FYP Defense

*Designing a **Serious Game** to Promote Citizen's Policy Understanding during a Public Health Crisis*

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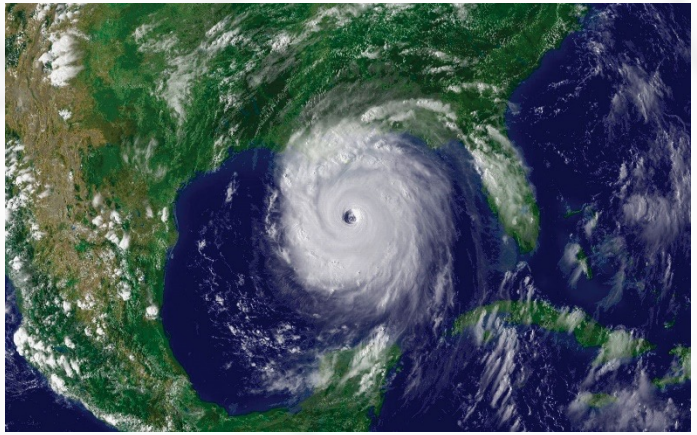
Introduction

BACKGROUND

Throughout human history, various public crises have arisen, prompting governments to implement special policies.



Hurricane Katrina

9/11 terrorist attacks

Fukushima nuclear disaster

BACKGROUND

We utilize the COVID-19 pandemic as a case study due to its global scale and immediate relevance.
During the epidemic of COVID-19, special policies have been executed by governments for disease control purposes.

Isolation

Lockdown

Compulsory testing

BACKGROUND

According to our survey, such disease control policies bring two main negative outcomes of citizens whose daily routines are affected:

- Mental health issues
- Policy compliance

Research has shown that one way to mitigate these detrimental effects is to enhance citizen's policy understanding, which refers to the comprehension of the rationale behind policies

Existing Solutions

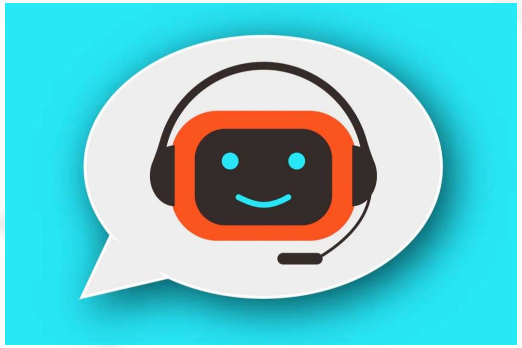
Gaps

Social Media

Open and participatory communication platform → Lack of citizen's engagement

It offers benefits to interactive communications between governments and the public, cultivating their policy understanding.

Chatbots



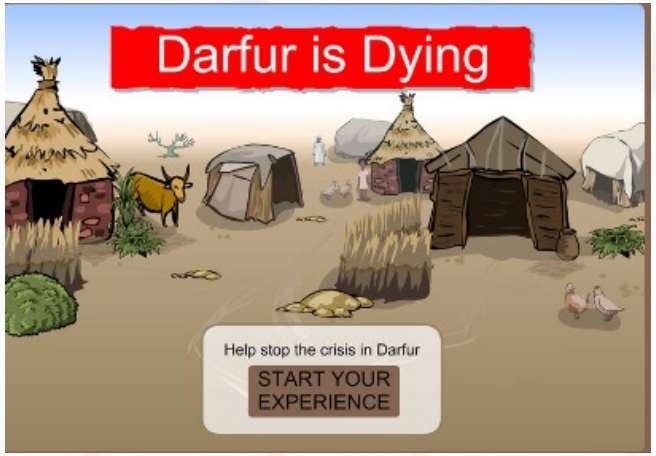
Agents with the ability to interact with users → Need of expertise

It promotes public engagement by providing an interactive channel to gather feedback from the citizens, which can be used as support for policy-making practice

