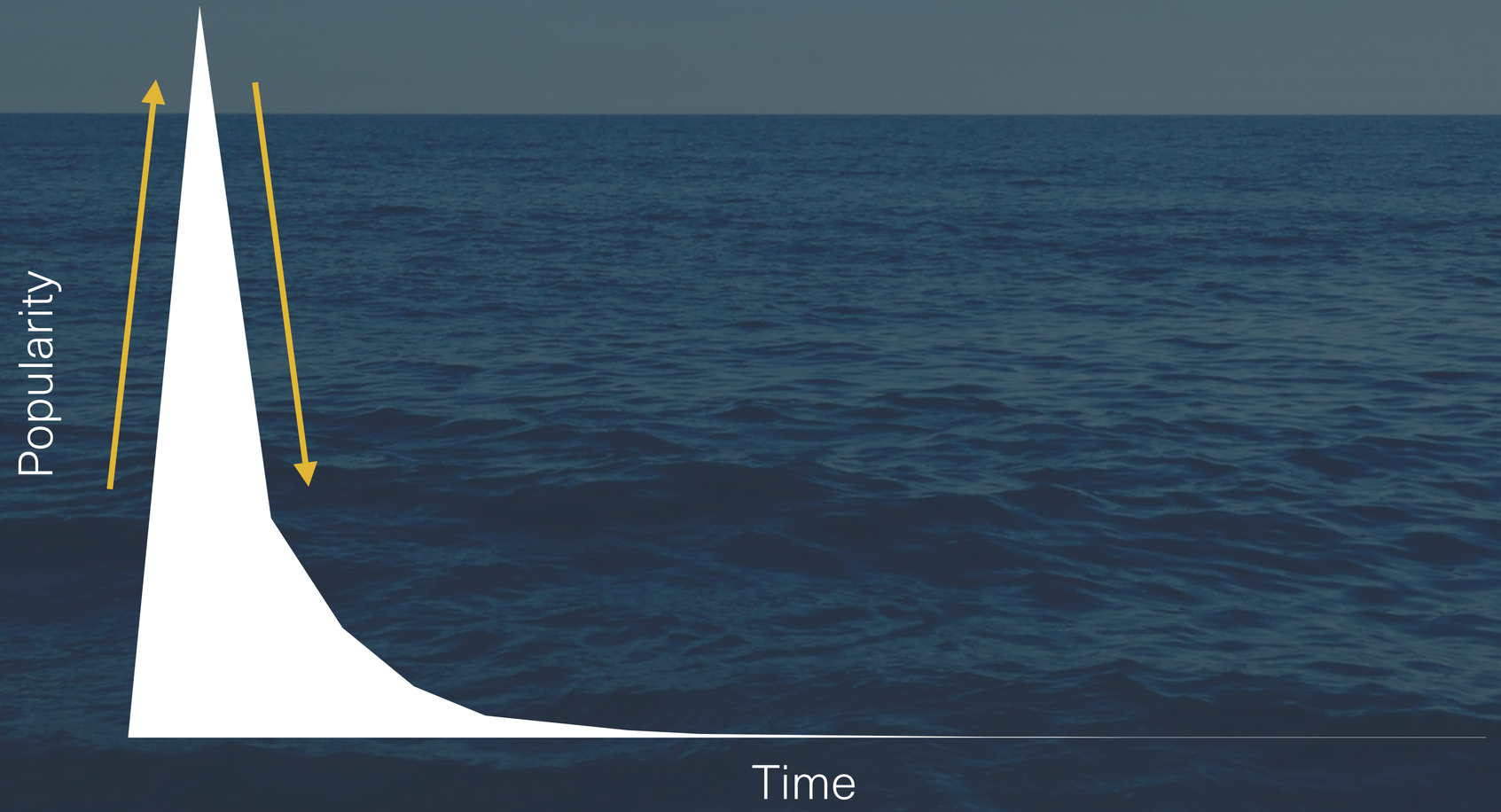
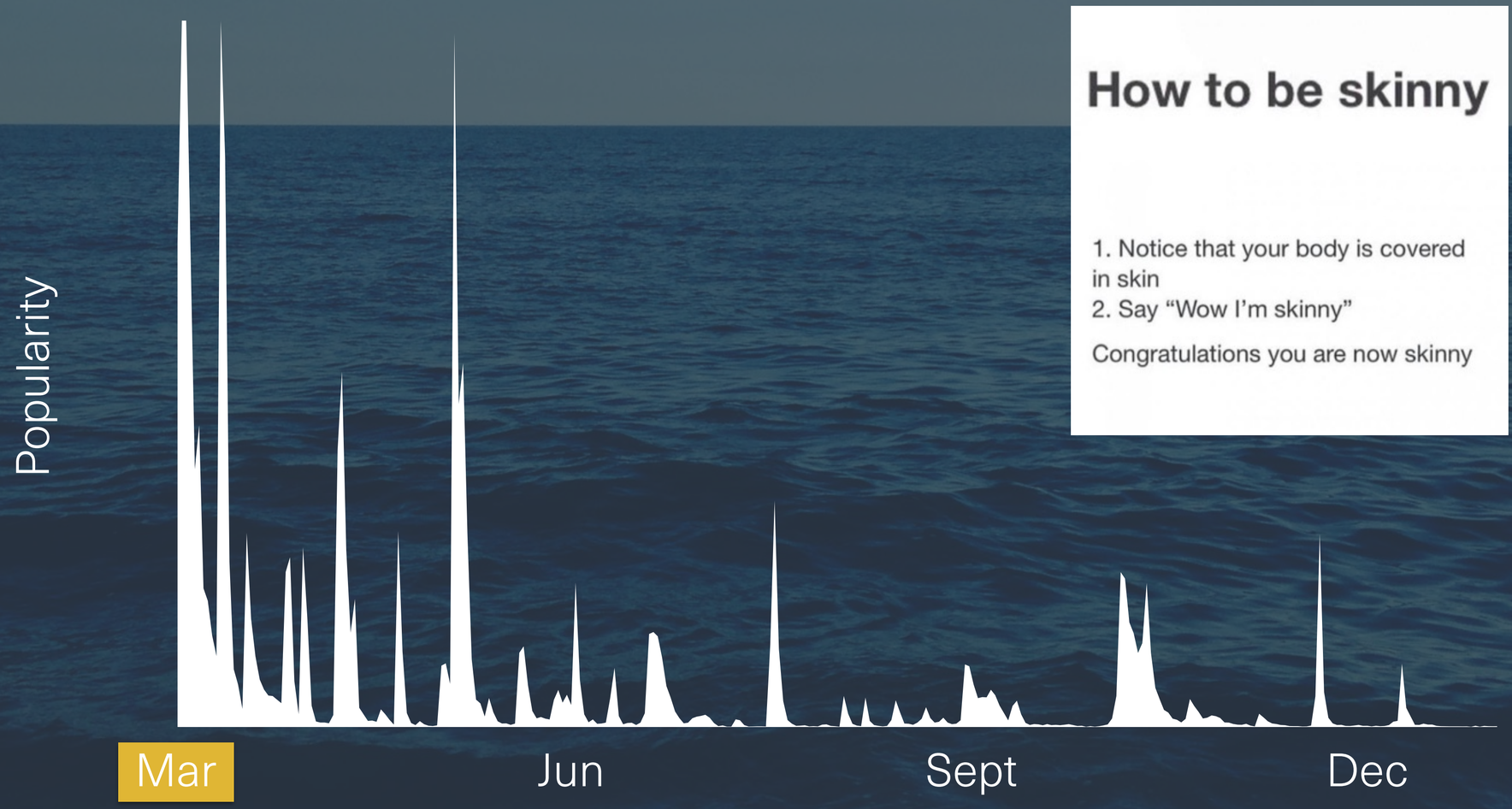
Prior work: cascades rise, then fall



Ahmed et al. (2013), Bauckhage et al. (2013), Matsubara et al. (2012), Yang & Counts (2010)

Cascades rise and fall many times



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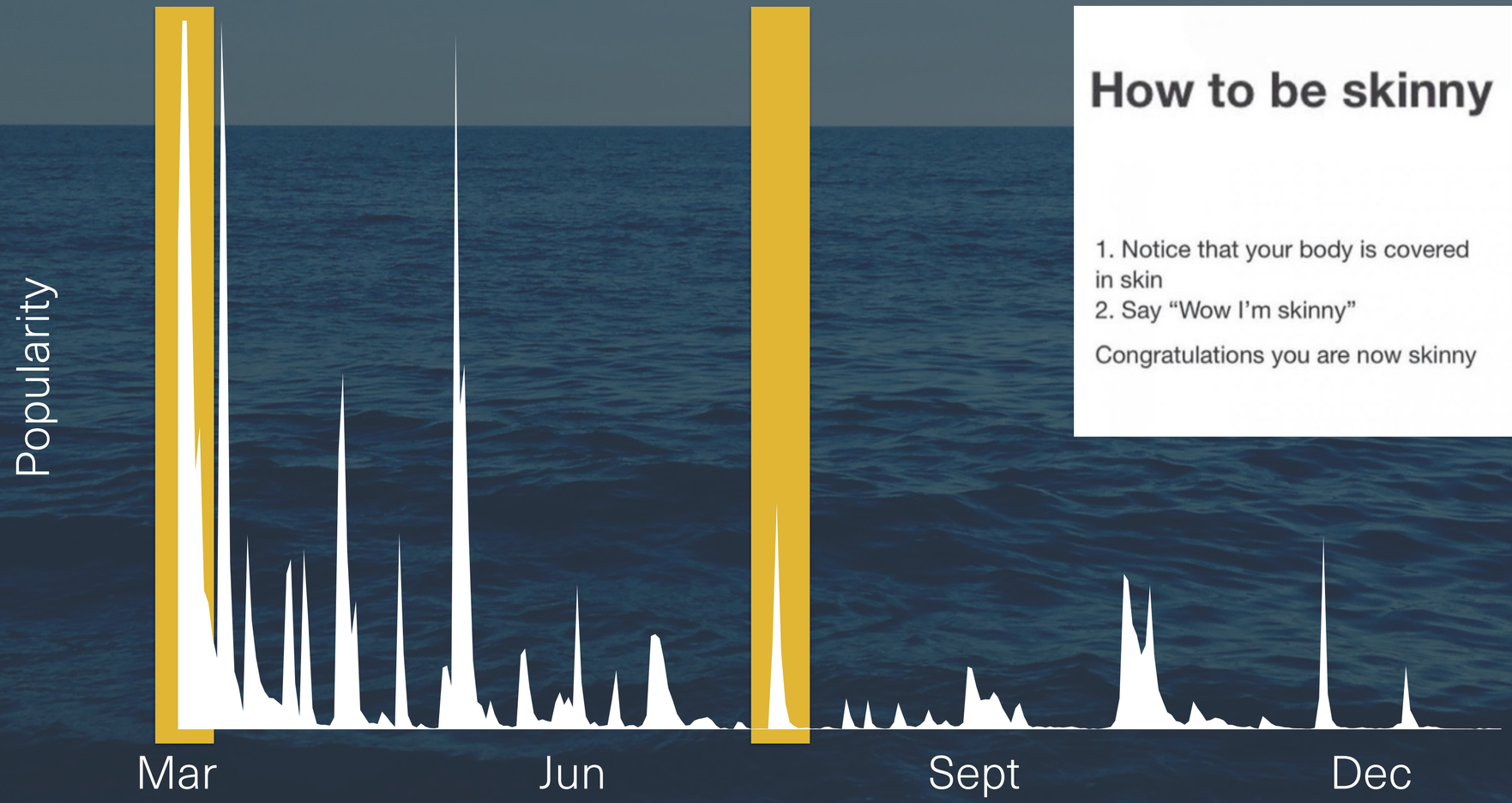

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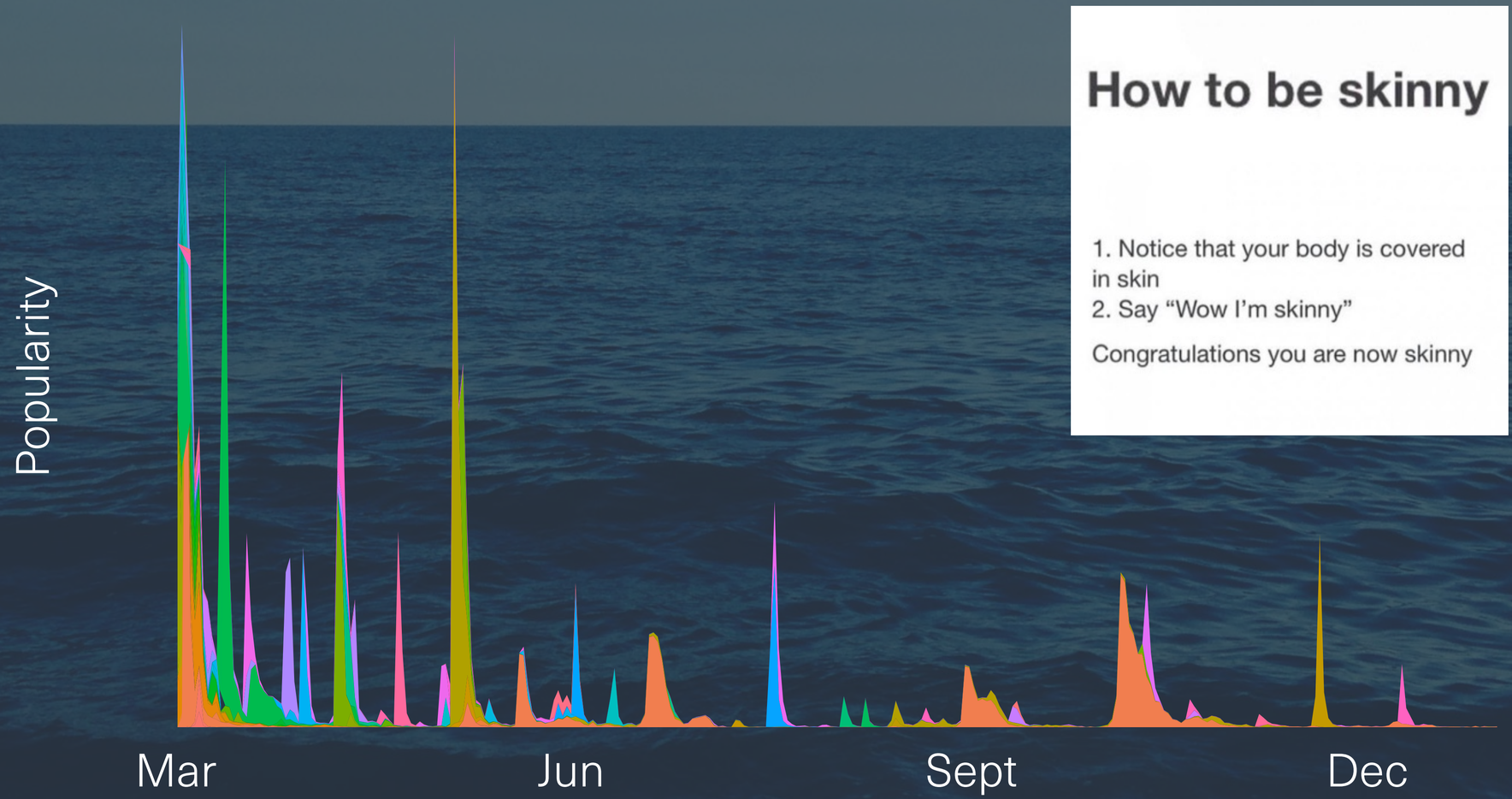
Cascades consist of multiple copies



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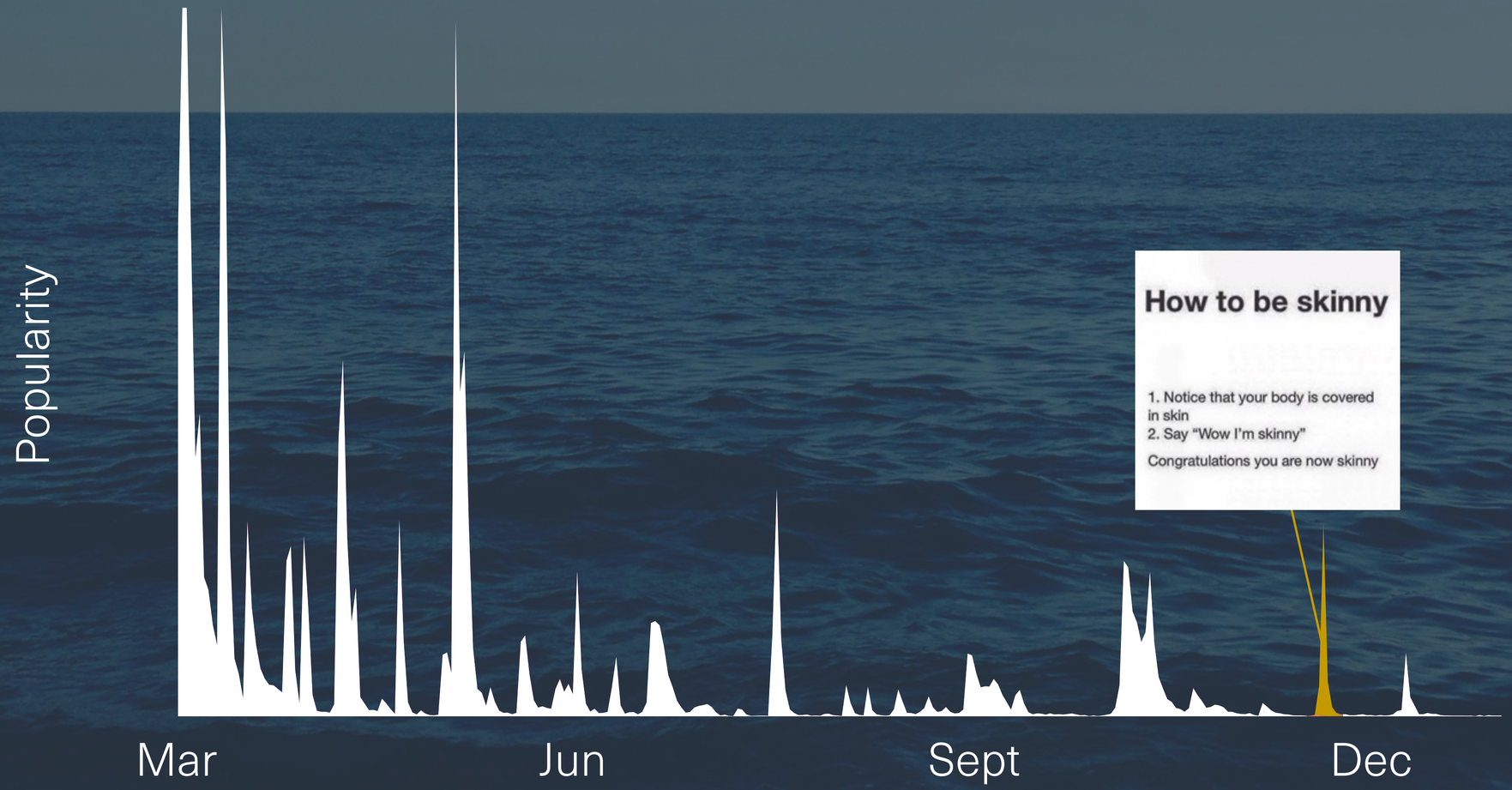
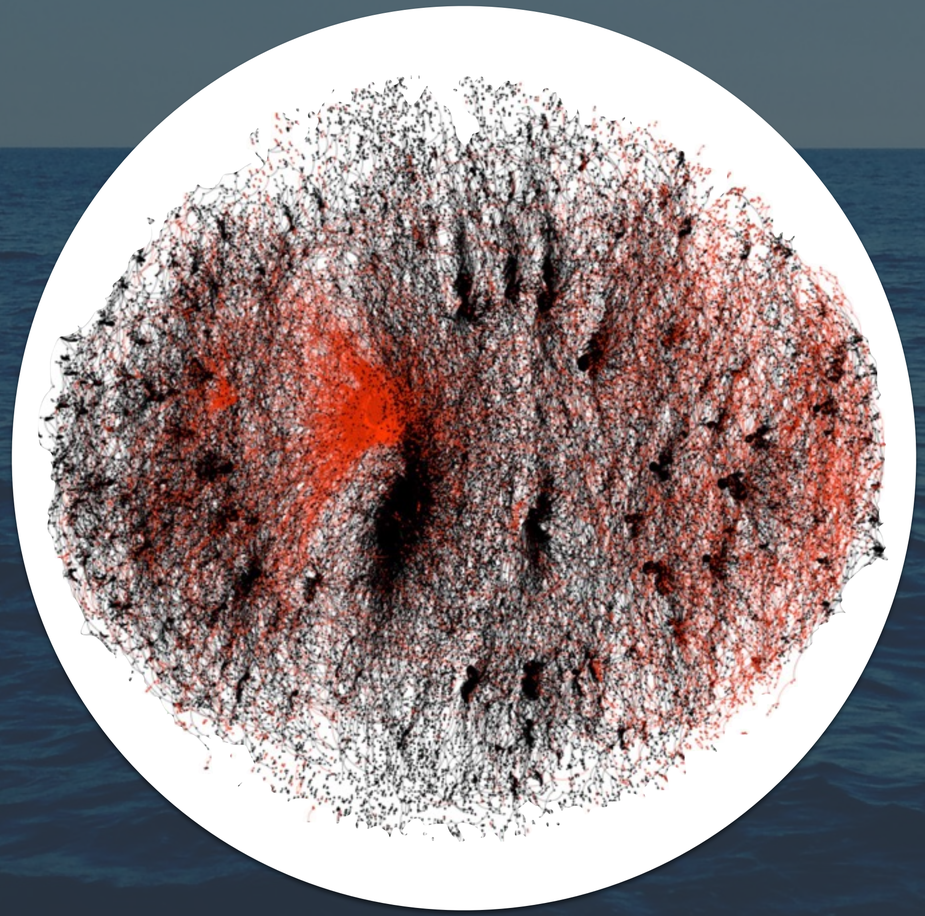


