



# COVID-19'S EFFECT ON THE RHYTHMS OF SMILING ON SOCIAL MEDIA

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# INTRODUCTION

- **Smiling** is a salient, common, and impactful socio-affective signal
- Photos posted to **social media** are a rich source of data for studies of smiling (large, frequent, global)
- Social behavior and affect are known to have **temporal rhythms** (e.g., daily, weekly, and seasonal)
- We planned to analyze temporal rhythms of smiling on Instagram
- *Then something happened in 2020...*



# INTRODUCTION

- The **COVID-19 pandemic** was highly disruptive to many aspects of life
- Fear, uncertainty, loneliness, and loss were widespread **negative emotions**
- Social distancing and face masks changed **social communication**
- Lockdowns and work-from-home policies altered **temporal rhythms**
- We measured smiling on social media to study temporal rhythms before and during the pandemic



# HYPOTHESES



## HYPOTHESIS 1

At baseline, smiling will be *higher during weekend* days and show a seasonal cycle that *peaks during summer* months



## HYPOTHESIS 2

Smiling will *decrease* during COVID's first year and then *partially return to baseline* during COVID's second year



## HYPOTHESIS 3

COVID's first year will show a *dampened weekend* effect and *partially return to baseline* during COVID's second year



## HYPOTHESIS 4

COVID's first year will show a *dampened seasonal* amplitude and *partially return to baseline* during COVID's second year



# DATA AND MEASURES

Where did the data come from? How did we measure smiling?



# SOURCE & COUNTS

Partnered with **Whalar** (an international influencer management company)

- 1,905,424 images publicly uploaded
- 5,469 influencers on Instagram
  - 77.3% female, 21.2% male, 1.4% other
  - Age 18-64 (M=29.34, SD = 5.98)
- 76 countries of origin for influencers
  - 48.5% USA, 26.5% UK, 25% other
- 921 days from May 2019 – Oct 2021
  - All data were missing during Apr 2020





# MEASURES

- Smile intensity was estimated using the OpenFace 2.0 toolkit (CV + ML system)



- Validated by 3 crowd-workers rating smile intensity (sample of 595 images)

$$r = 0.41, 95\% \text{ CI: } [.34, .47]$$



# MODELING APPROACH

How can we parameterize a model to test our hypotheses?