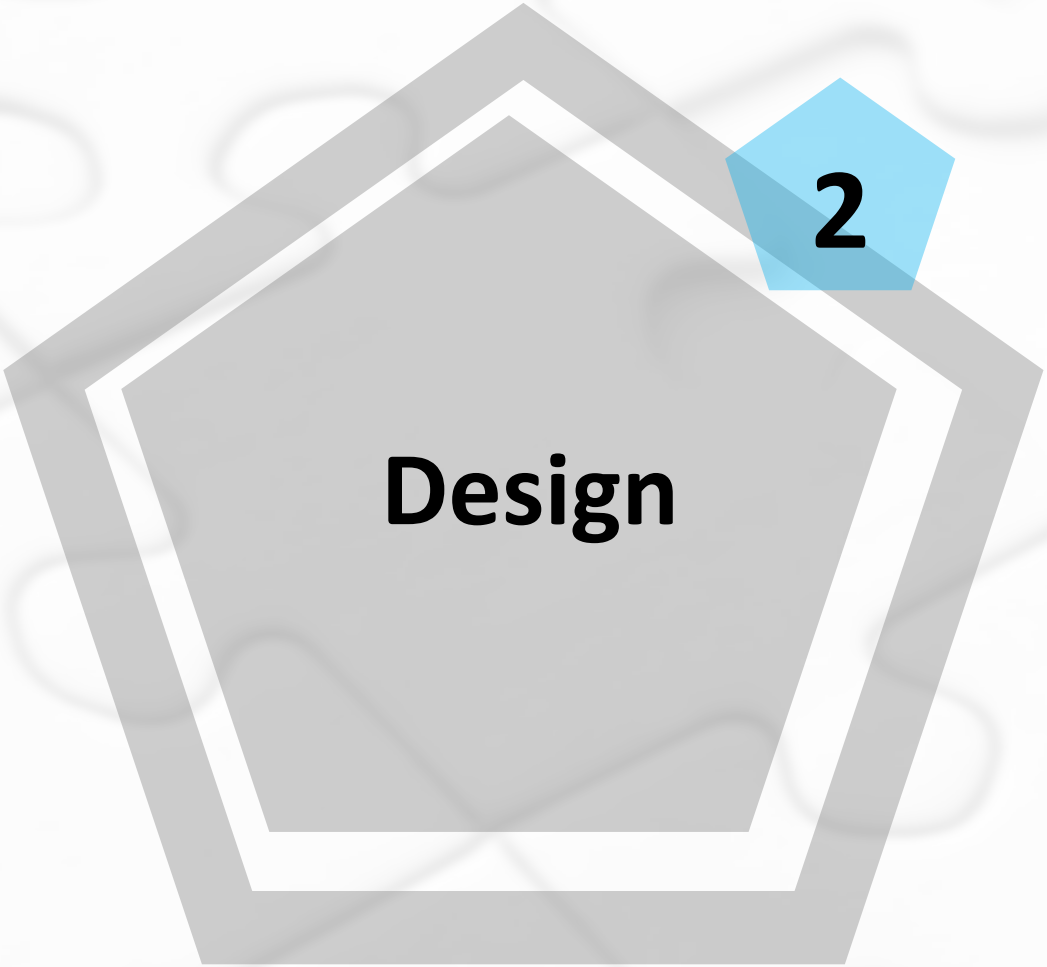
Proposed Solutions

- **Serious games**: games not primarily designed to entertain.
- They utilize game elements (e.g., storyline, rewards) to facilitate learning and transform player behaviors and perceptions on specific topics.
- It has proven to be a promising way to advance citizens' understanding of COVID-19 policy.
- It also has the potential to address the gaps mentioned above.

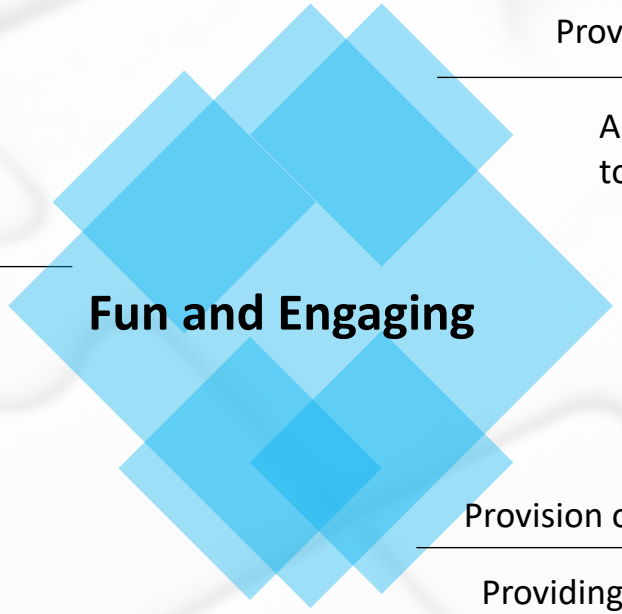
The Mayor Game



Darfur is Dying


2
Design

Design Requirements & Choices



B

Provision of choice

An essential design element to facilitate learning efficiency.

A

Storyline

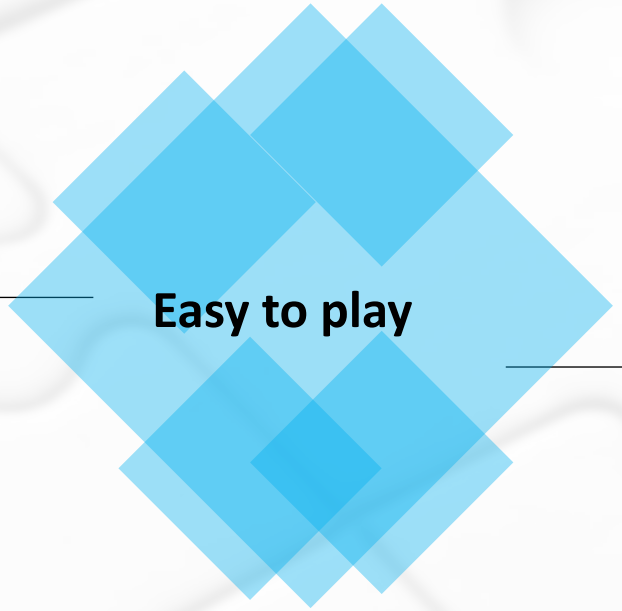
Policidemic employ storylines to enhance users' intrinsic motivation to learn.