Cascades are complex

Cascades are complex

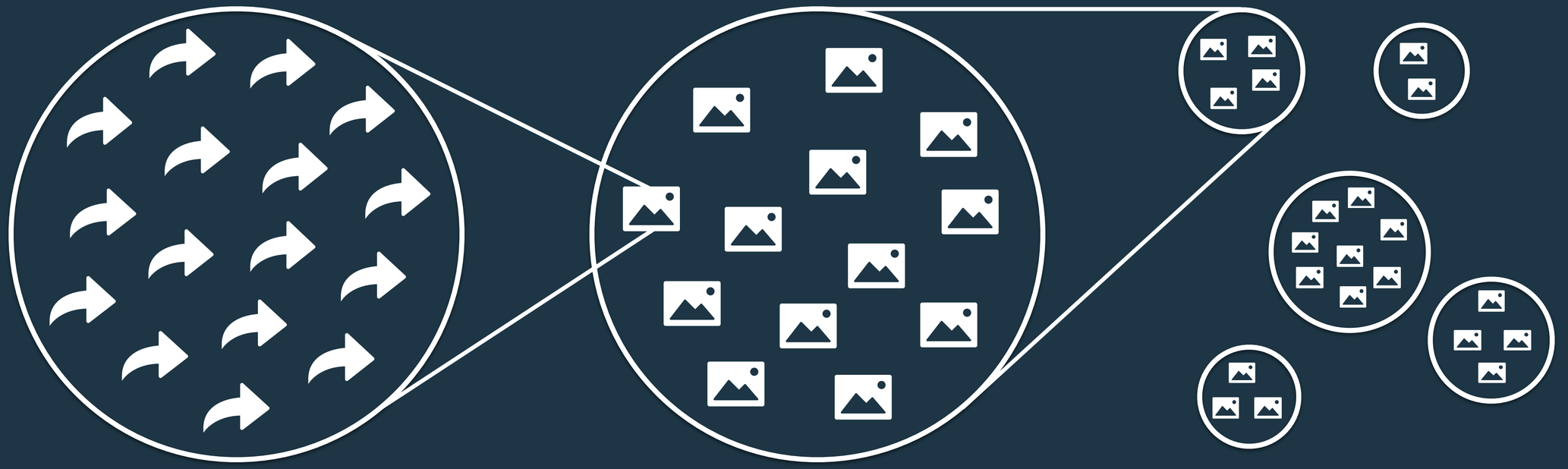
Time

Individual copies recur



Time

Studying recurrence on Facebook



5 billion reshares **100 million** photos **76 thousand** clusters

(Sampled over all of 2014 and de-identified)

2 out of 5 image memes on Facebook recur.


1 out of 3 videos
on Facebook recur.

Cascades recur.

Cascades recur.

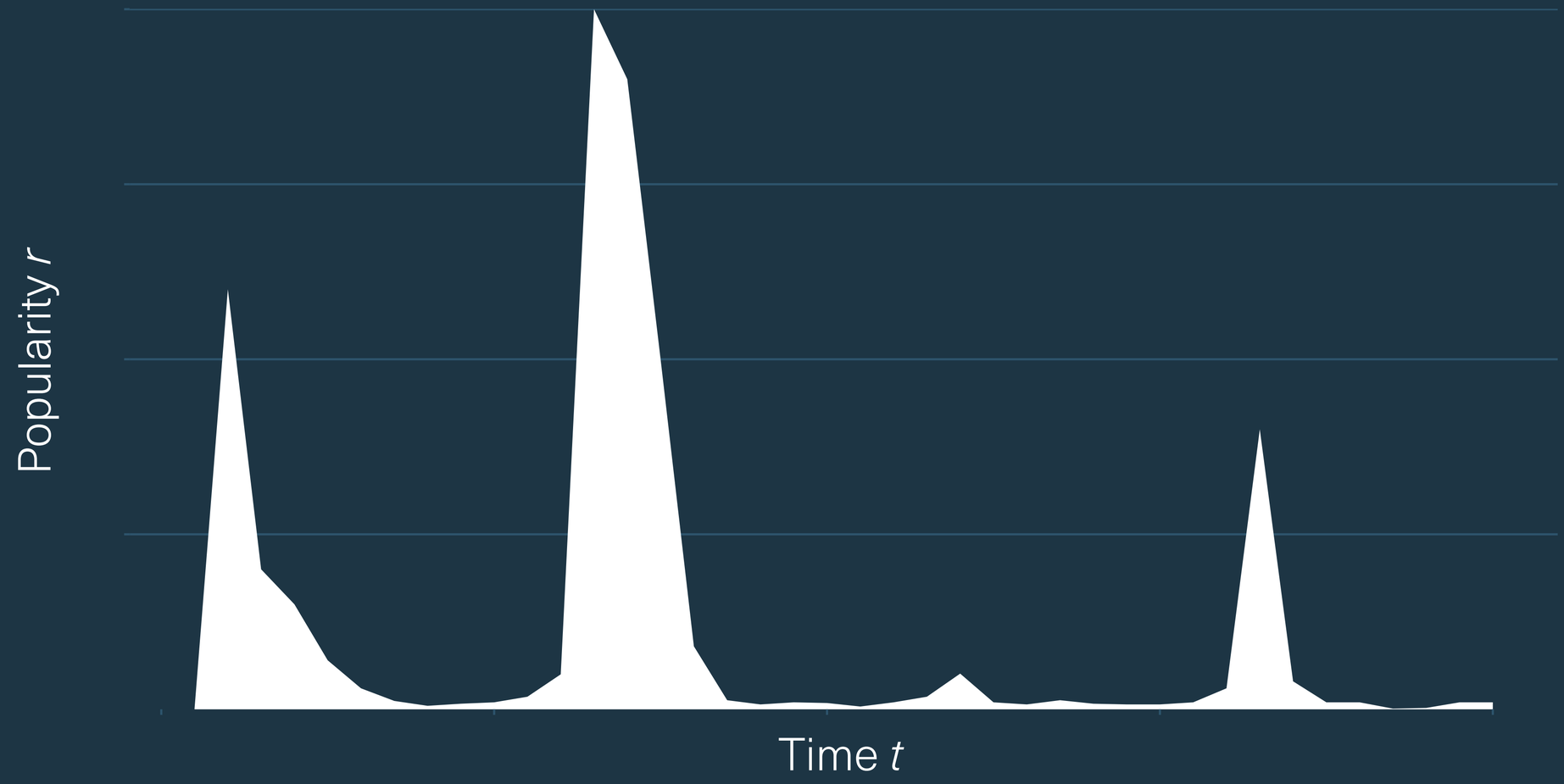
What is recurrence?

How do cascades recur?

Why do cascades recur?

What is recurrence?

Defining recurrence



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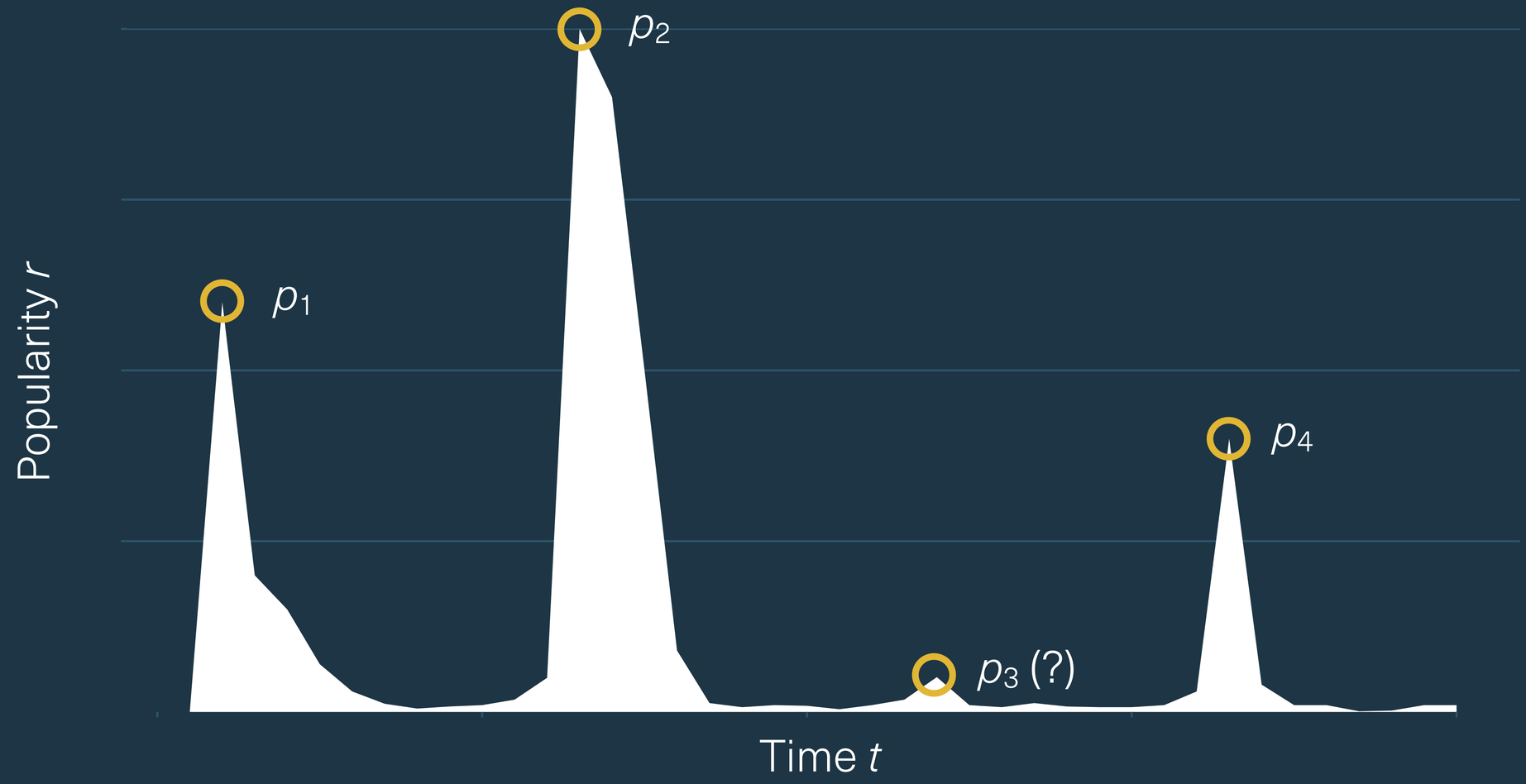

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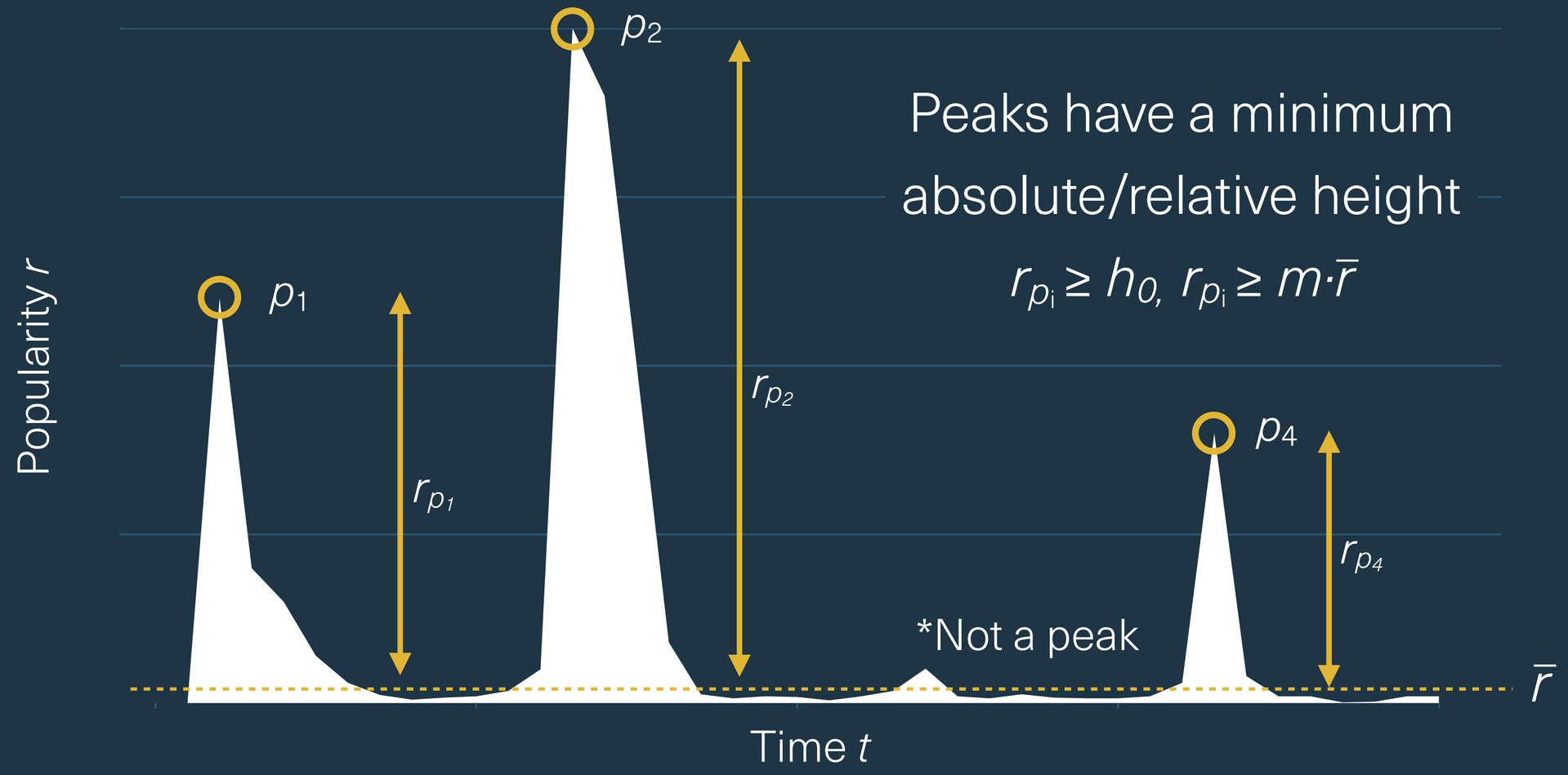
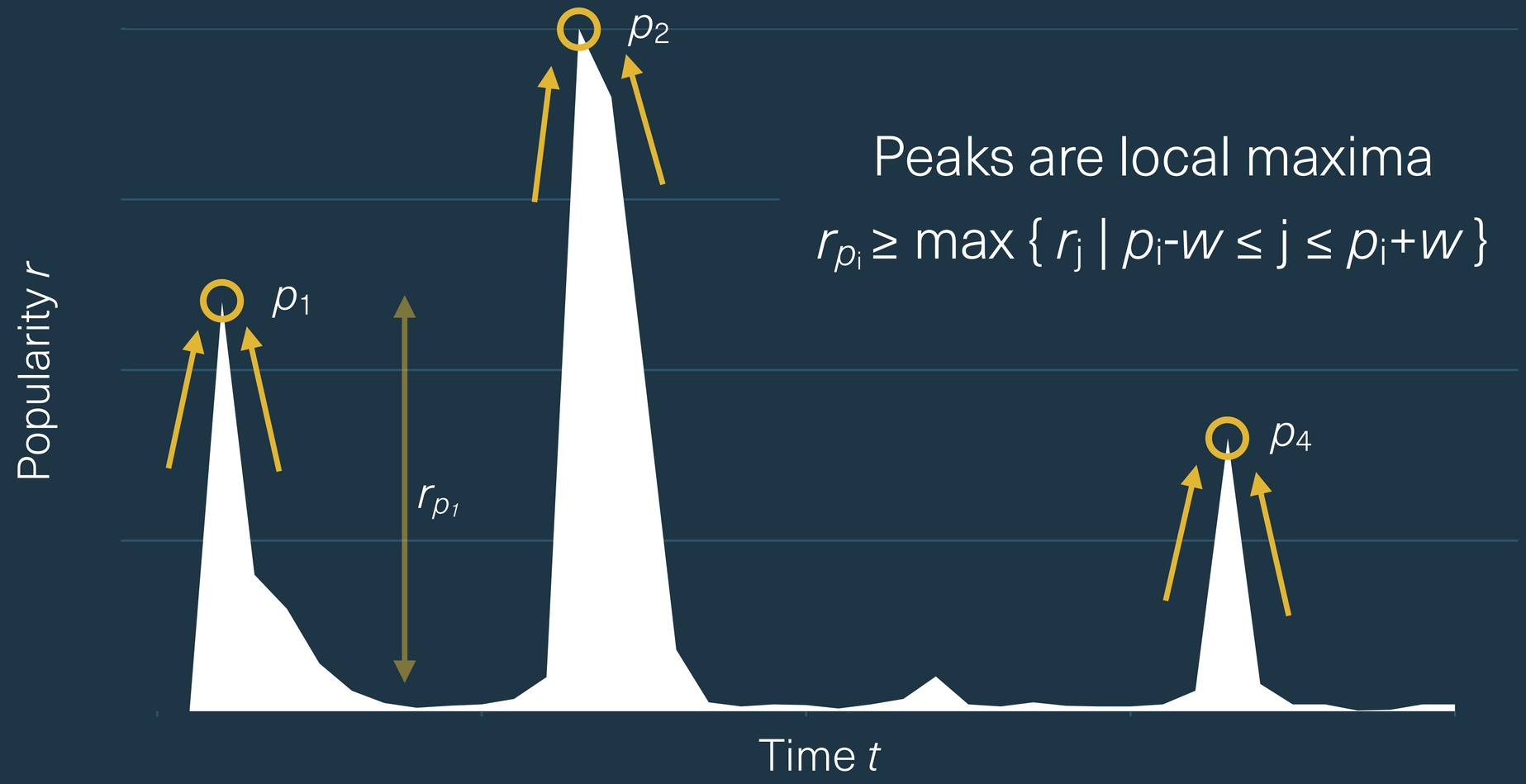