# COMPARING TEMPORAL RHYTHMS

## SEASONAL PERIODIC EFFECTS



$$\text{Amplitude} = \sin\left(t \times \frac{2\pi}{365}\right)$$

*How large is the peak of the seasonal cycle?*

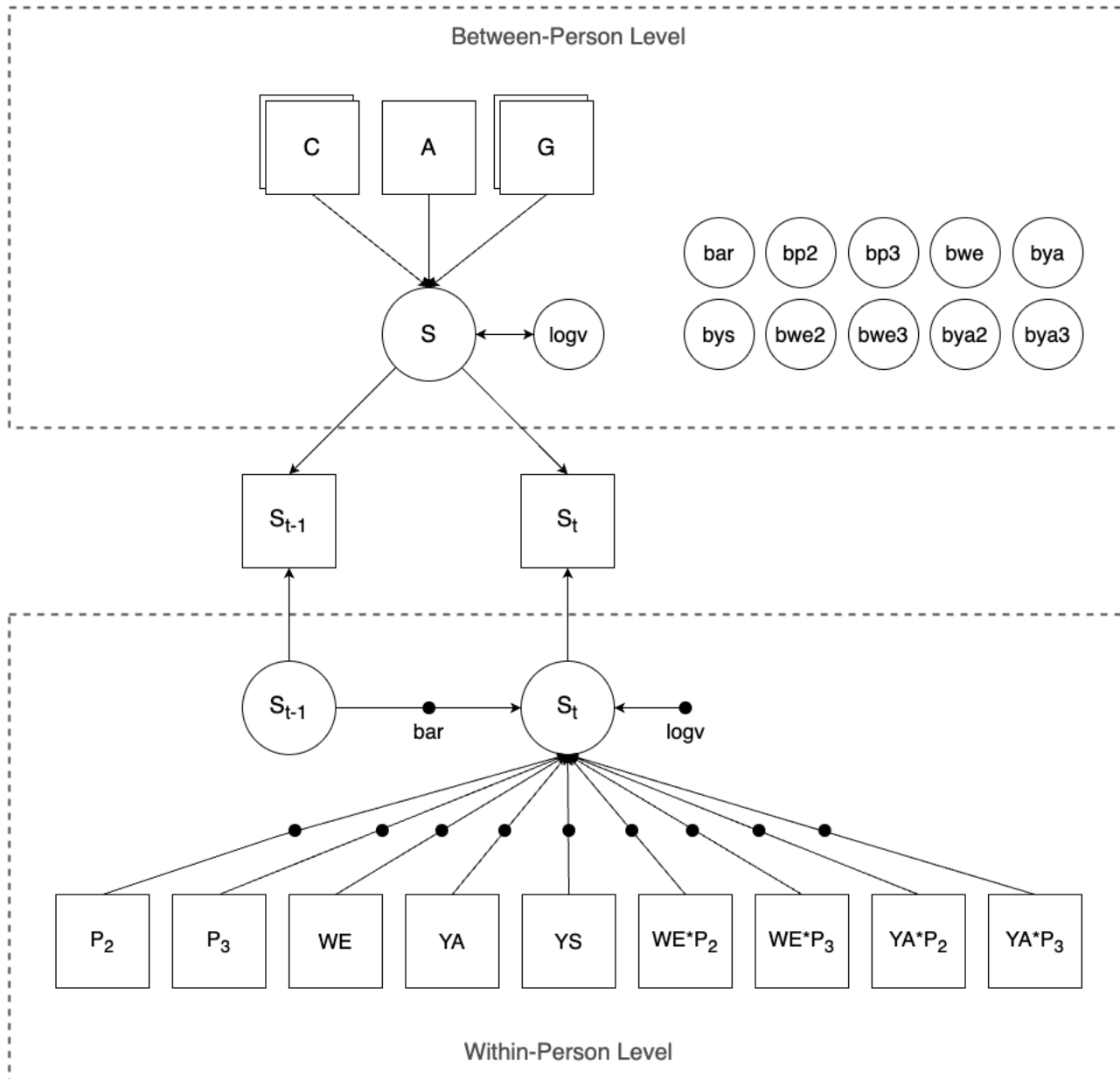
$$\text{Phase Shift} = \cos\left(t \times \frac{2\pi}{365}\right)$$

*When (in the year) does the cycle start?*

- Add amplitude and phase shift parameters
- Add a dummy code for weekend day
- Add dummy codes for study period (Baseline, COVID Year 1, COVID Year 2)
- Add interactions with period dummy codes
- *Does the weekend effect differ by period?*
- *Does seasonal amplitude differ by period?*
- *Does seasonal phase shift differ by period?*