D

Provision of feedback

Providing feedback can influence players' learning behaviors for long-term, challenging goals.

Design Requirements & Choices



A

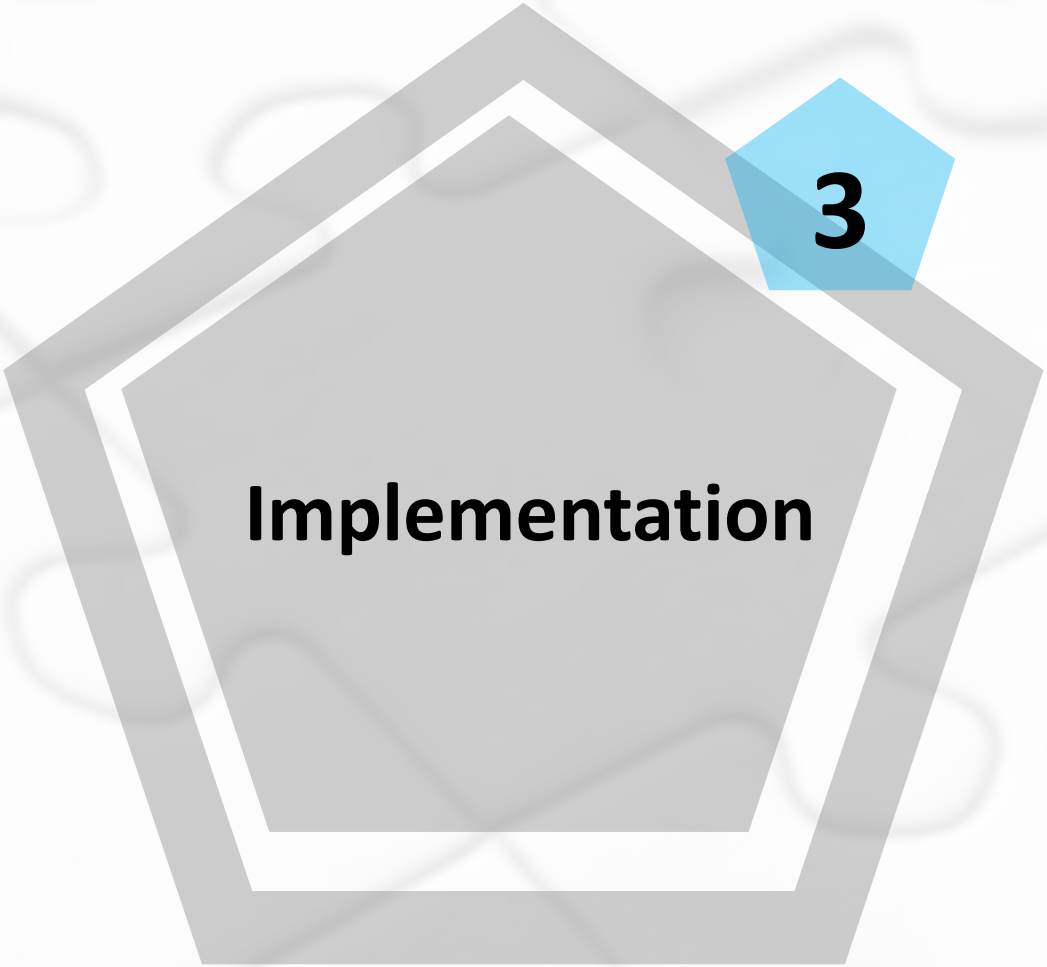
Data visualization

By significantly reducing users' cognitive load, the game is more accessible.