Peaks have a minimum absolute/relative height

$r_{p_i} \geq h_0,\ r_{p_i} \geq m \cdot \bar{r}$

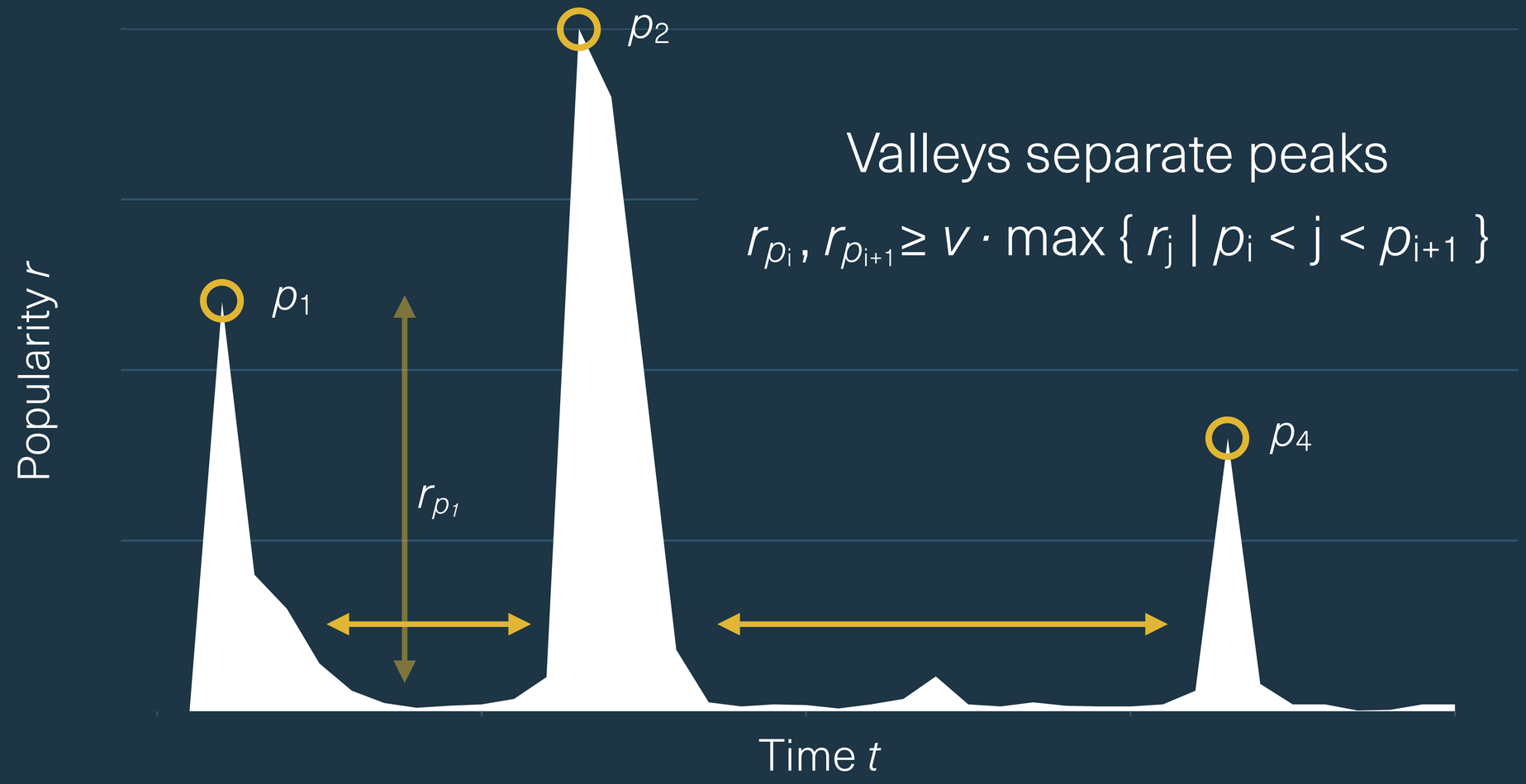
Defining recurrence



Peaks are local maxima

$$r_{p_i} \geq \max \{ r_j \mid p_i\text{-}w \leq j \leq p_i\text{+}w \}$$

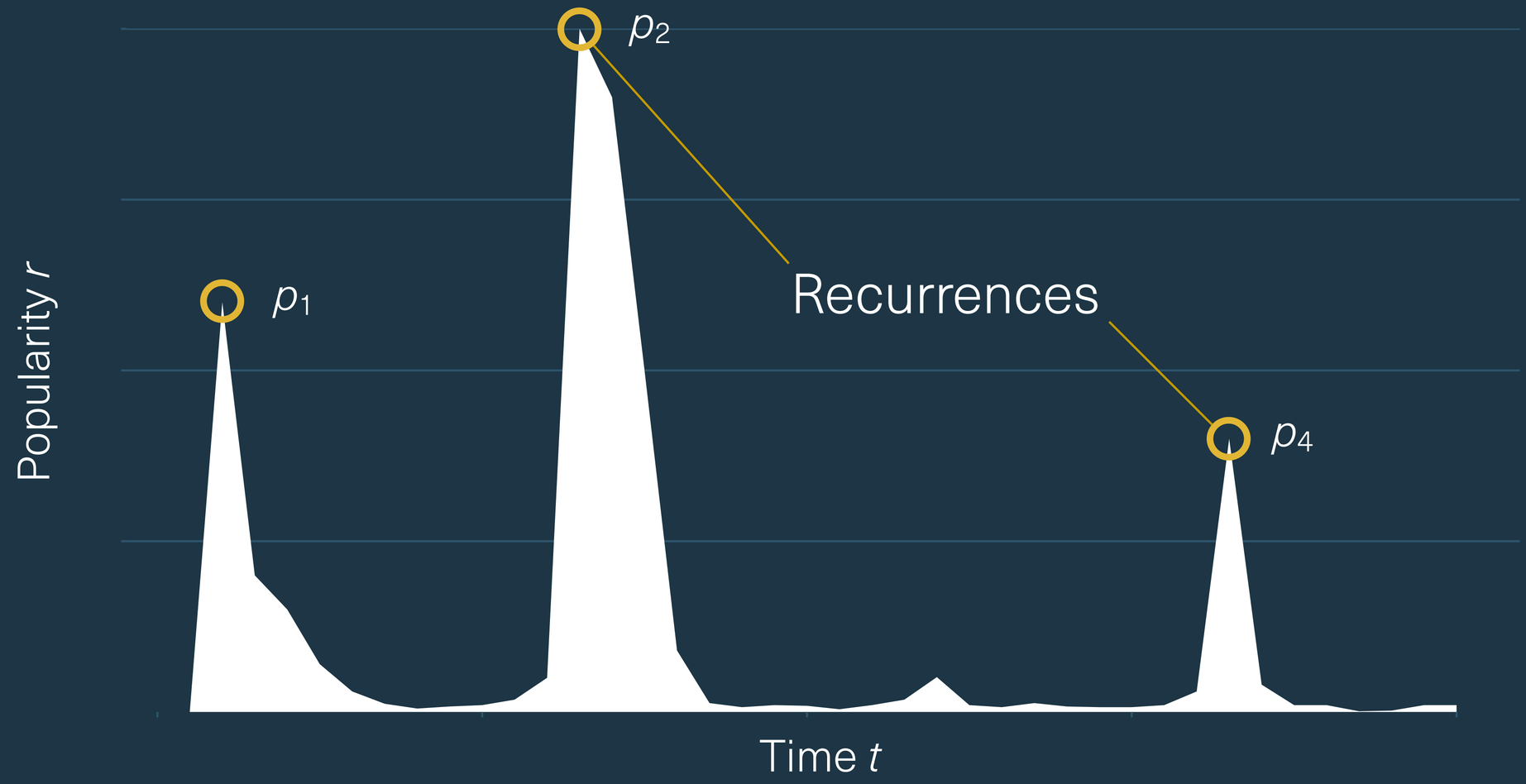
Defining recurrence



Valleys separate peaks

$$r_{p_i}, r_{p_{i+1}} \geq v \cdot \max \{ r_j \mid p_i < j < p_{i+1} \}$$

Defining recurrence



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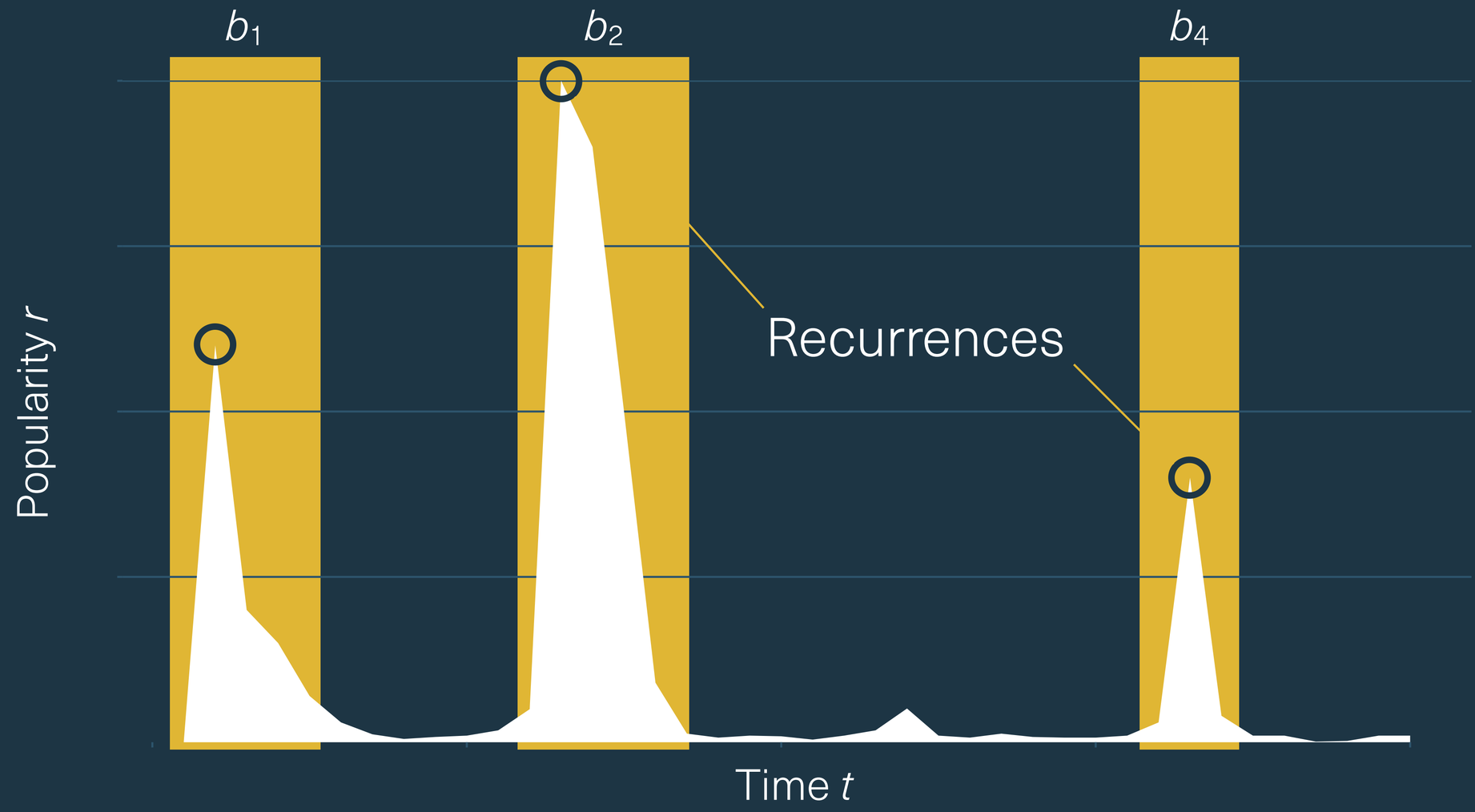
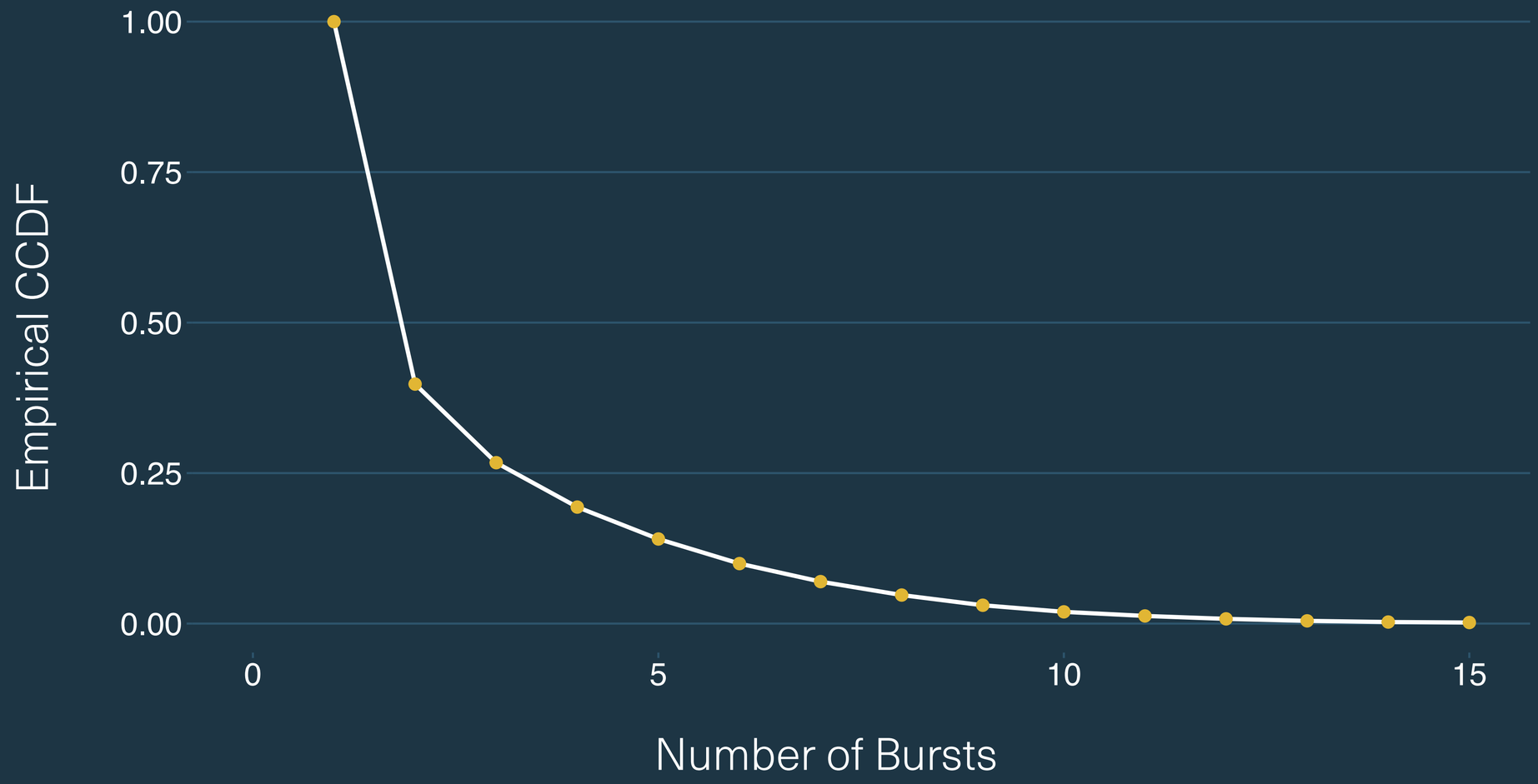