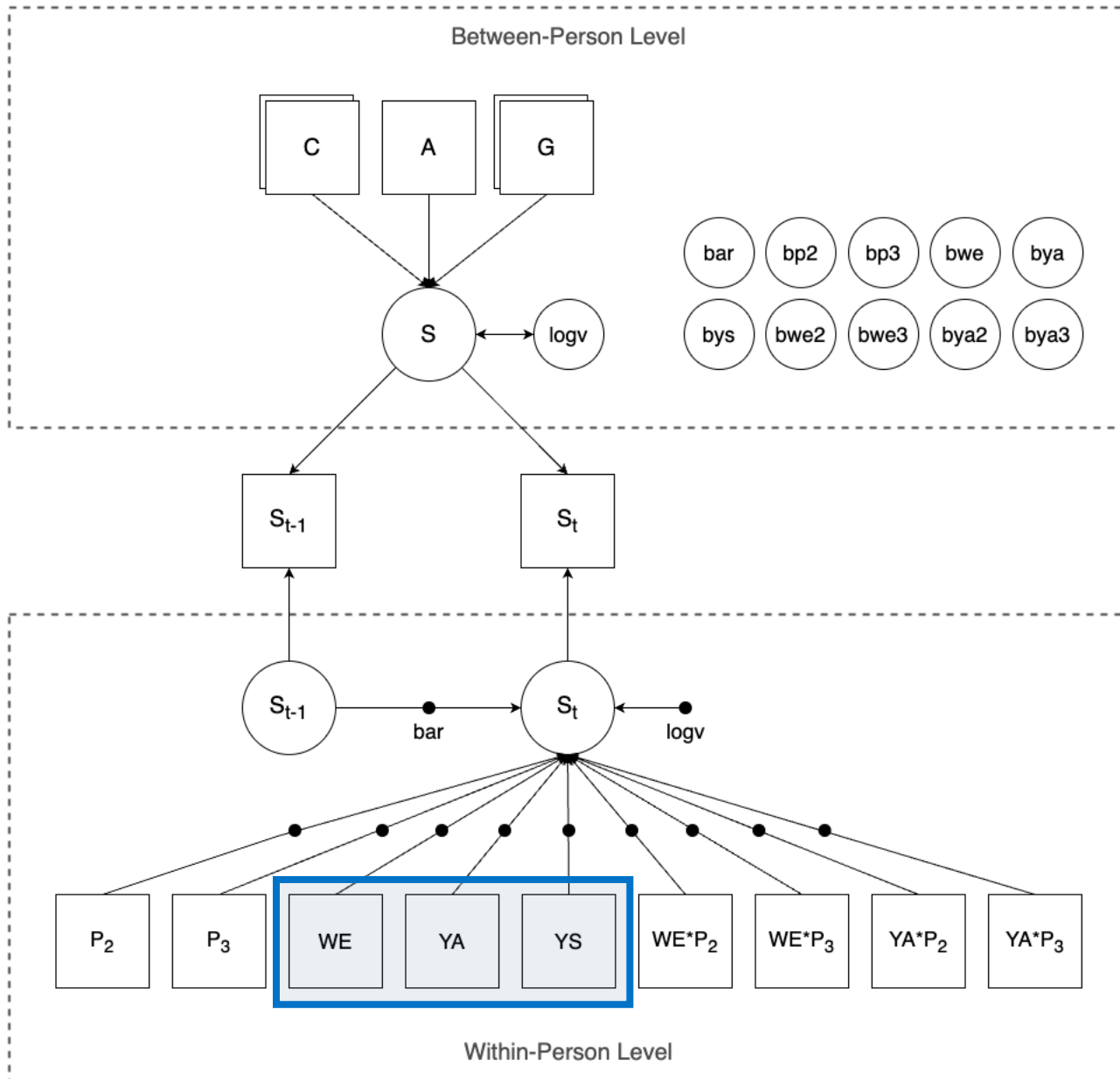
## MODERATION BY PERIOD



## DSEM PATH DIAGRAM

### *Dynamic Structural Equation Modeling*

- Decompose into within/between levels
- Latent autoregressive/lagged effect
- Random intercepts, slopes, and errors
- Control for country, age, and gender