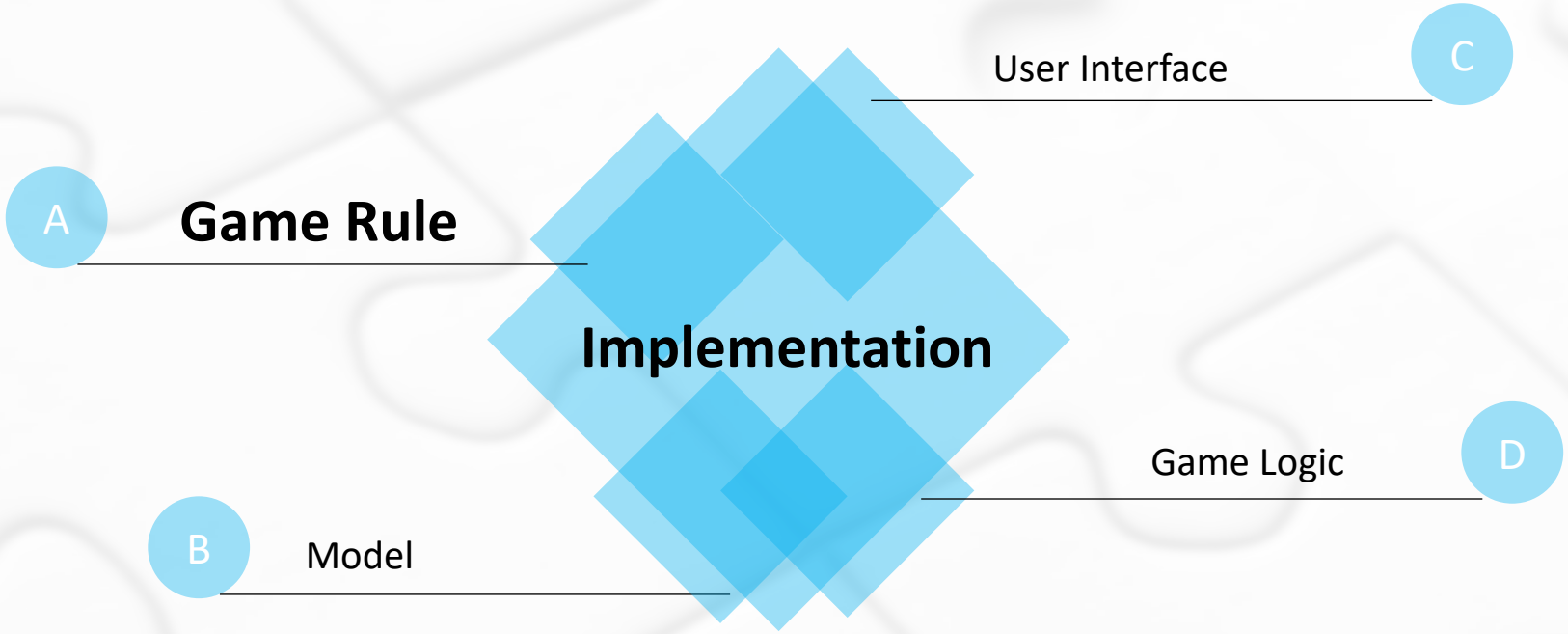
B

Simple interaction mode

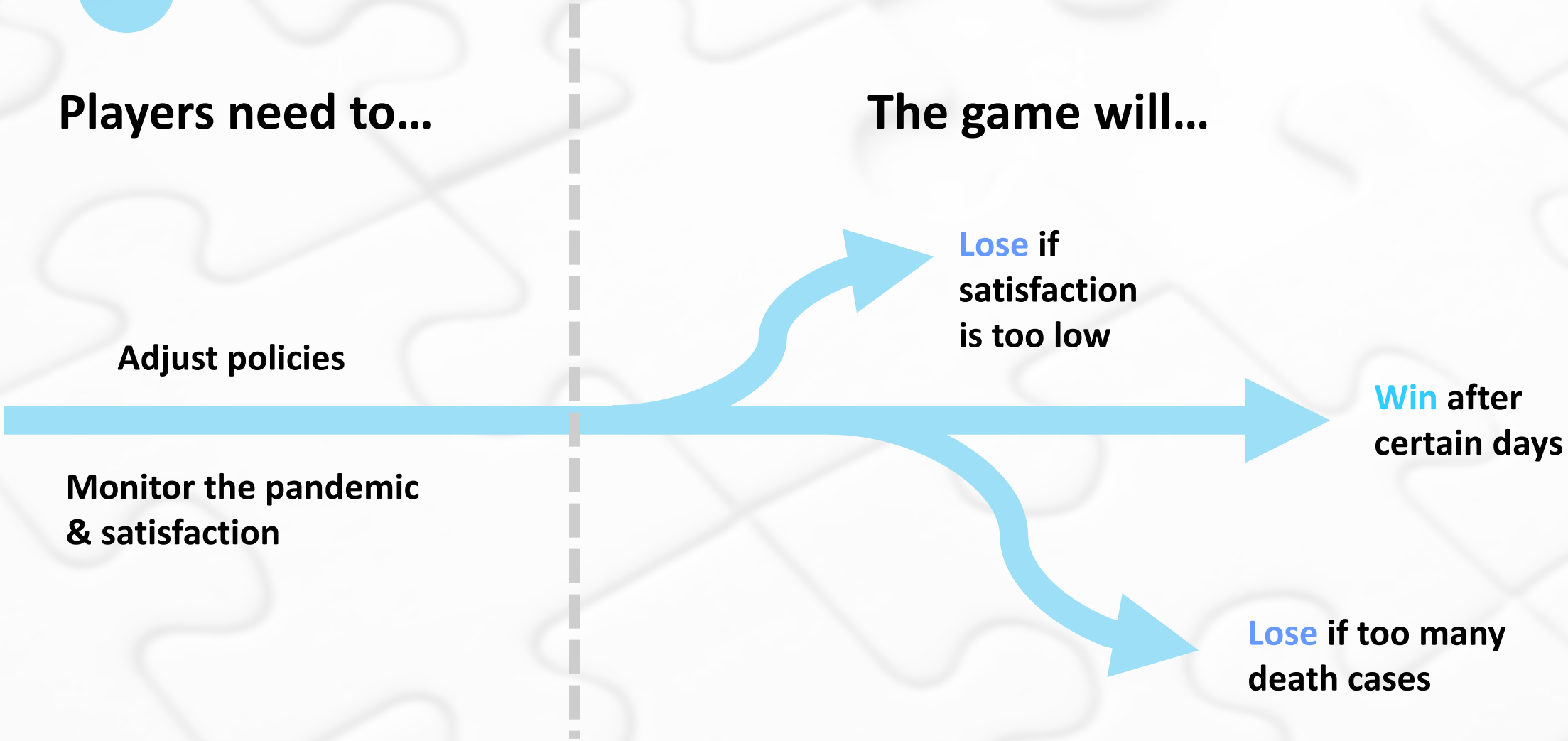
Policidemic only requires players to analyze the data and adjust the policies.