Recurrence is common



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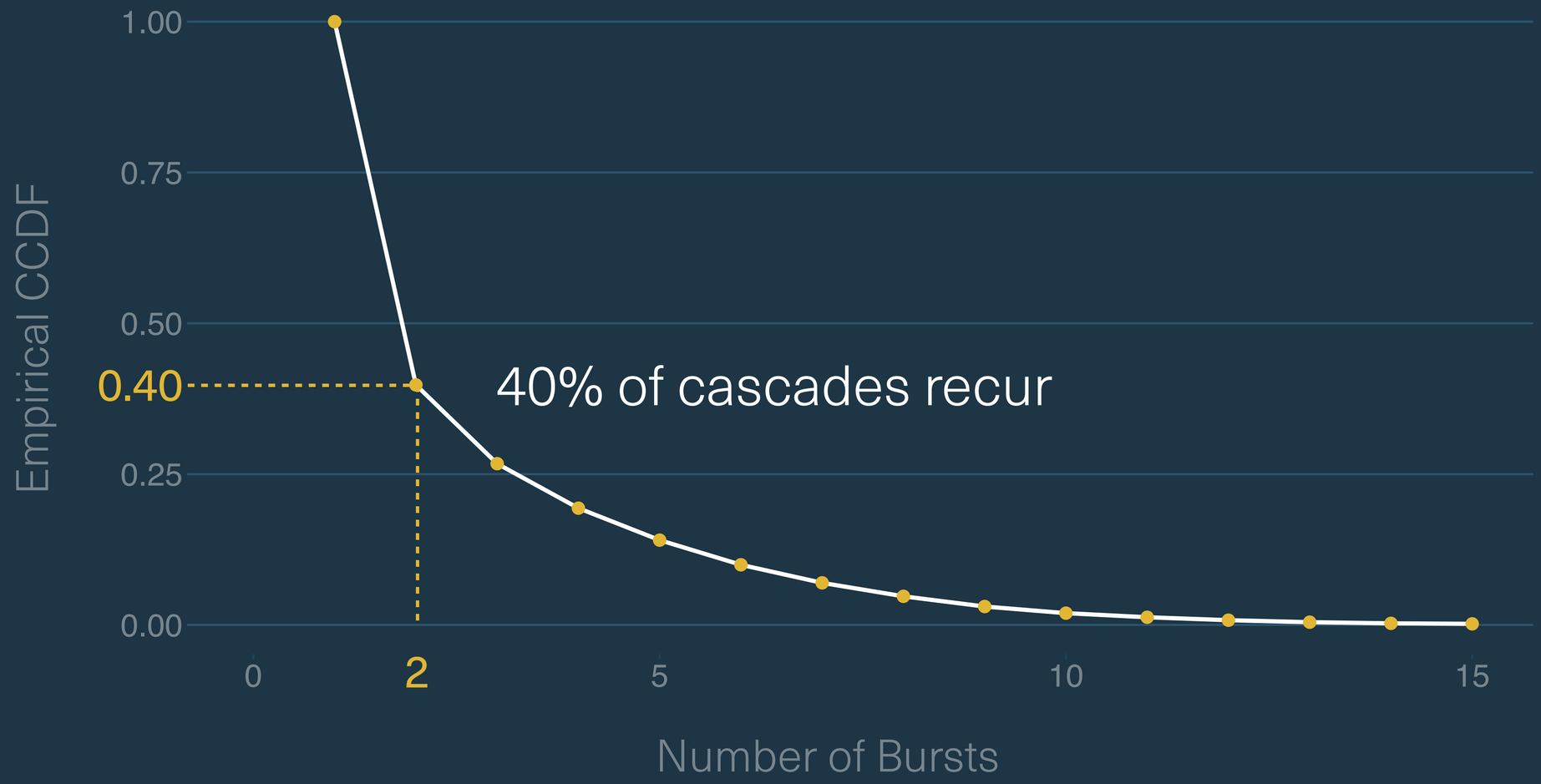

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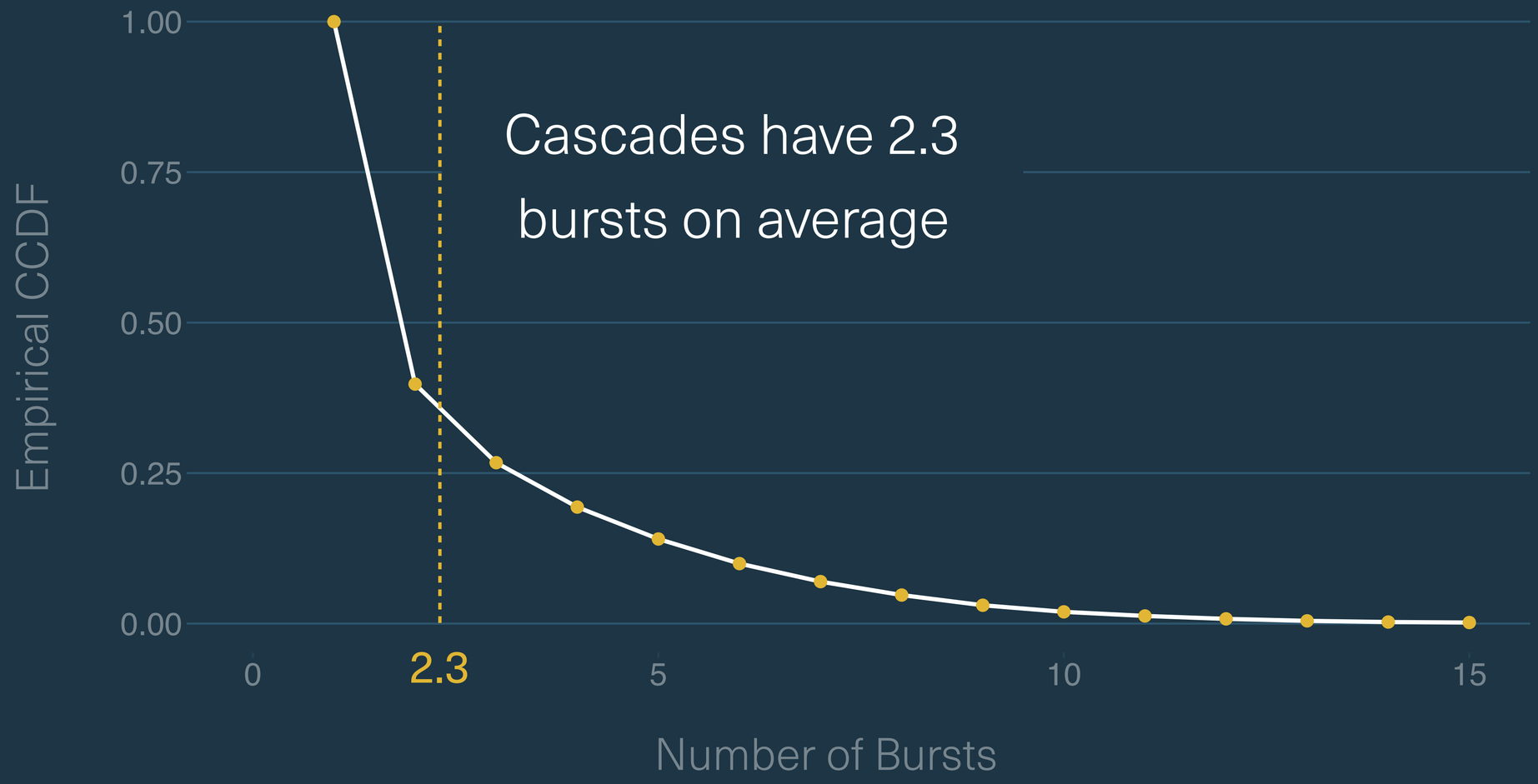
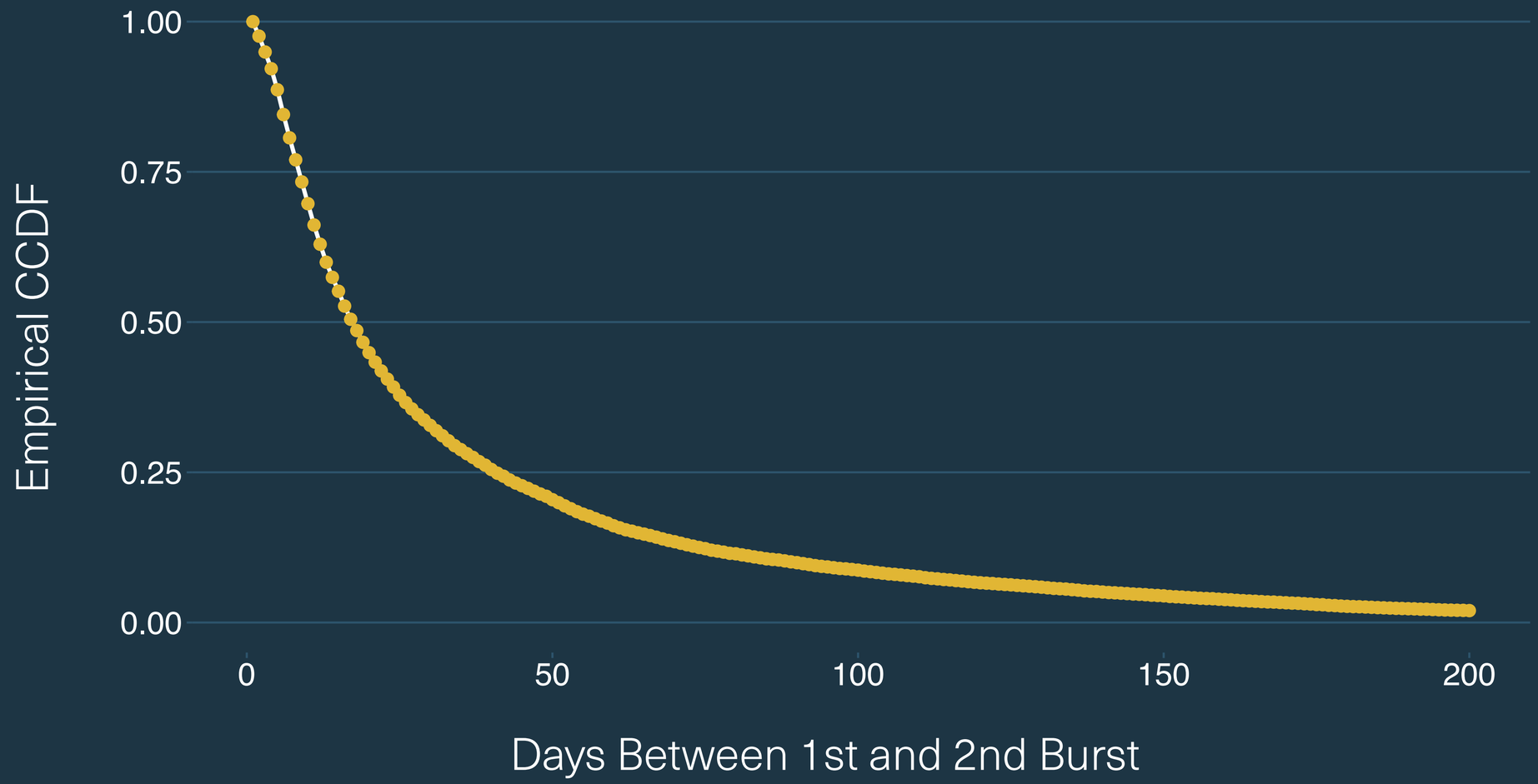


Recurrence takes time



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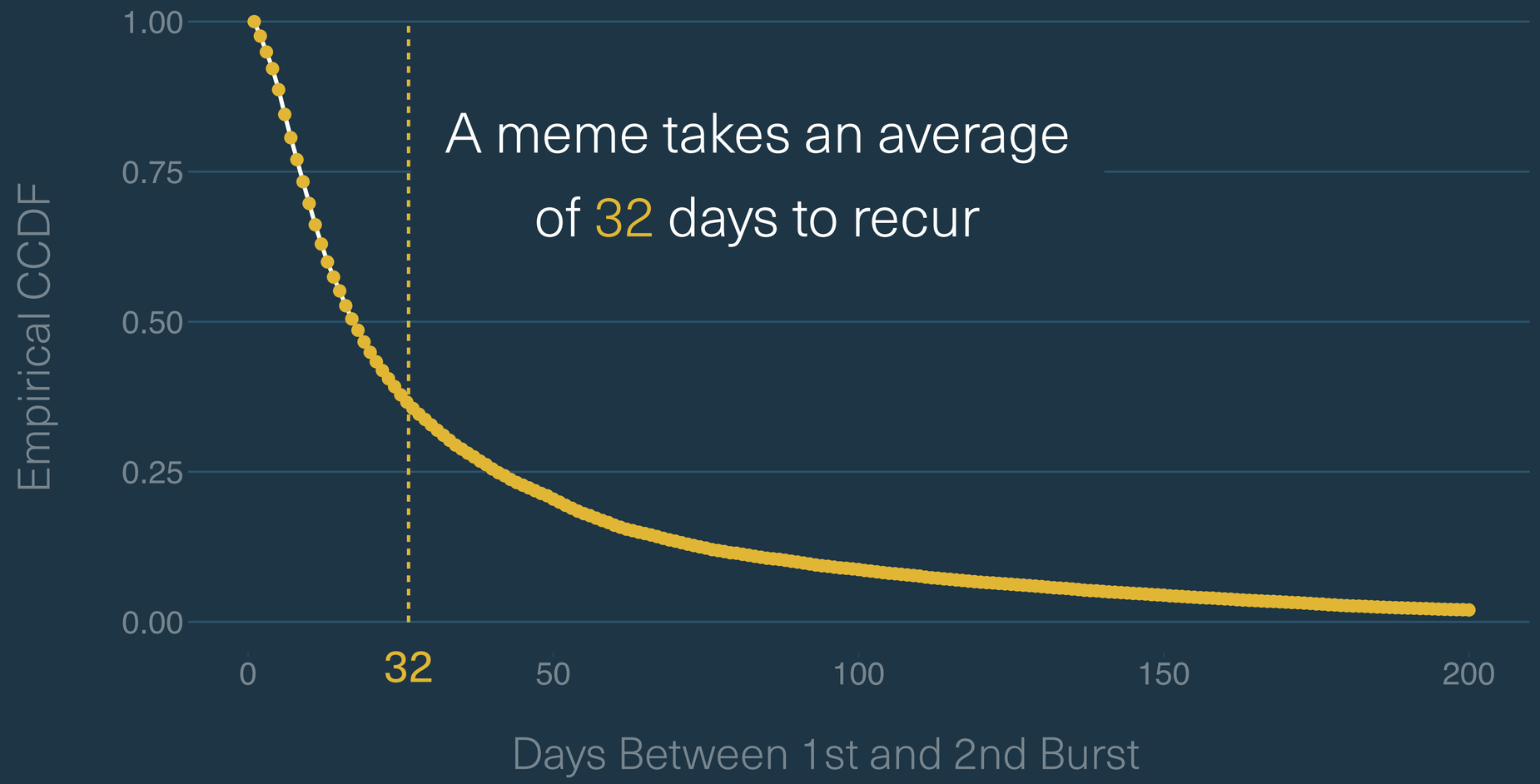


What is recurrence?

A cascade recurs when it peaks in popularity more than once.

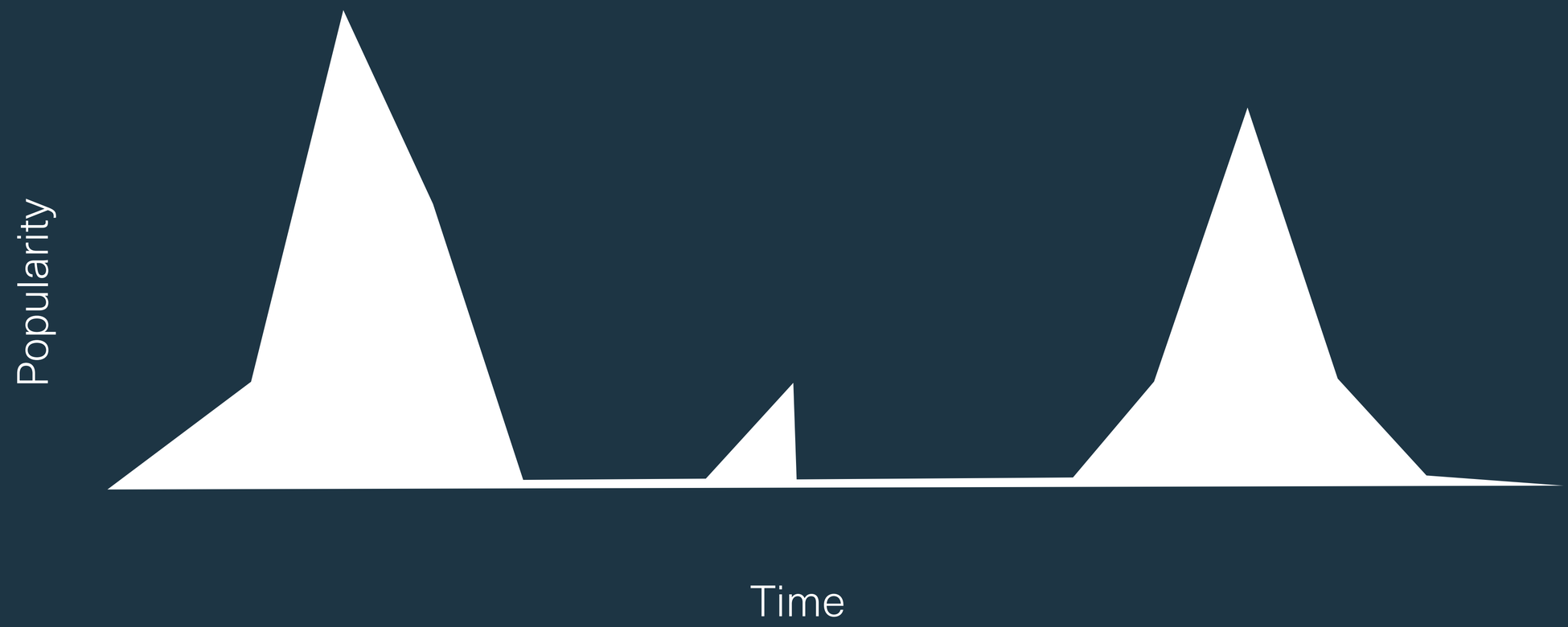
Recurrence is common.

Recurrence takes time.

How do cascades recur?

Do bursts occur in different parts of the network?