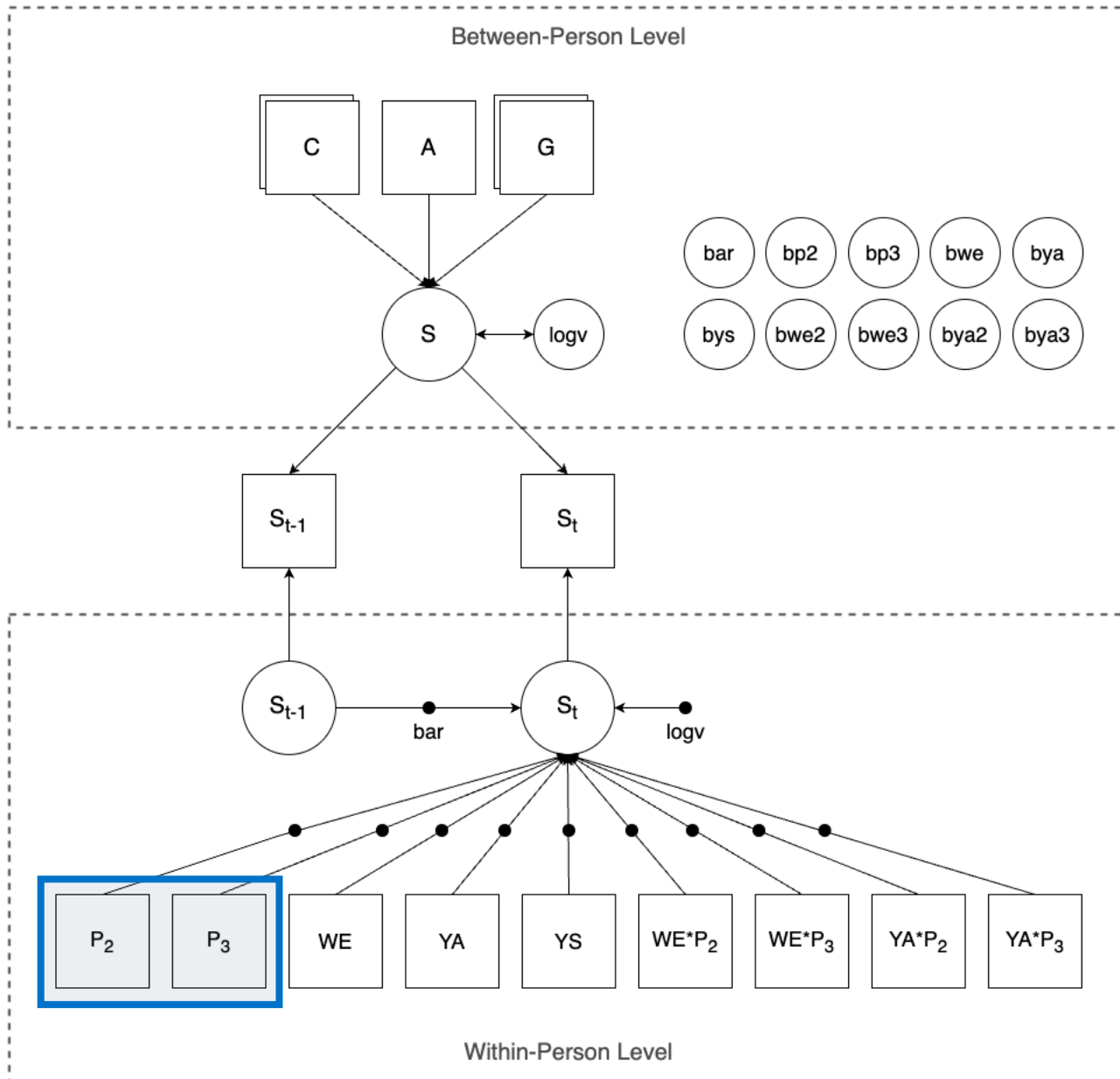


## DSEM PATH DIAGRAM

### Hypothesis 1

- During the **baseline** period, did smiling show a **weekend** effect?
- During the **baseline** period, did smiling show a **seasonal** cycle?