3
Implementation

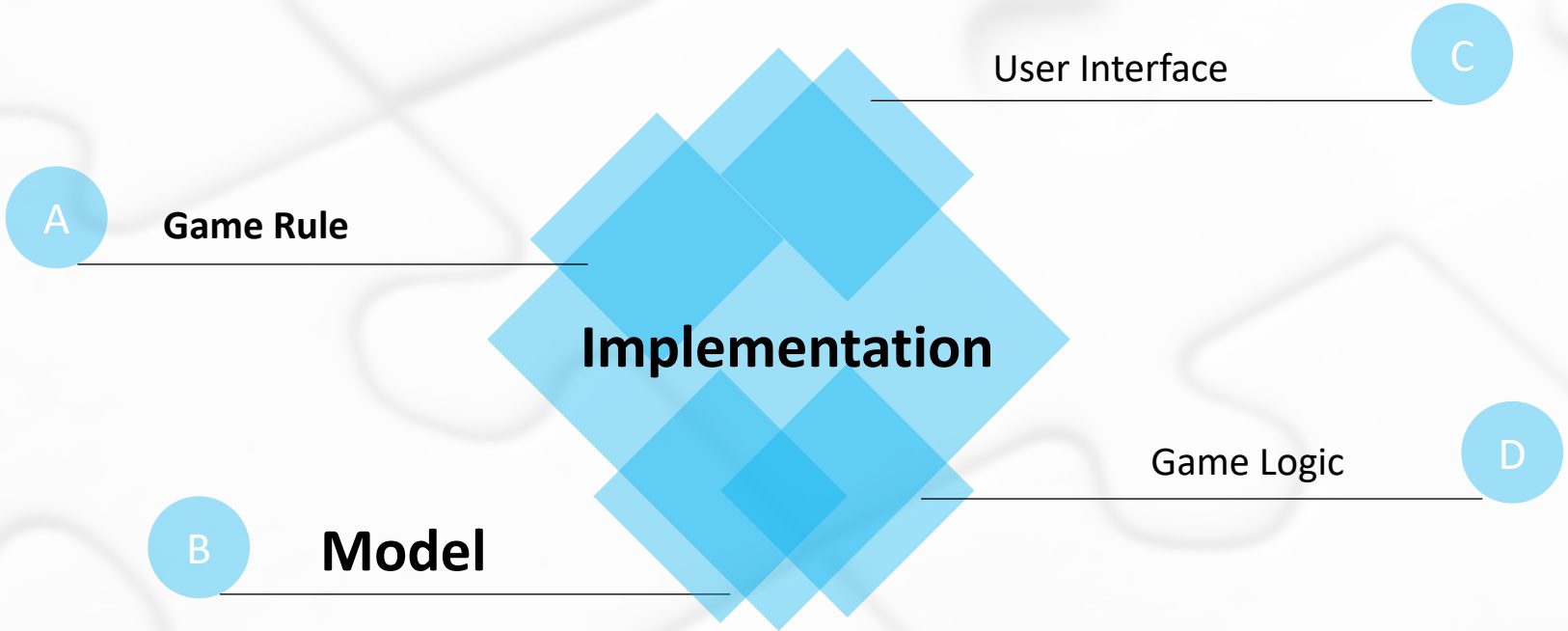
IMPLEMENTATION



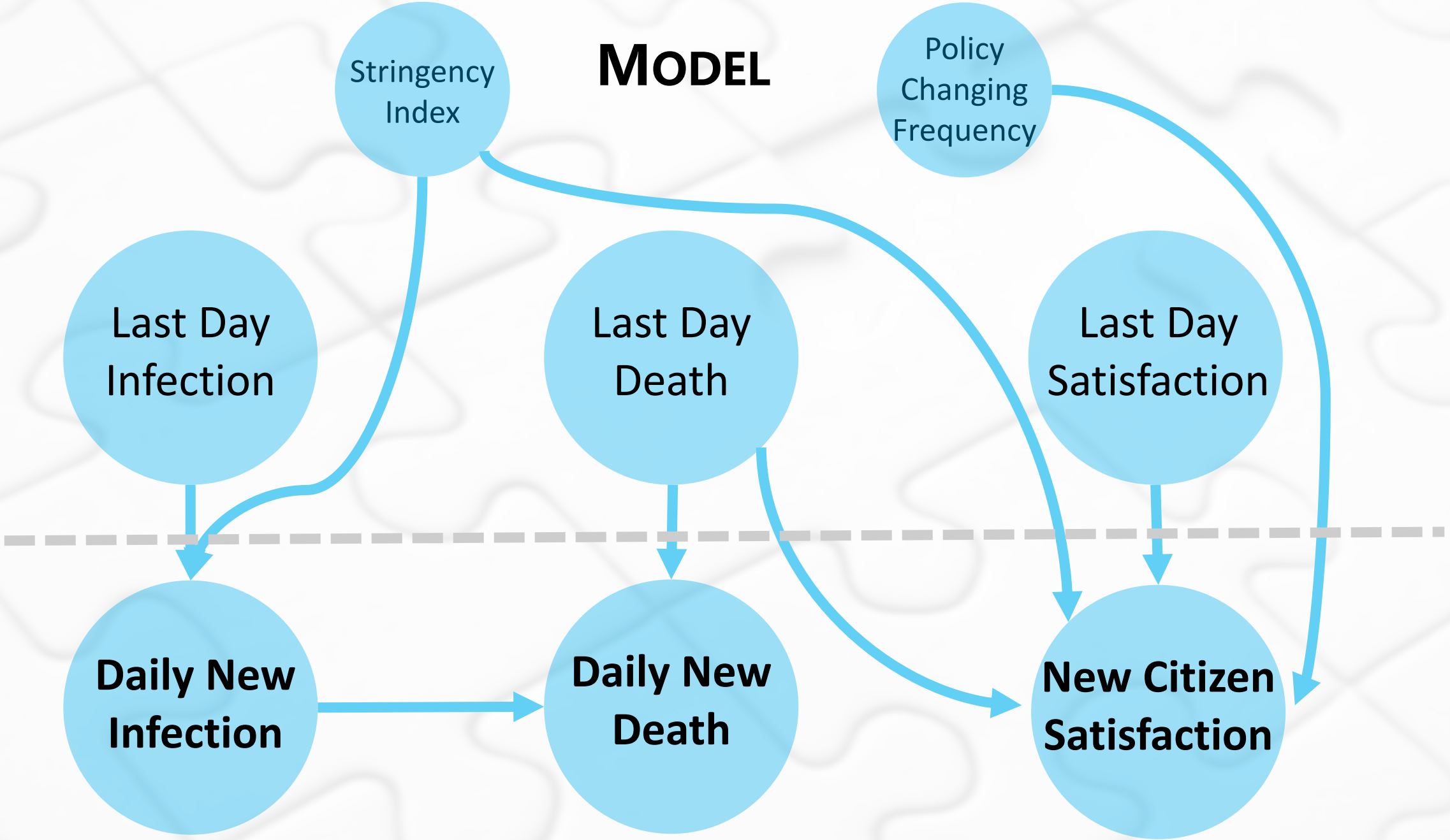
Game Rule


Players need to…
The game will…
Adjust policies
Monitor the pandemic & satisfaction
Lose if satisfaction is too low
Win after certain days
Lose if too many death cases

IMPLEMENTATION



Model


Stringency Index
Policy Changing Frequency
Last Day Infection
Last Day Death
Last Day Satisfaction
Daily New Infection
Daily New Death
New Citizen Satisfaction

Policies in the Model

We are considering 7 policies in the implementation:

- School Closing (0 ~ 3)
- Workplace Closing (0 ~ 3)
- Cancel Public Events (0 ~ 2)
- Restrictions on Gathering Size (0 ~ 4)
- Close Public Transport (0 ~ 2)
- Stay-at-home Requirement (0 ~ 3)
- Restrictions on Internal Movement (0 ~ 2)