Bursts are (somewhat) separated



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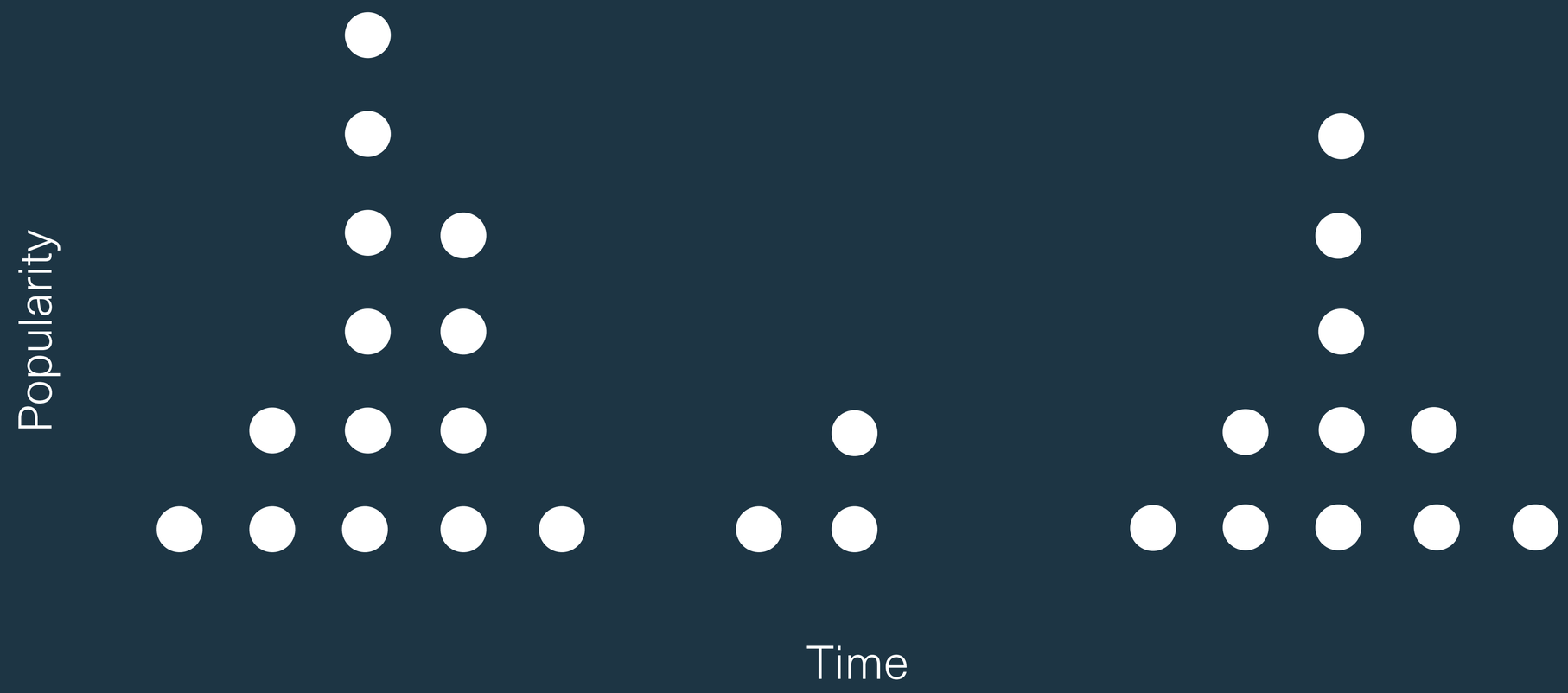

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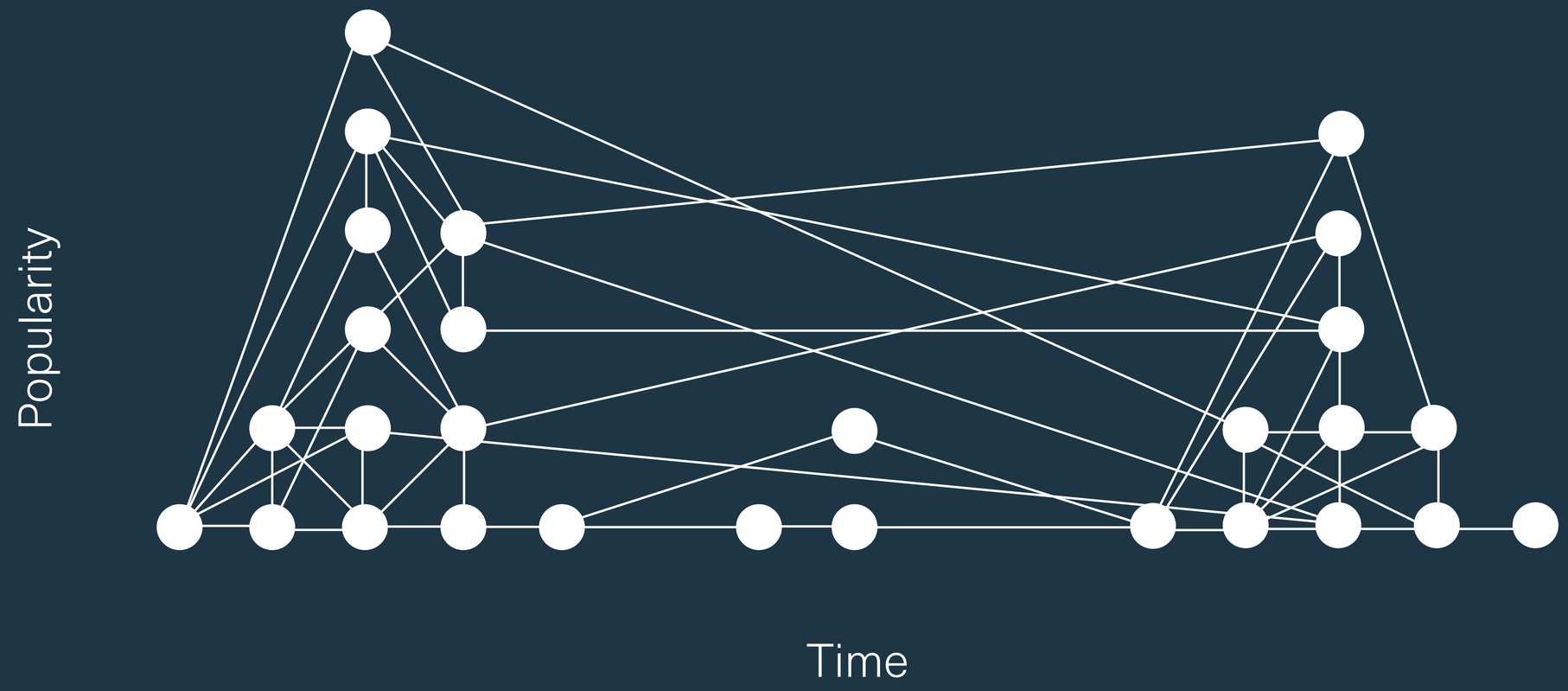
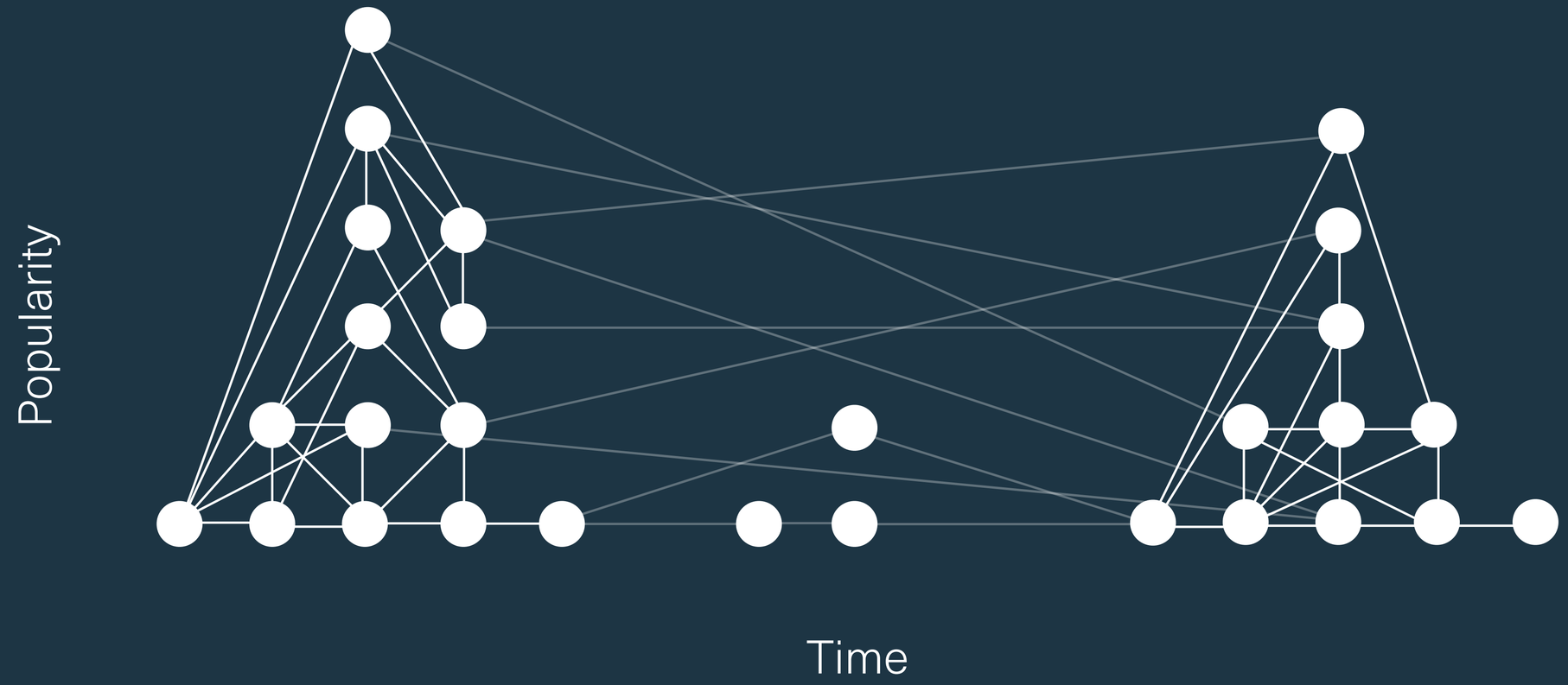


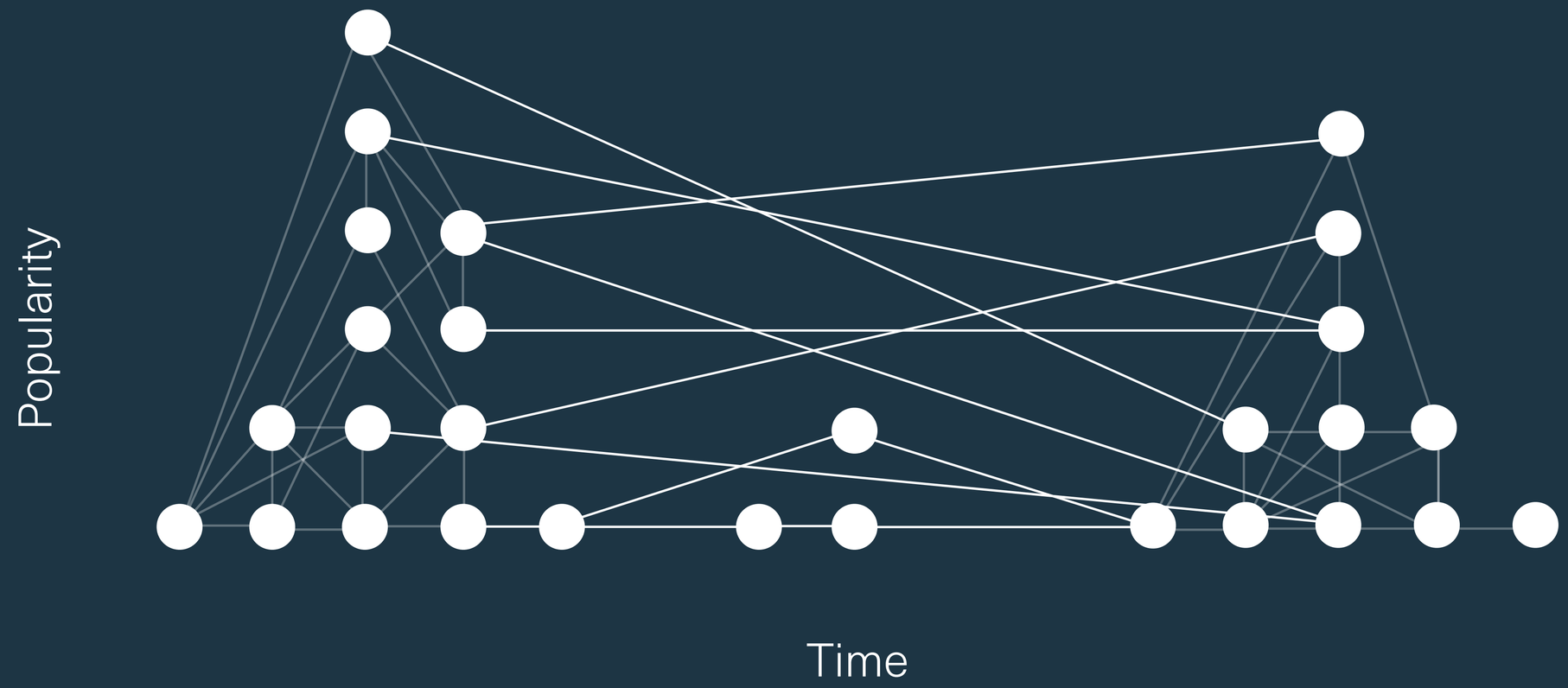
Bursts are (somewhat) separated

3.2 connections **within** bursts



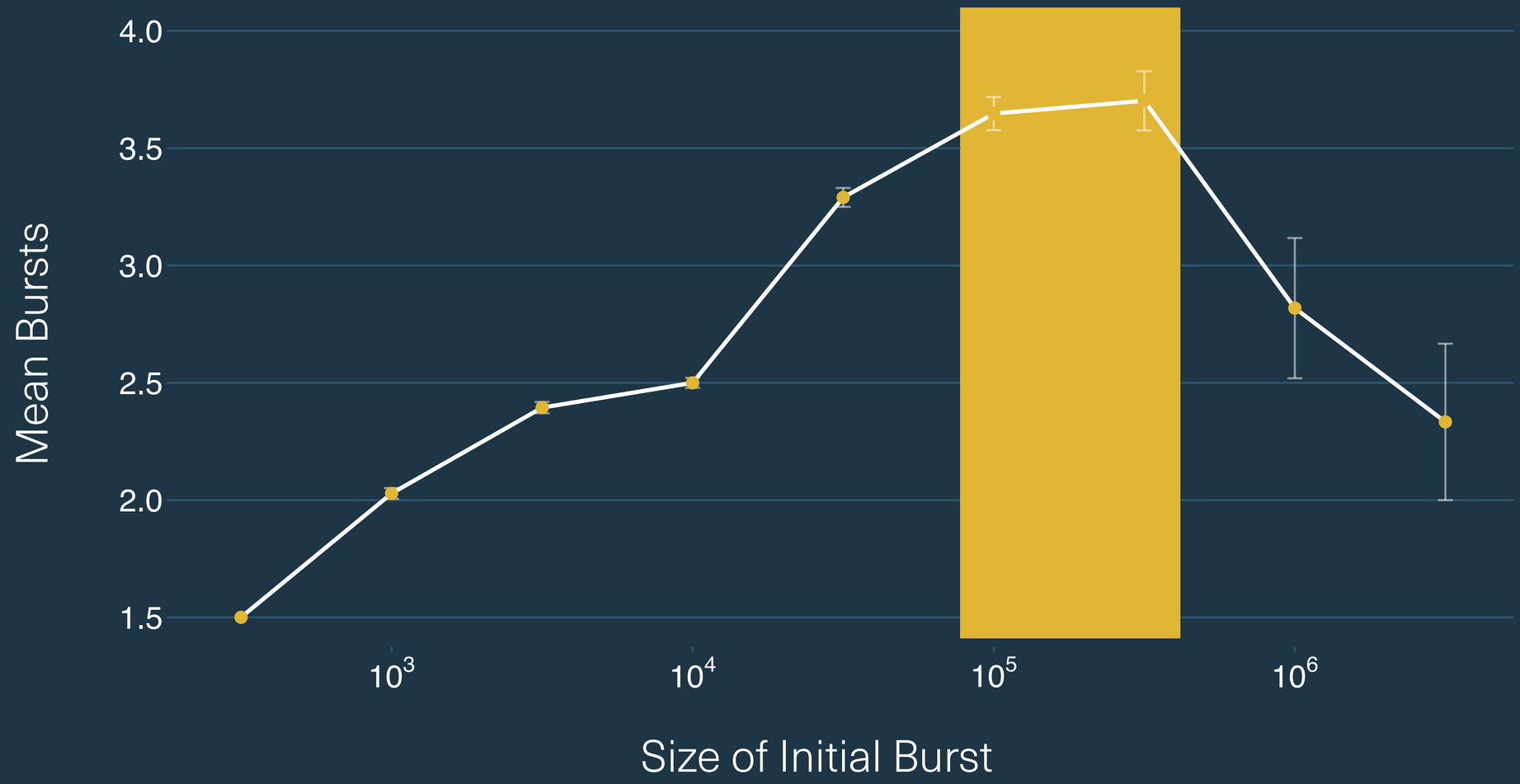
Bursts are (somewhat) separated

1.4 connections **across** bursts

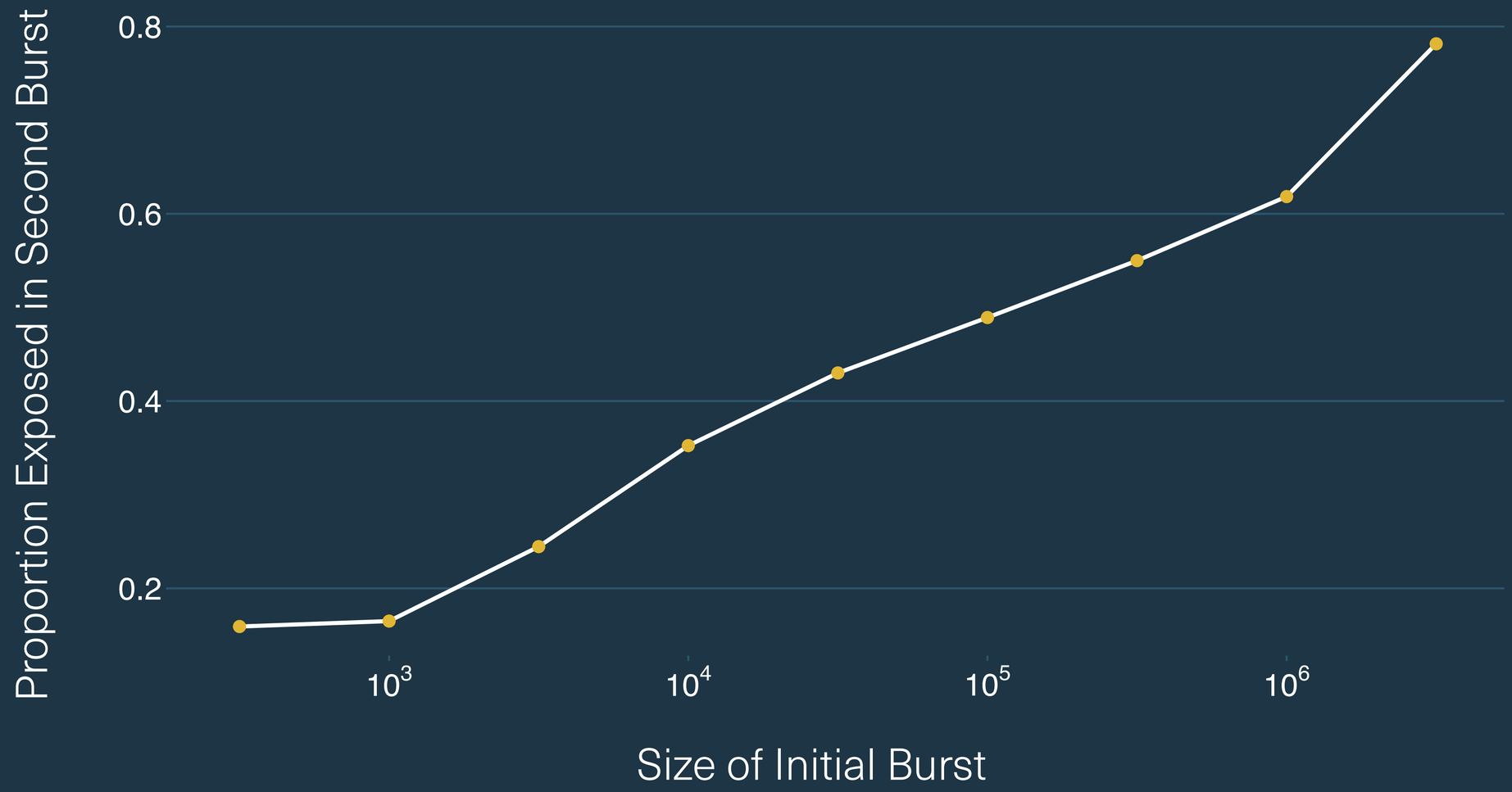


Are more popular cascades more likely to recur?