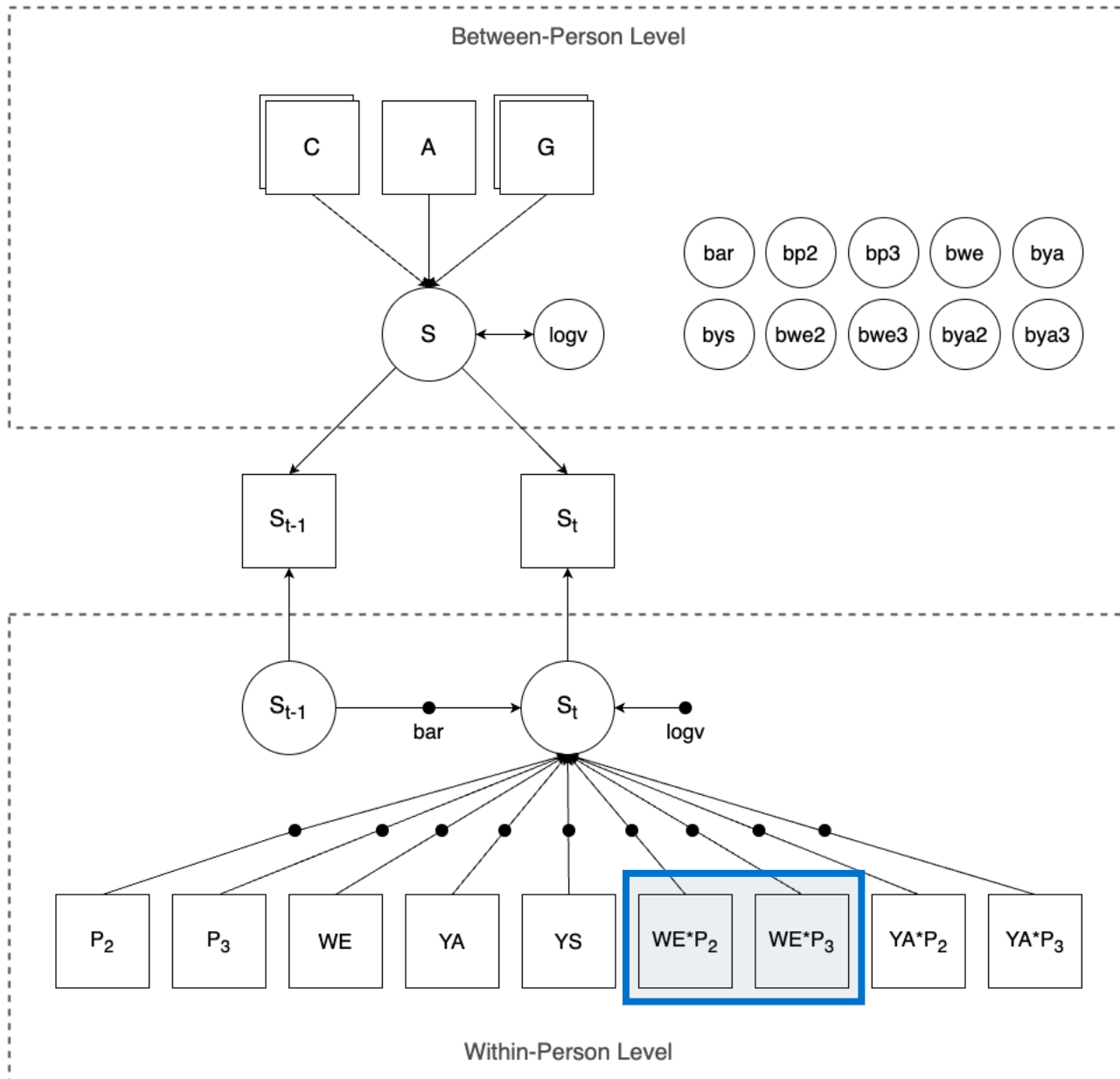




## DSEM PATH DIAGRAM

### Hypothesis 2

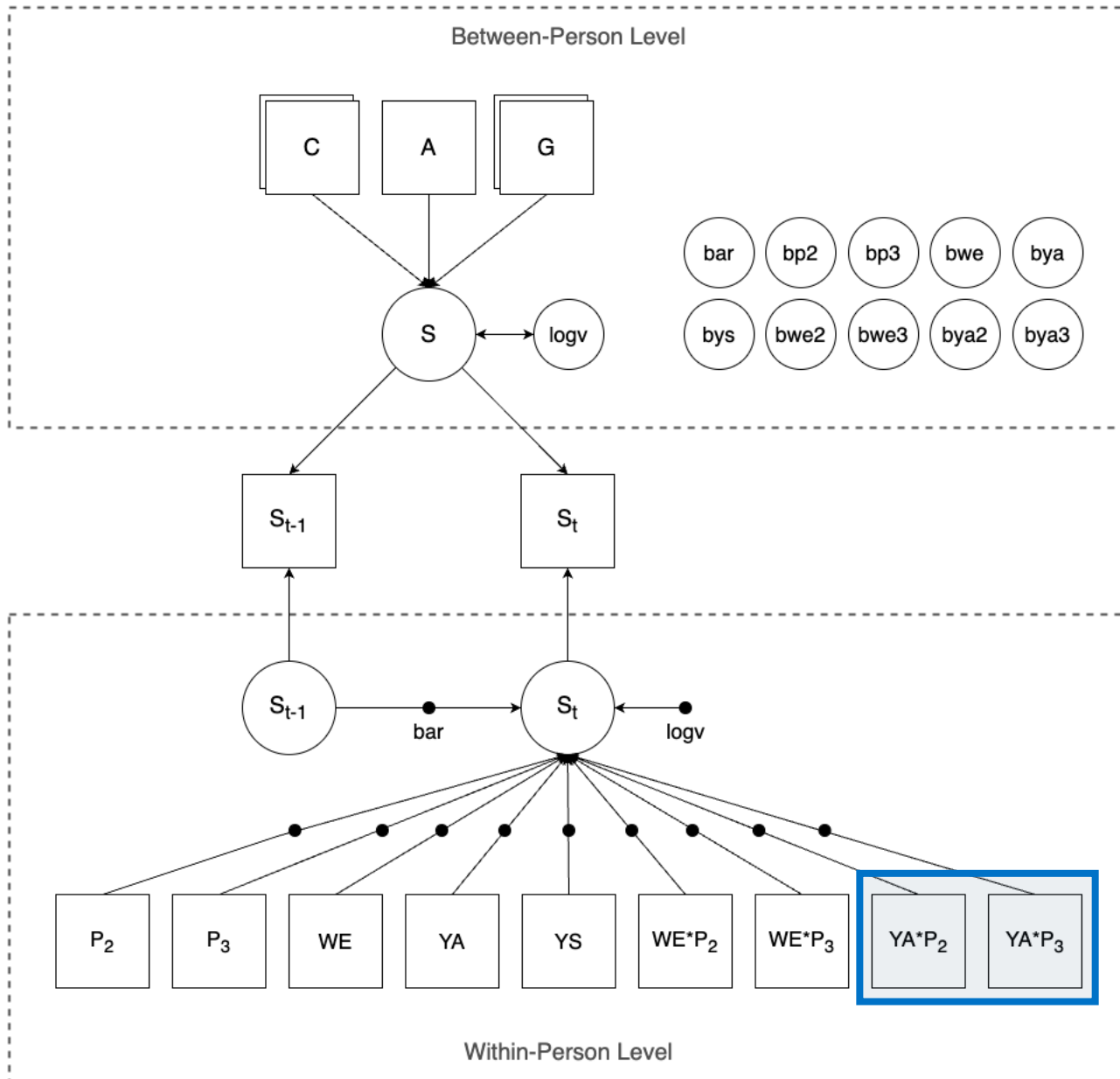
- Did **average** smile intensity change from baseline to COVID **year one**?
- Did **average** smile intensity change from baseline to COVID **year two**?