Given a set of policies $P = [p_1, \dots, p_k]$ **with max possible values** $M = [m_1, \dots, m_k]$

$$Stringency\ Index(P) = \frac{1}{k}\sum_{i=0}^{k}\frac{p_i}{m_i} \times 100$$

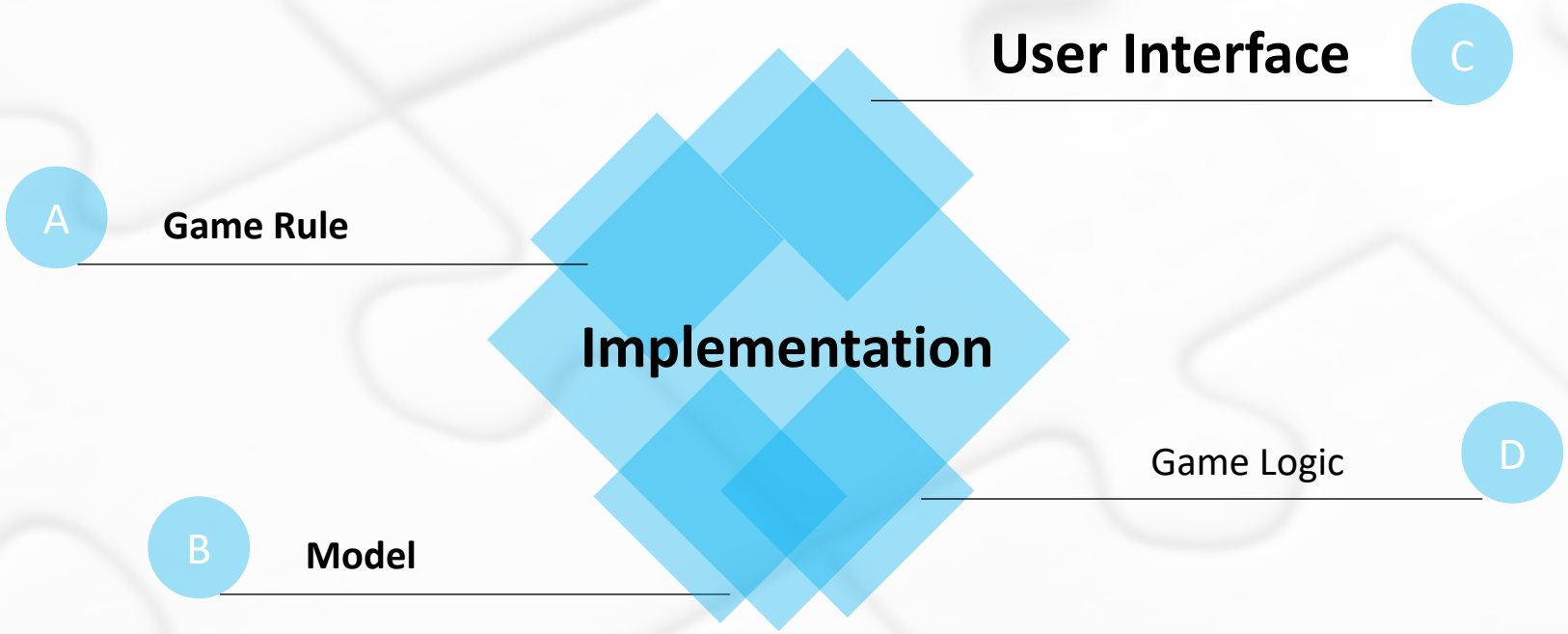
Adopted from Literature, a weighted average that rescales the total stringency into 0 ~ 100.

Given a set of policies in the past k days $\Delta P = [\Delta p_1, \dots, \Delta p_k]$

$$Policy\ Changing\ Frequency = \frac{\sum_{i=0}^{k} \Delta p_i}{k}$$

We want to panelize too frequent change of policies.

IMPLEMENTATION



User Interface

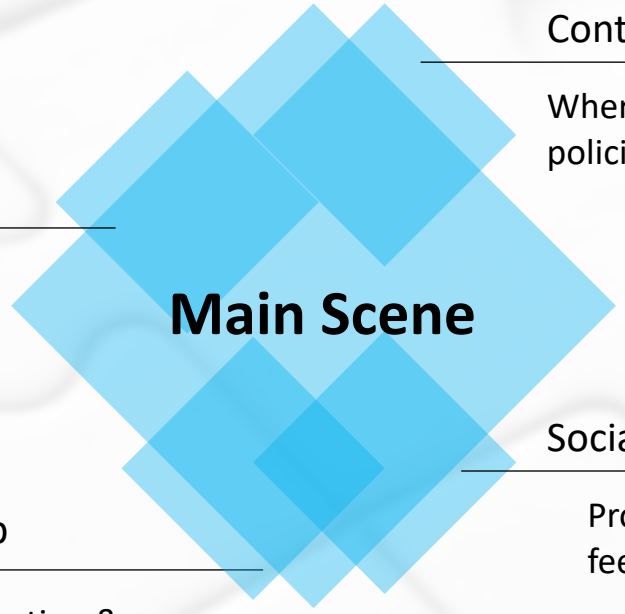
Start Scene

Main Scene

TUTORIAL

- Mandatory when the game is loaded for the first time
- Can be referenced in the main scene afterwards