Moderate popularity increases recurrence

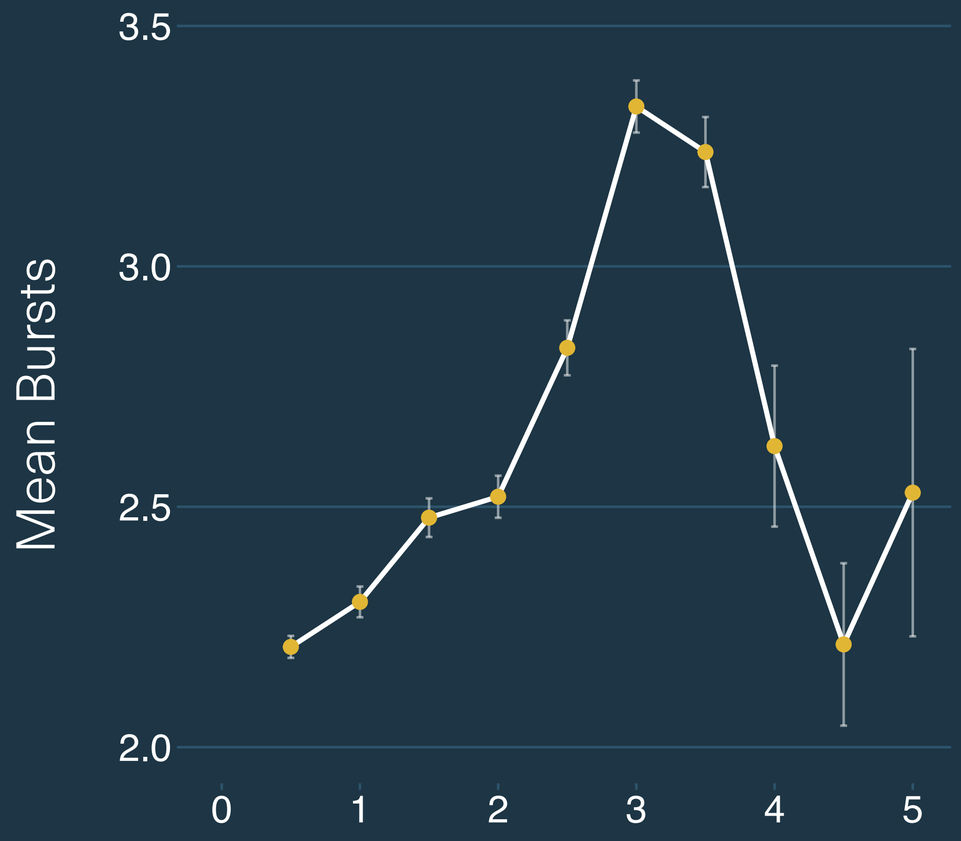


Large initial bursts exhaust susceptibles

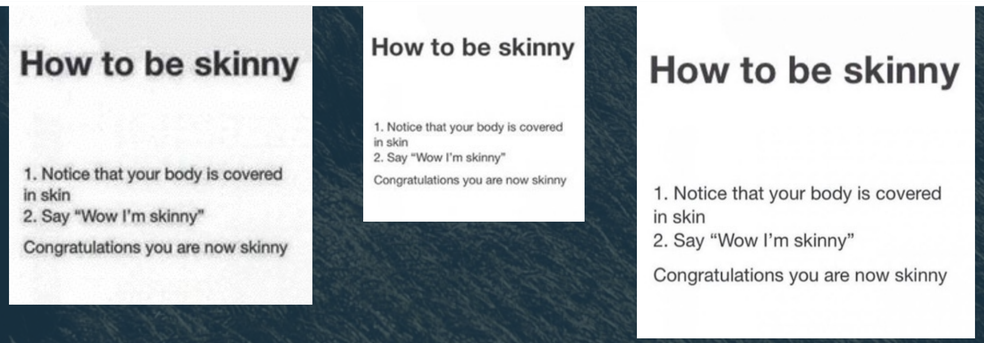


Are cascades with more diverse populations more likely to recur?

Moderate diversity increases recurrence



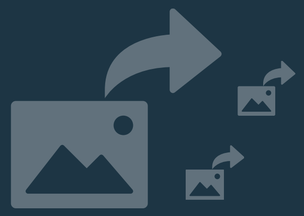
Do new copies of the same meme spark recurrence?



New copies can spark recurrence...

Recurring

Non-recurring



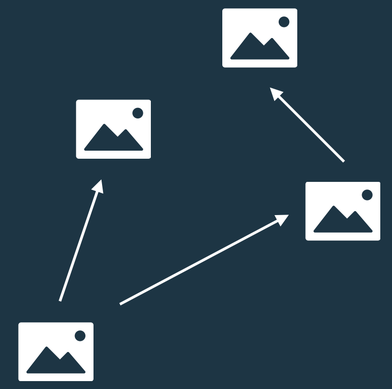
Recurring cascades are spread out over more copies

***r* = 0.66**

Introduction of new copies & number of reshares

New copies correlate with recurrence

...but copies aren't the only cause!



75%

of copies can be attributed
via the friendship graph

Copies can be traced
back to other copies

18%

of individual copies recur

Individual copies
also recur

How do cascades recur?

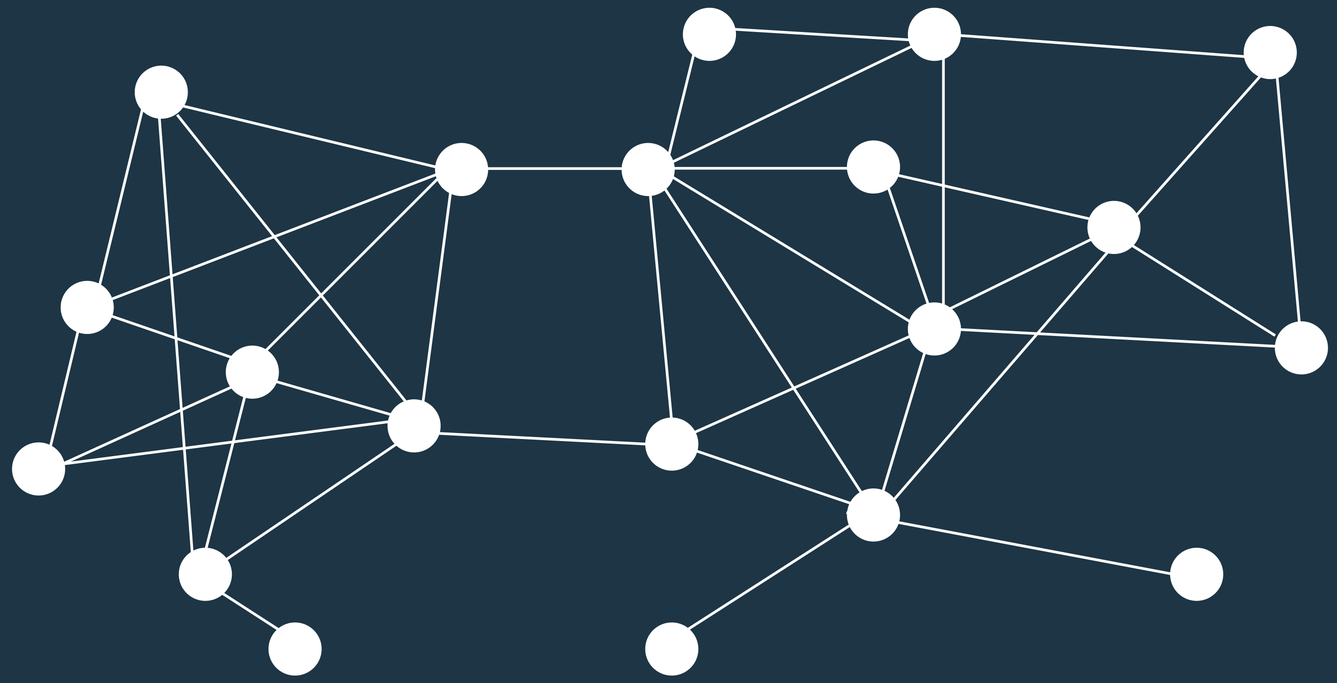
Bursts happen in separate parts of the network.

Moderately viral/diverse content tends to recur.

New copies can spark recurrence.

Why do cascades recur?

A model of recurrence



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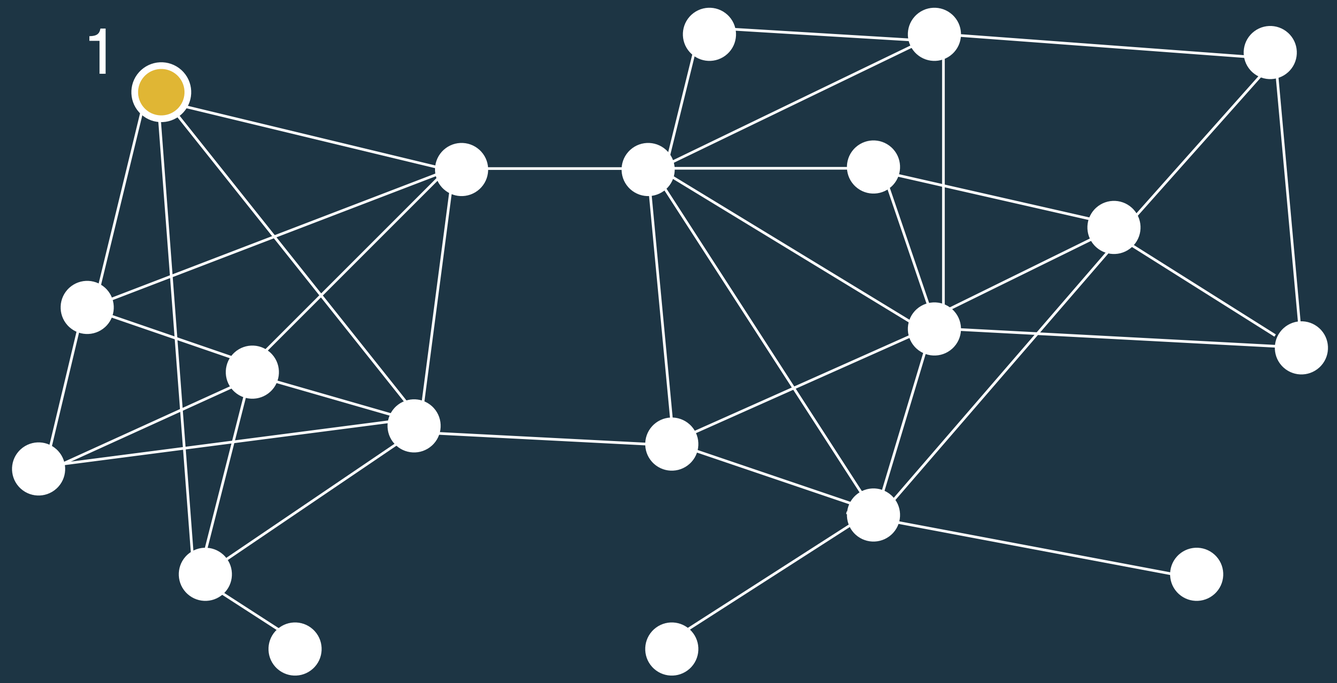

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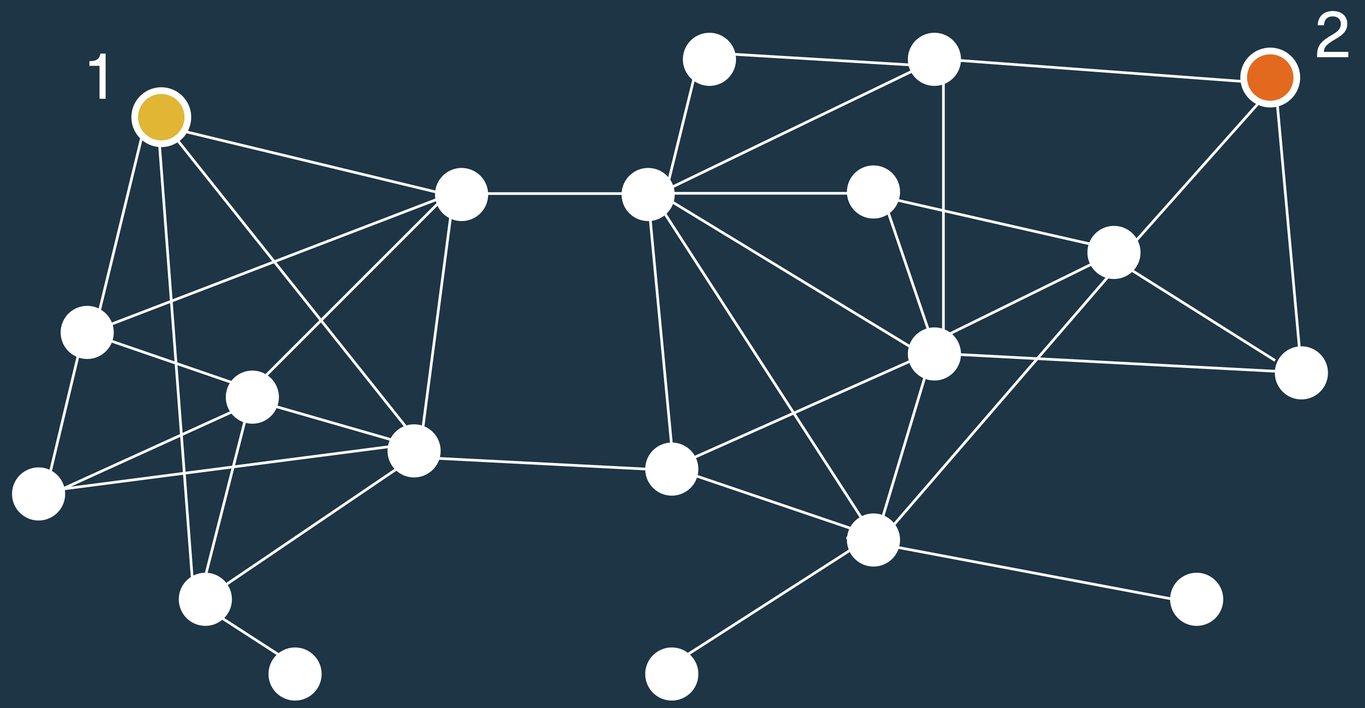
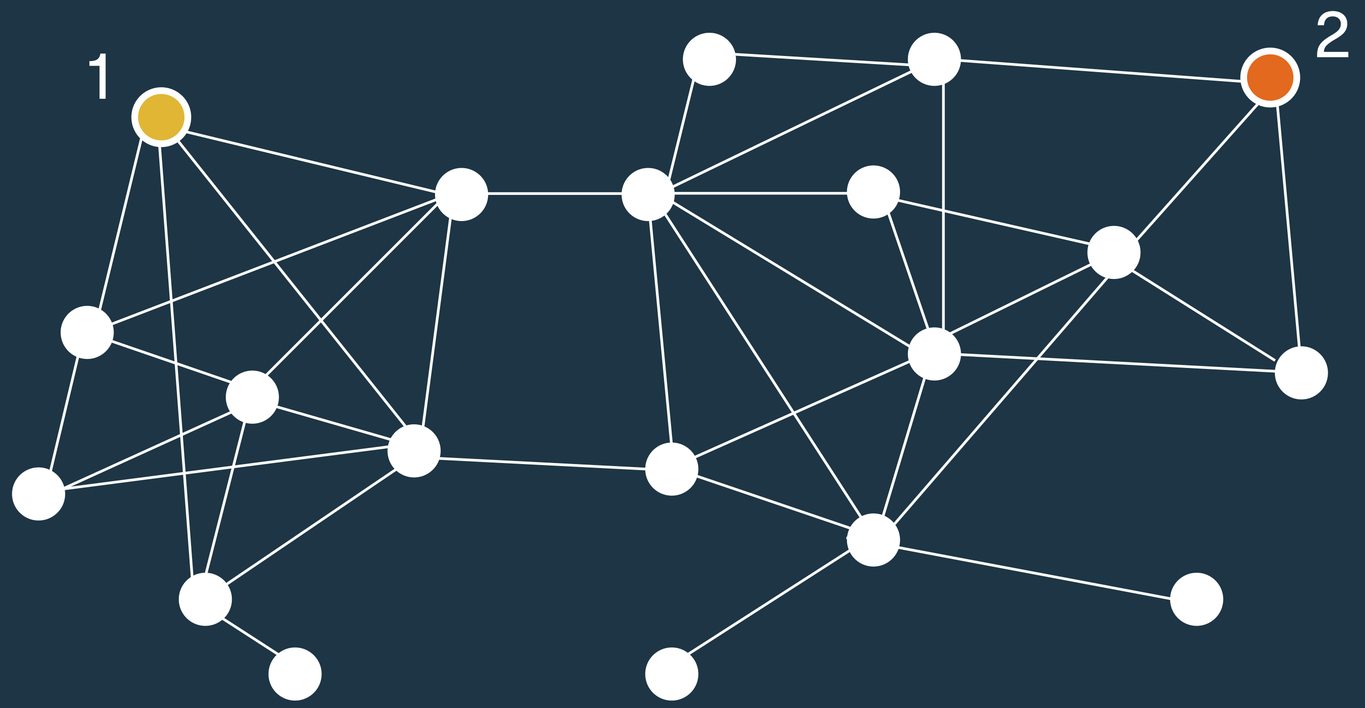