## DSEM PATH DIAGRAM

### Hypothesis 3

- Did the **weekend** effect change from baseline to COVID year one?
- Did the **weekend** effect change from baseline to COVID year two?



## DSEM PATH DIAGRAM

### Hypothesis 4

- Did the *seasonal* effect change from baseline to COVID year one?
- Did the *seasonal* effect change from baseline to COVID year two?



# RESULTS

What did our model find?



# FIXED EFFECTS

Parameter	Est.	p	Sig.
Intercept	20.65	<.001	***
Age	0.73	<.001	***
Sex: Male	-4.03	<.001	***
Sex: Other	-2.11	<.001	***
Autoregression	0.03	<.001	***
Period 2	-0.11	.038	*
Period 3	0.32	<.001	***
Weekend	0.75	<.001	***
Yearly Amplitude	0.33	<.001	***
Yearly Phase Shift	0.00	.456	

**H1**

	Est	p	Sig.
Weekend × Period 2	-0.14	.027	*
Weekend × Period 3	0.25	<.001	***
Amplitude × Period 2	-0.02	.400	
Amplitude × Period 3	0.52	<.001	***

# FIXED EFFECTS

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Intercept	20.65	<.001	***
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Yearly Phase Shift	0.00	.456	

H2

	Est	p	Sig.
Weekend × Period 2	-0.14	.027	*
Weekend × Period 3	0.25	<.001	***
Amplitude × Period 2	-0.02	.400	
Amplitude × Period 3	0.52	<.001	***



# FIXED EFFECTS

Parameter	Est.	p	Sig.
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**H3**

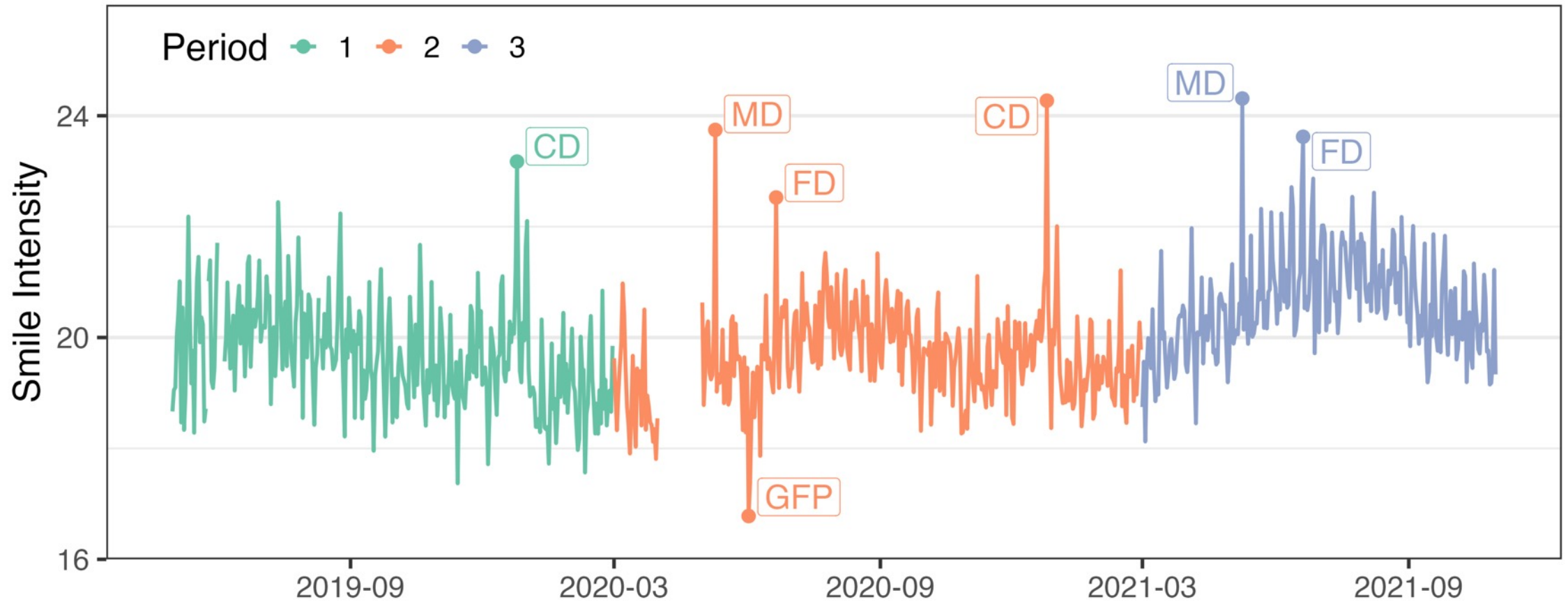
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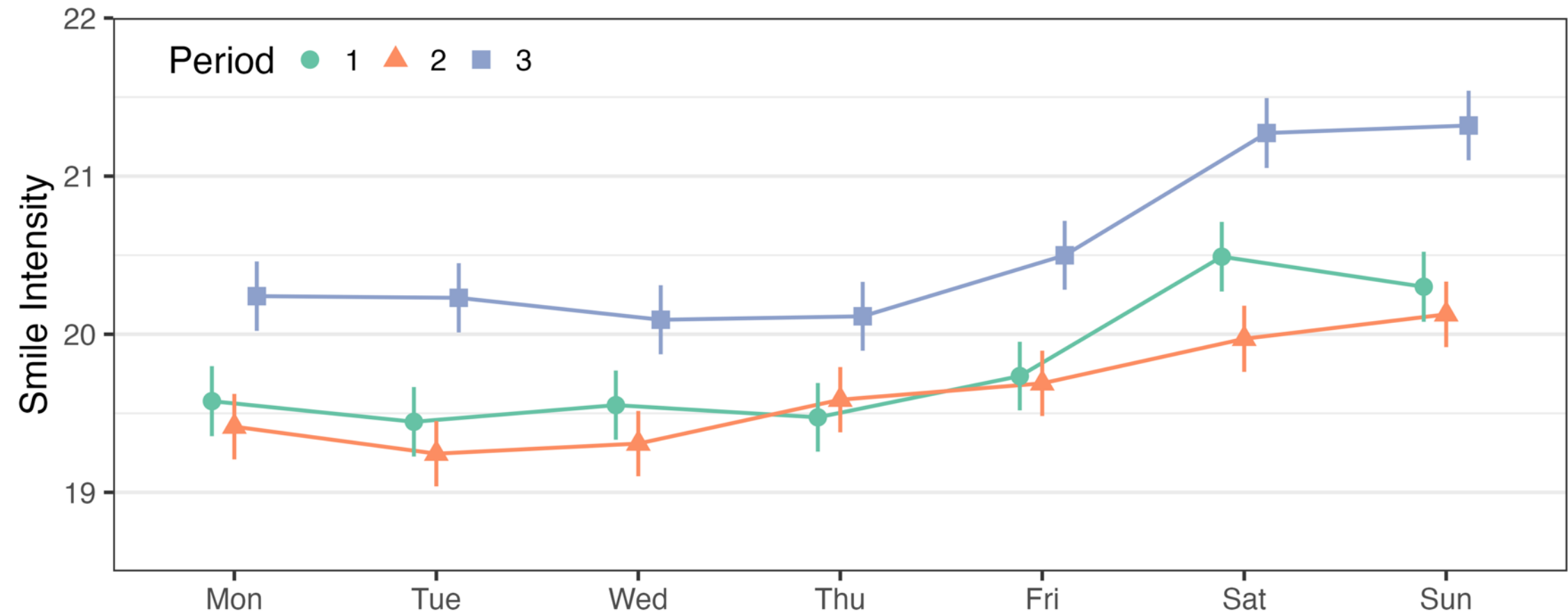
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**H4**