Low virality



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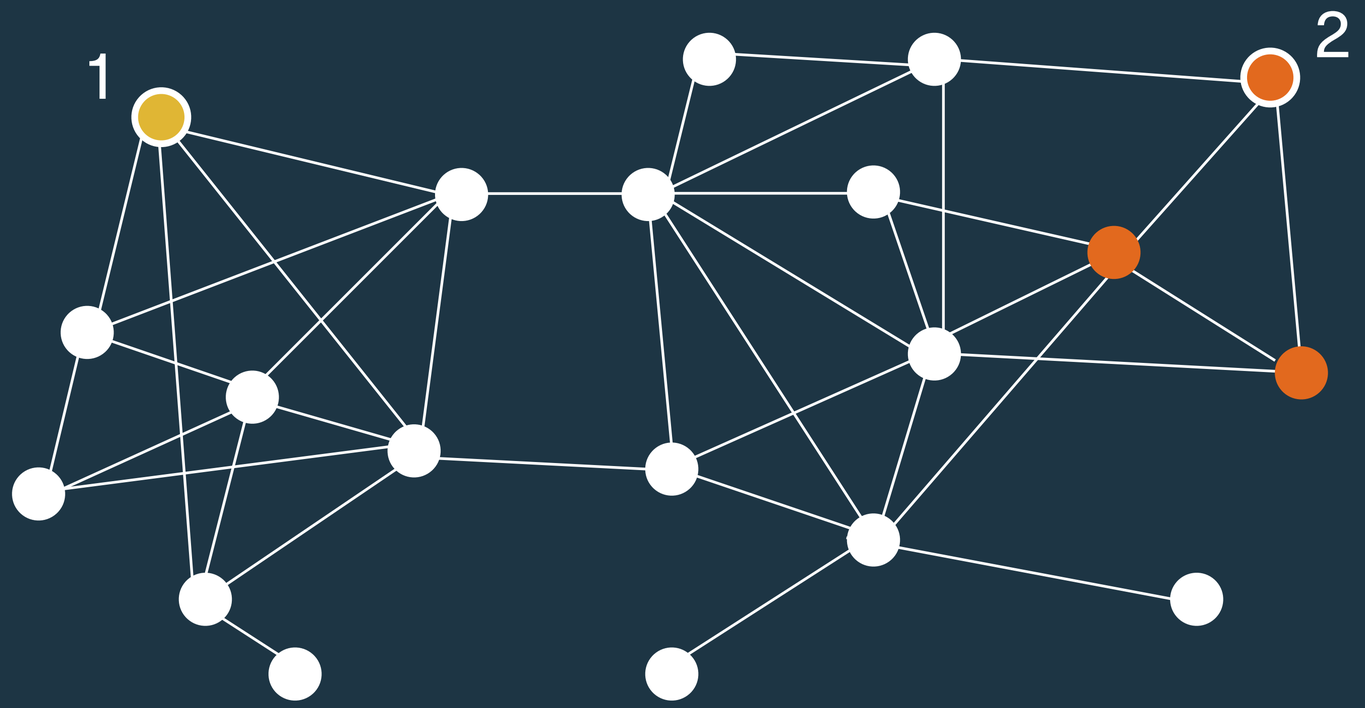

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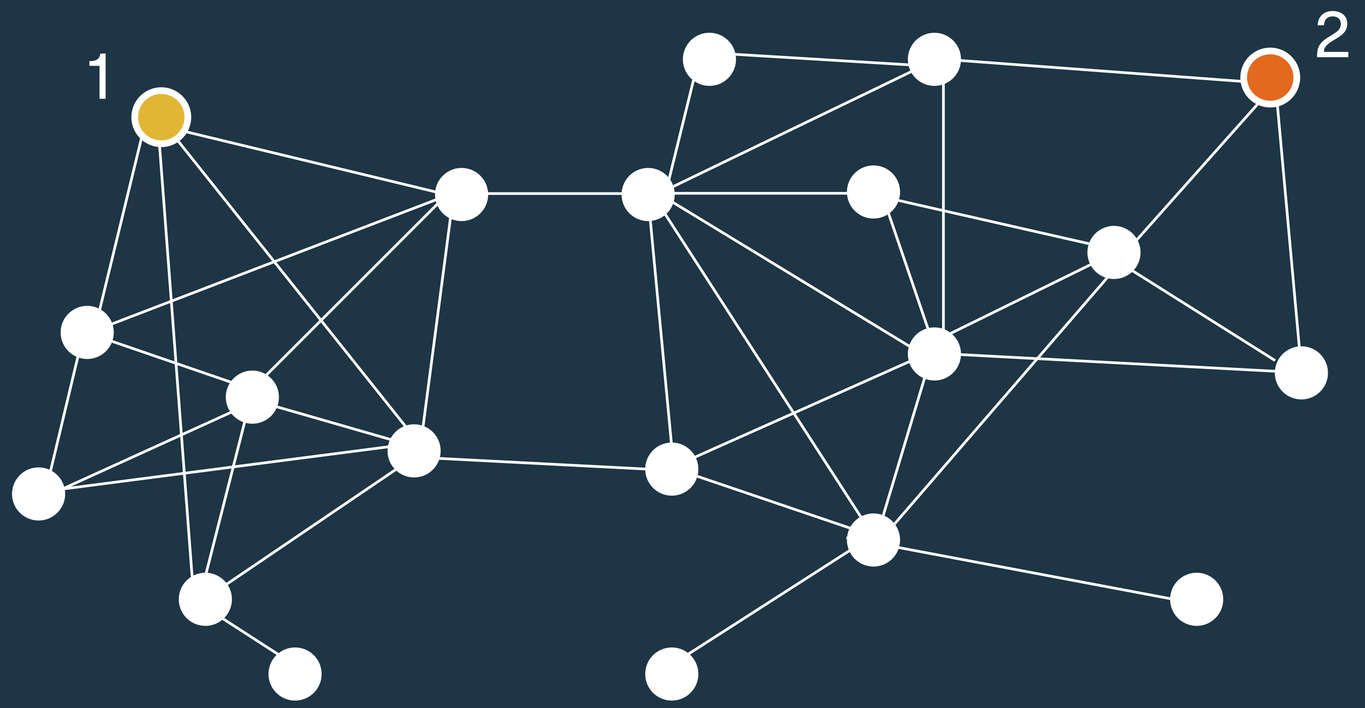

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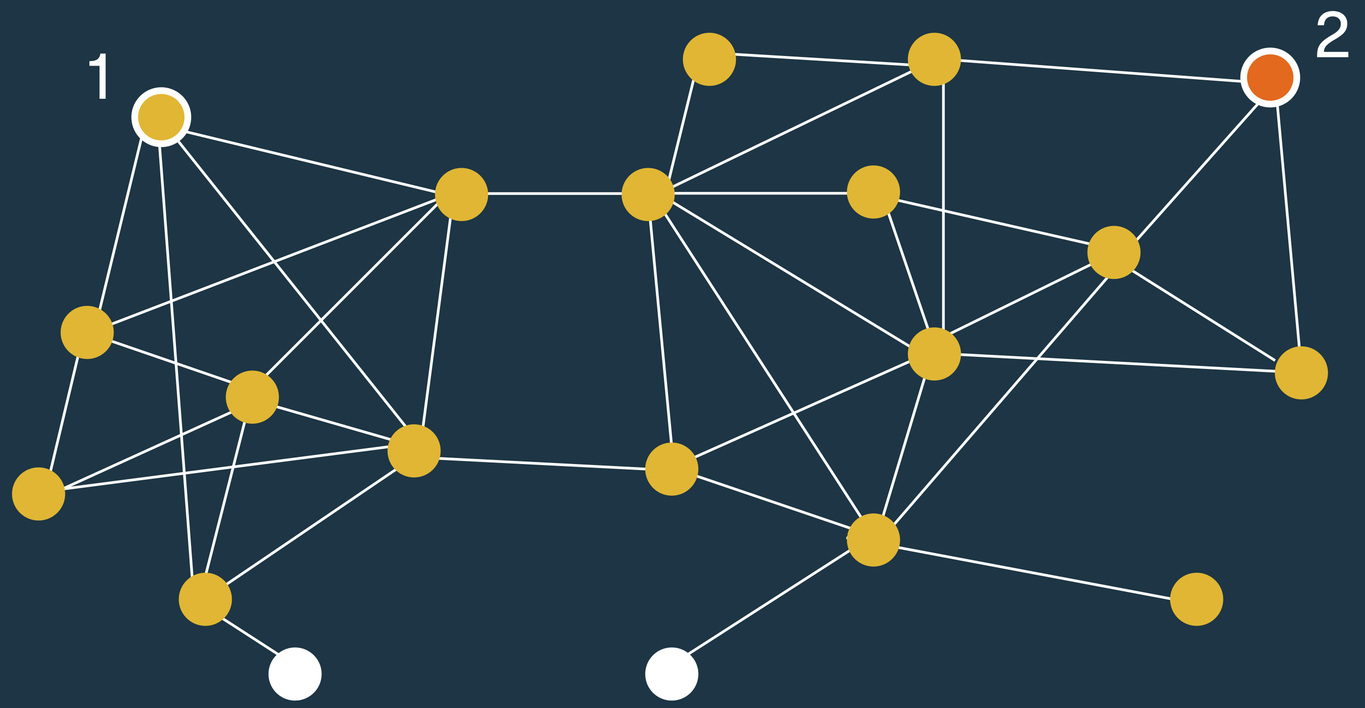
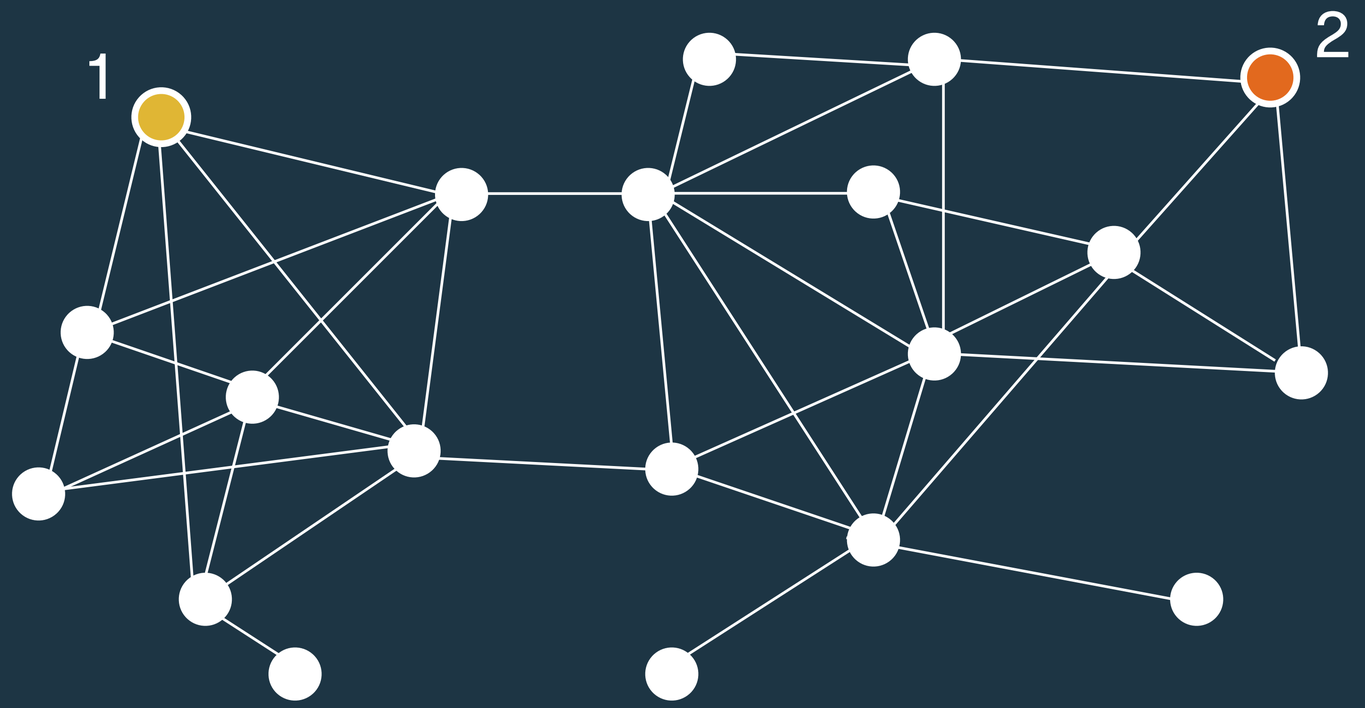


Moderate virality



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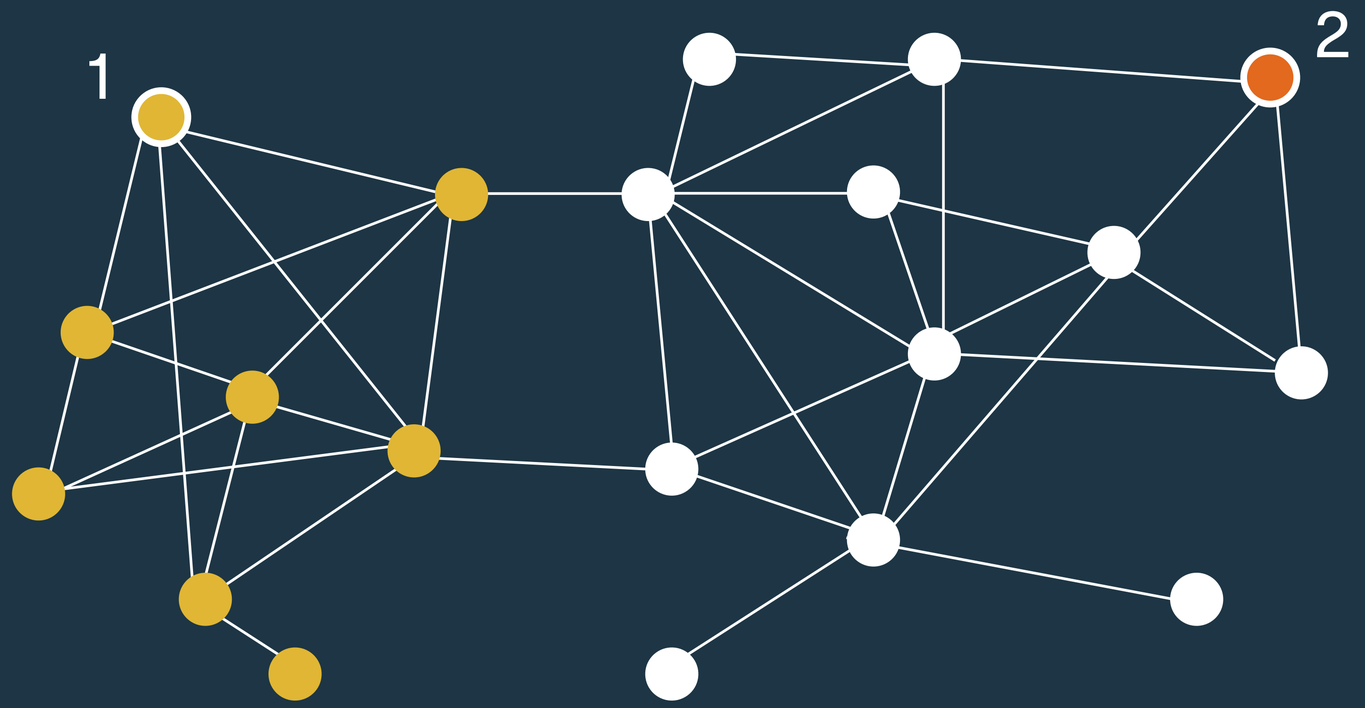