# DAILY AVERAGES ACROSS PERIODS

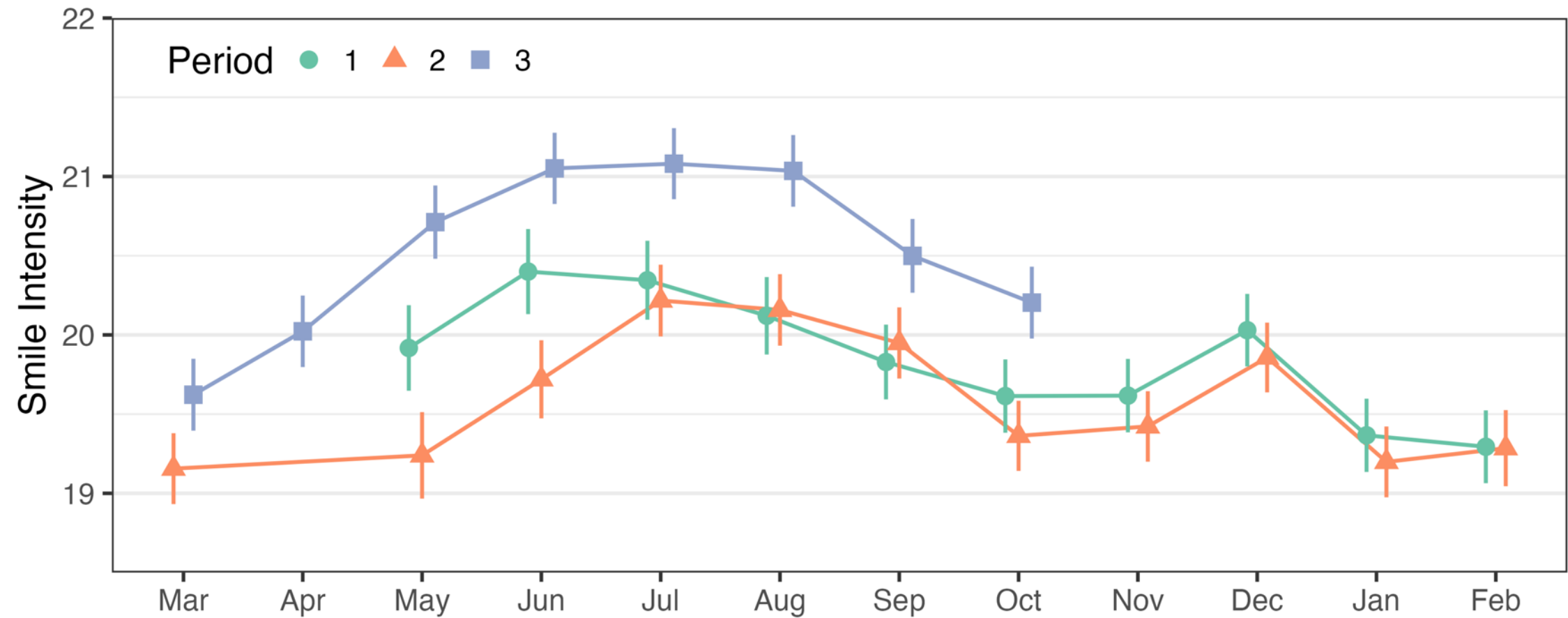


# WEEKDAY AVERAGES BY PERIOD





# MONTH AVERAGE BY PERIOD



# DISCUSSION

What does it all mean?



# CONCLUSIONS

- The baseline (pre-COVID) year showed *weekend* and *seasonal* effects on social media smiling
- COVID year 1 showed *lower smiling* and a *dampened weekend* effect
- COVID year 2 showed *higher smiling*, an *amplified weekend* effect, and an *amplified seasonal* effect
- These results are consistent with a “rebound” effect as lockdowns ended
- Re-engagement with the environment and stronger influence of its properties



# RESEARCH TEAM



**DASHAYERMOL**

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*Helped in conceptualizing the project, conducting literature reviews, and writing the paper.*



**DANIEL MCDUFF**

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*Helped in conceptualizing the project, processing the image data, and writing the paper.*



**COLIN CAMPBELL**

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*Helped access and collect the data, provided expertise on Instagram and influencers.*



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Stockholm School of Economics

*Helped access and collect the data, provided expertise on Instagram and influencers.*





# THANK YOU

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