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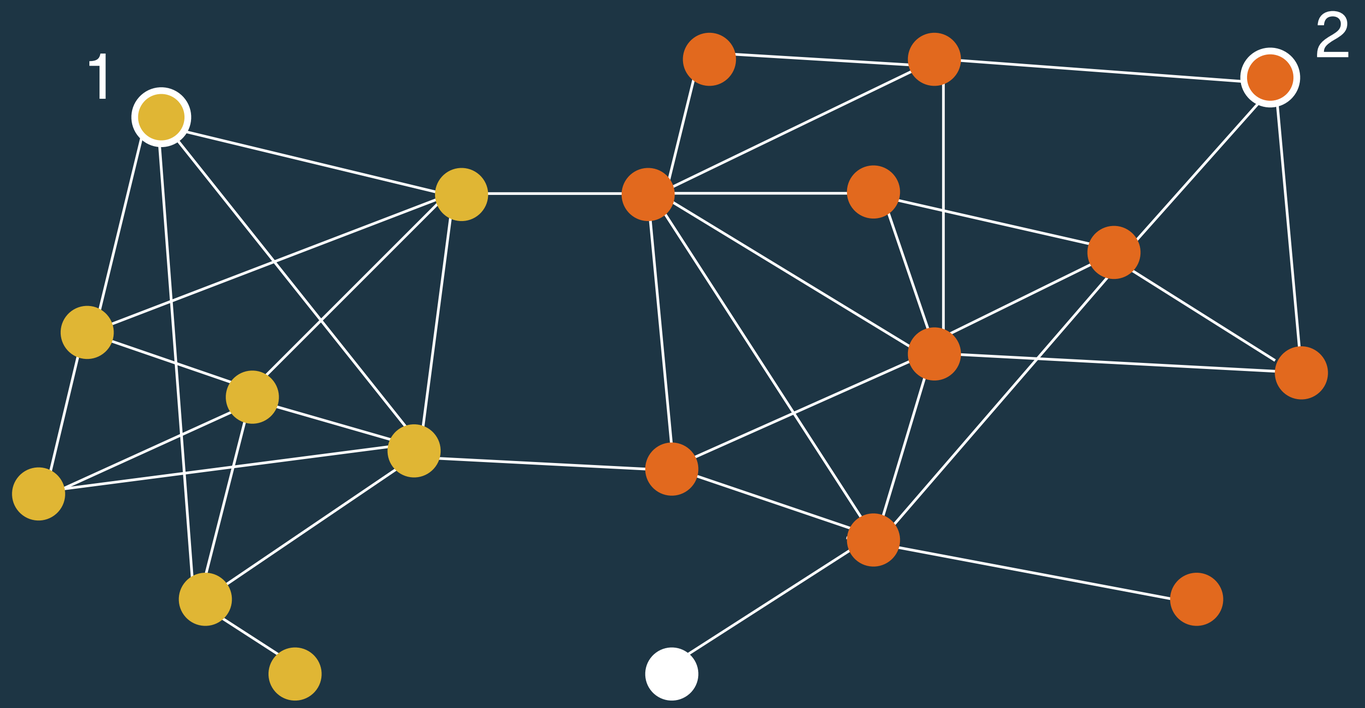
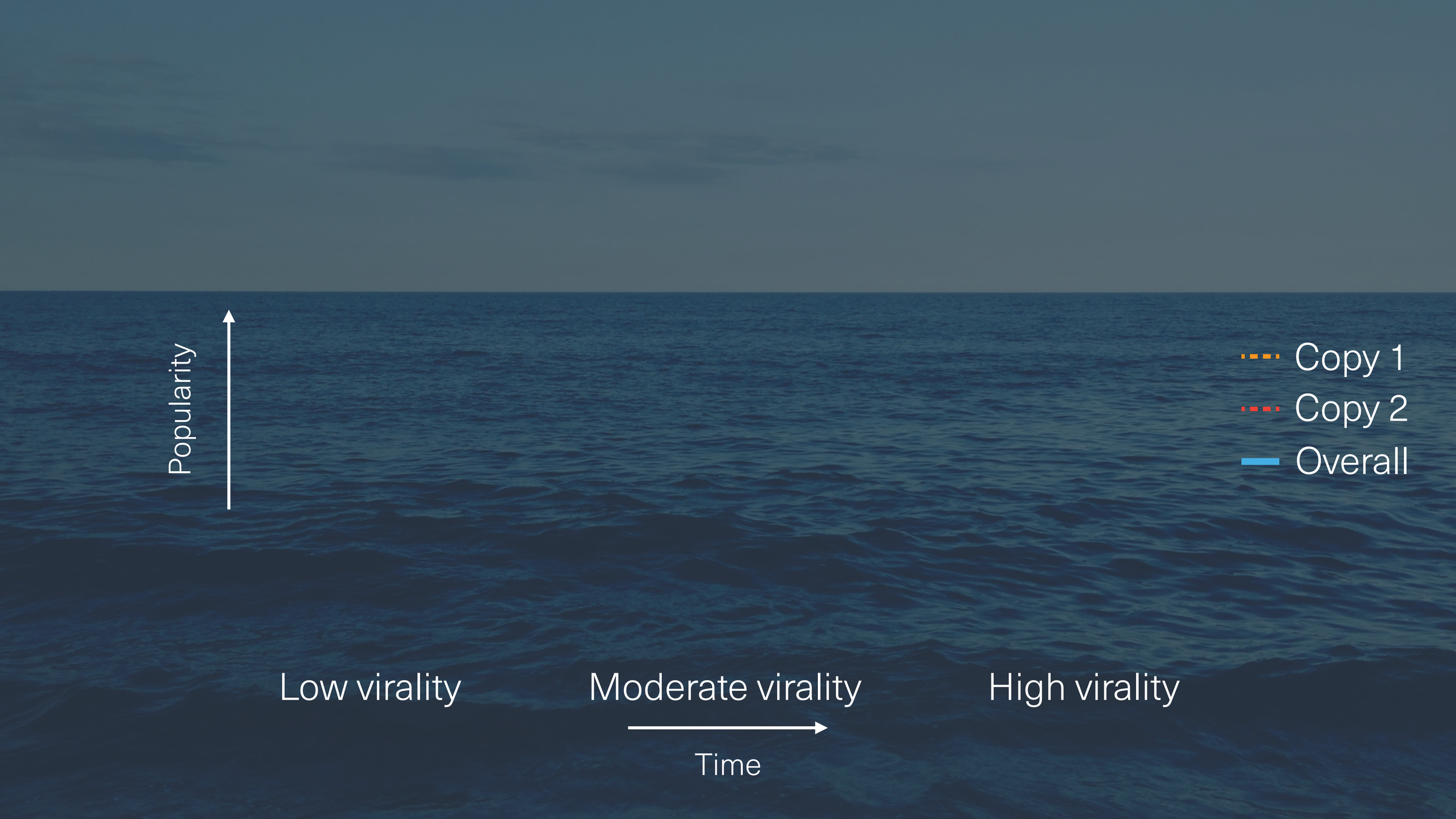
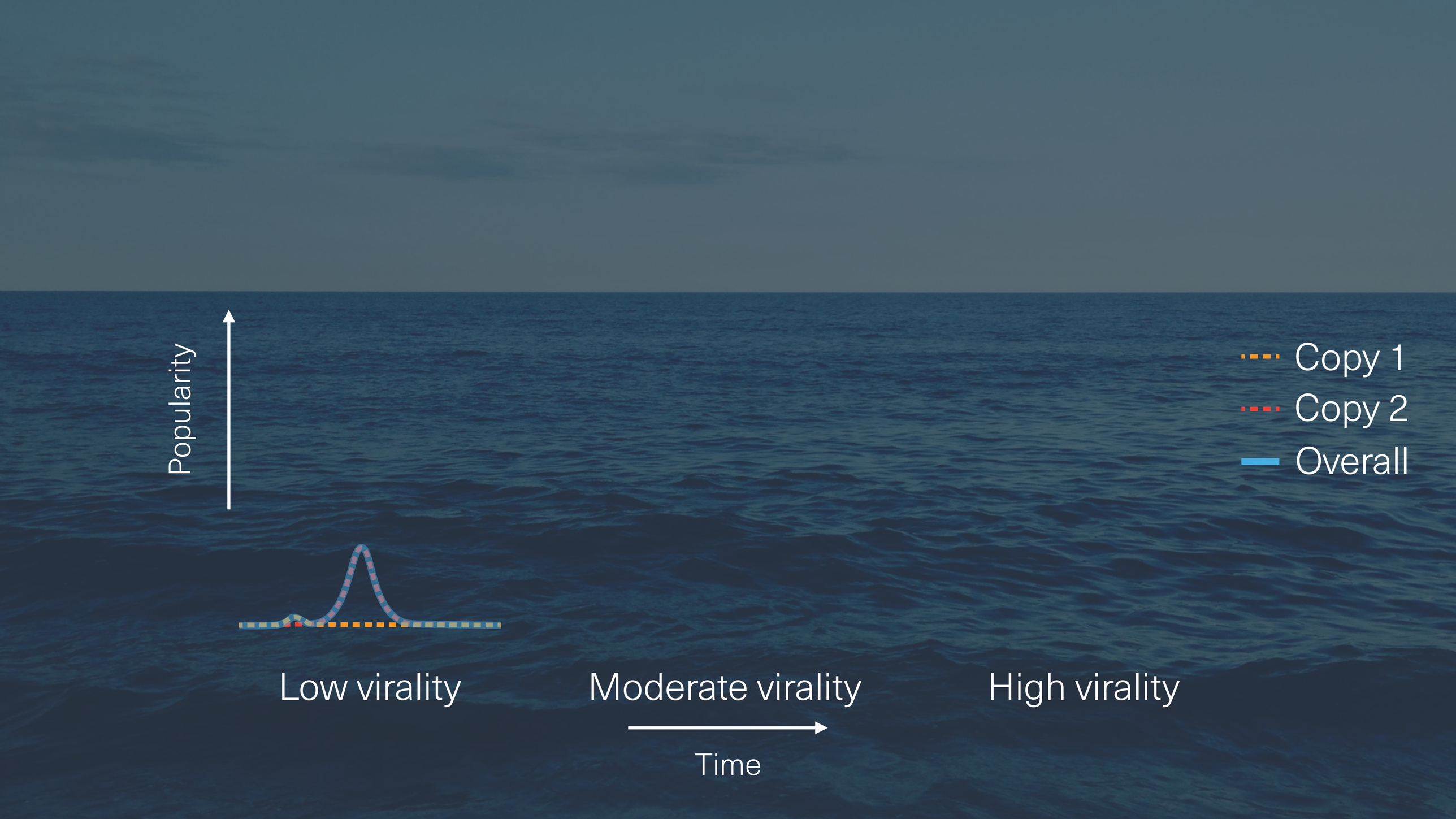



Popularity
Copy 1
Copy 2
Overall
Low virality
Moderate virality
High virality
Time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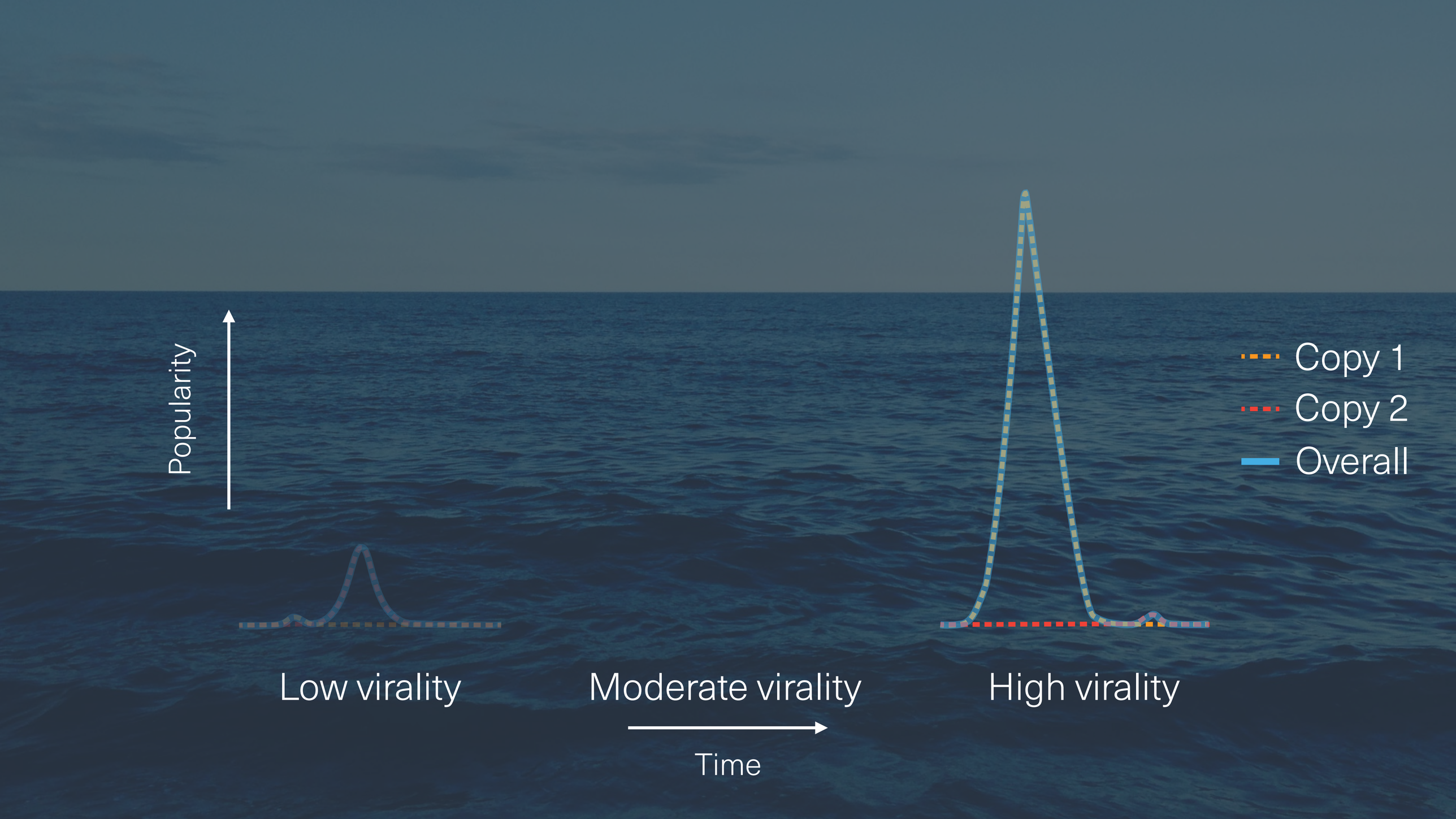
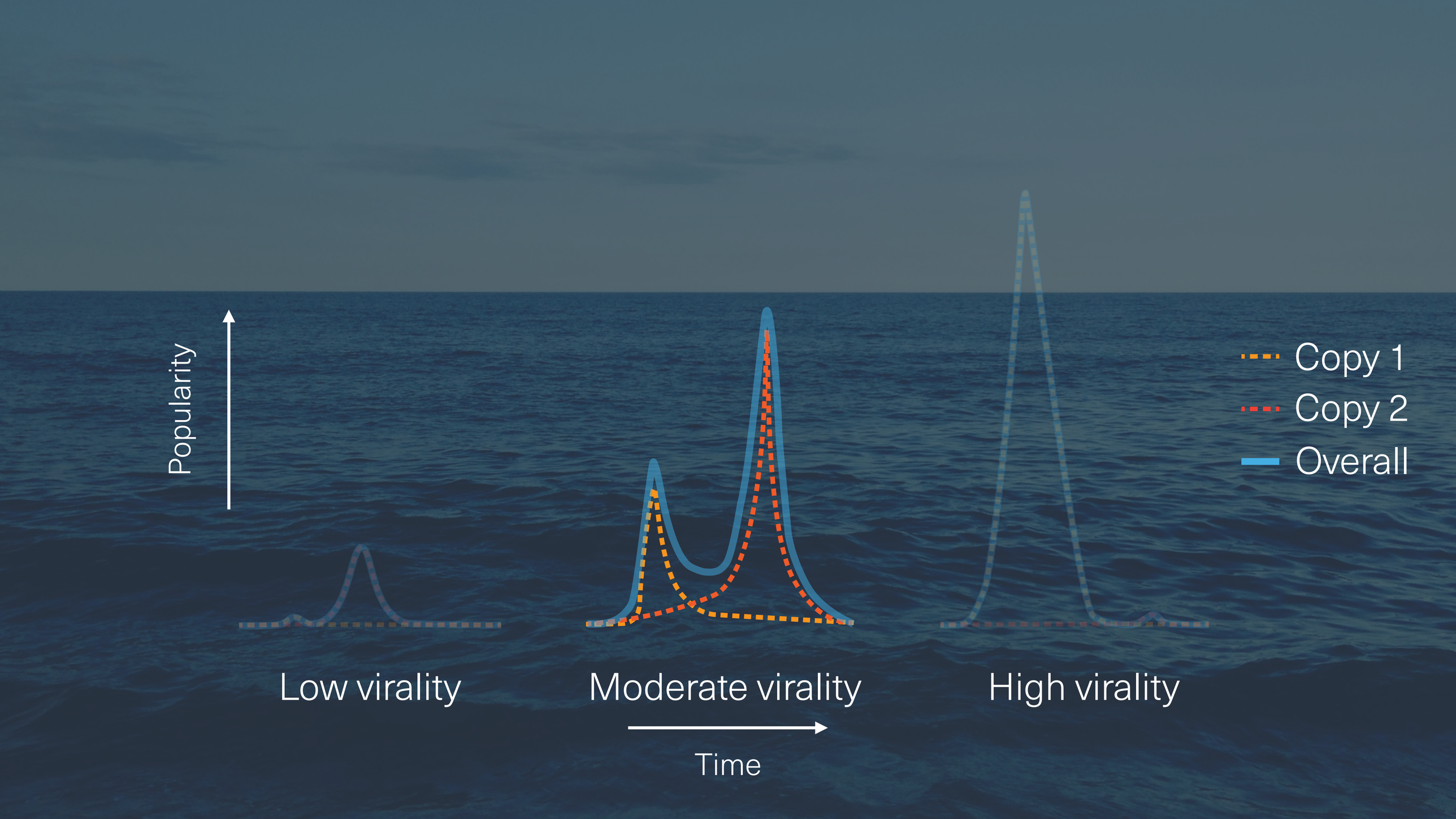
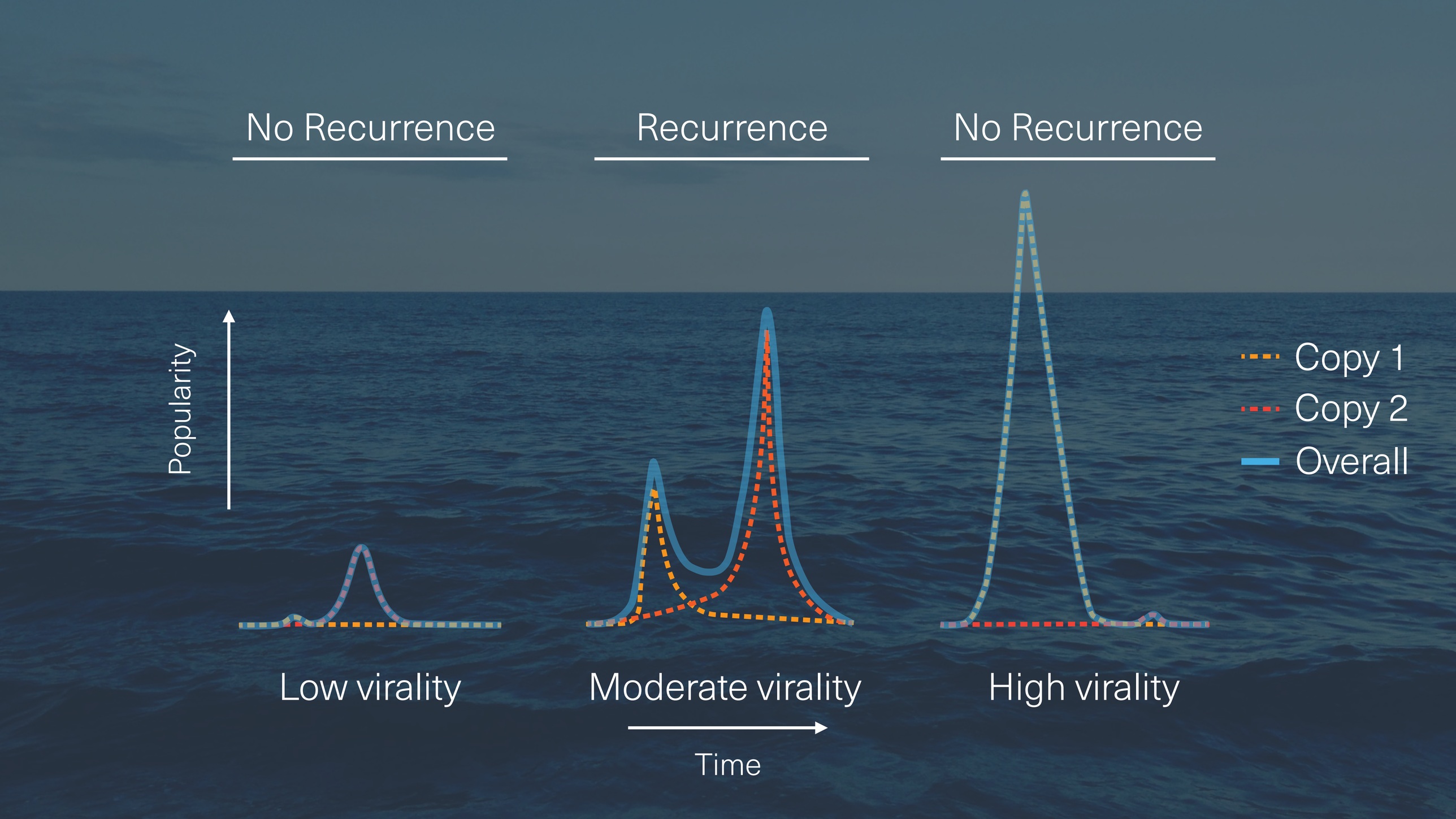
High virality
Time


Popularity
Copy 1
Copy 2
Overall
Low virality
Moderate virality
High virality
Time


Popularity
Copy 1
Copy 2
Overall
Low virality
Moderate virality
High virality
Time


No Recurrence
Recurrence
No Recurrence
Popularity
Copy 1
Copy 2
Overall
Low virality
Moderate virality
High virality
Time

Simulations of this model replicate previous key findings.

Can we predict recurrence?

Features

Temporal

(e.g., burst length)

Sharer

(e.g., gender)

Network

(e.g., # edges)

Copy

(e.g., # copies)

Predicting recurrence

Existence

Will it recur?

Size

Will it be larger?

Time

When will it recur?

Predicting recurrence

Existence	Size	Time
.89 AUC	**.78** AUC	**.58** AUC
Will it recur?	Will it be larger?	When will it recur?

Future / Related Work

- Effect of Multiple Networks, External Stimuli

  Gruhl et al. (2004), Kumar et al. (2005), Myers & Leskovec (2012)

- Improved Models of Recurrence

  Barabasi (2006), Cha et al. (2012), Matsubara et al. (2012)

- Other Factors Influencing Recurrence (Seasonality, Sentimentality)

  Altizer et al. (2006), Verdasca et al. (2005)

Cascades Do Recur.

Justin Cheng, Lada Adamic, Jon Kleinberg, Jure Leskovec

http://bit.ly/cascades-paper