Main Scene



C

Controller Panel

Where the player sets the policies

B

Data Panel

Visualize data about COVID-19 and satisfaction

D

Social Media & News Panel

Provide qualitative feedback to the player

A

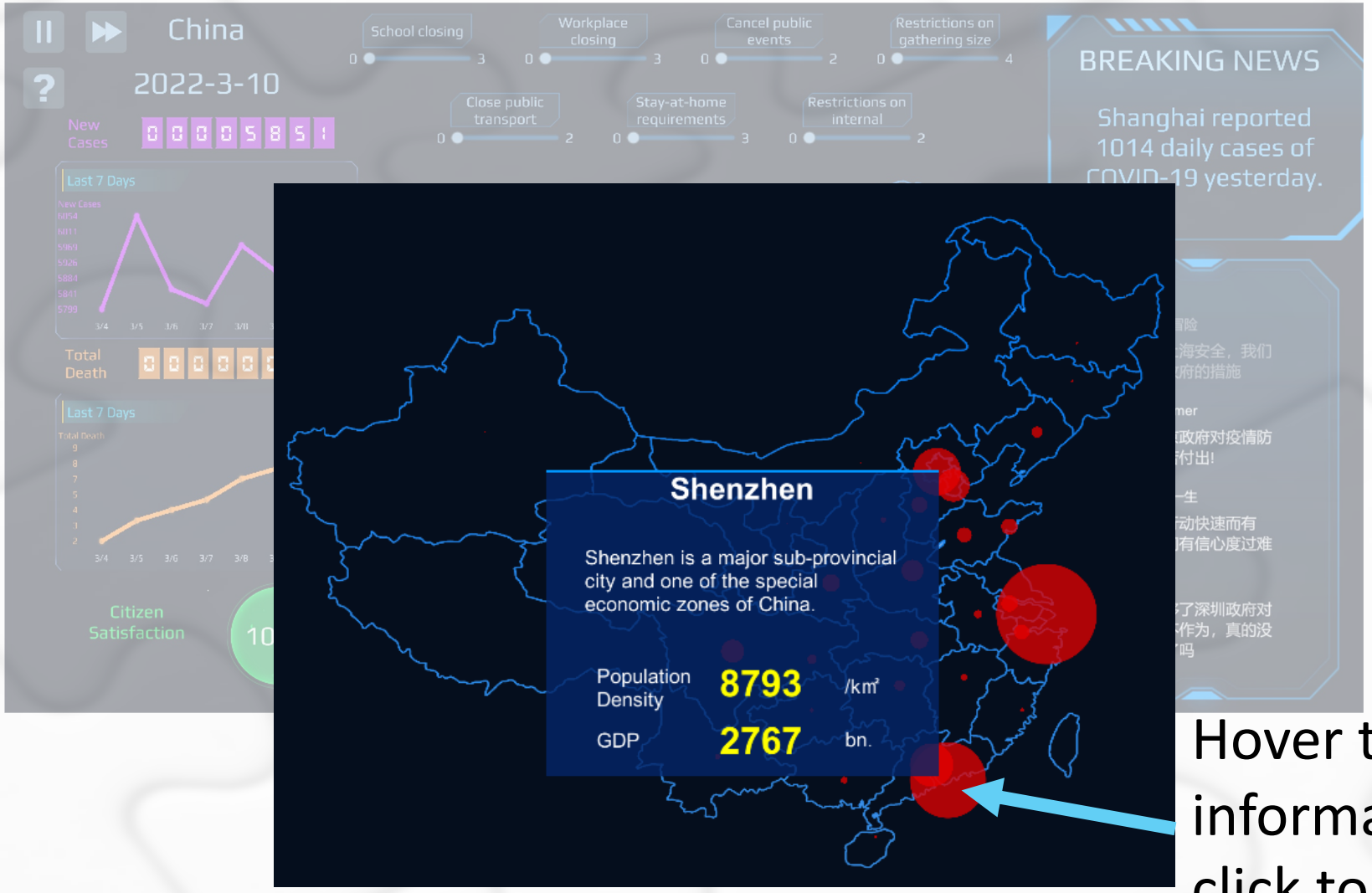
China Map

Provide overall situation & let the player select city

China Map

Size of the red dot represents total infection

China Map



Hover to display city information

click to select the city

China Map

Warning will be shown when satisfaction is low or death is high

When no city is selected…

Data Panel

Current date

Daily new infection

Daily infection trend over last 7 days

Daily total death

Total death trend over last 7 days

Average satisfaction over the whole country

When a city is selected…

DATA PANEL

Current date

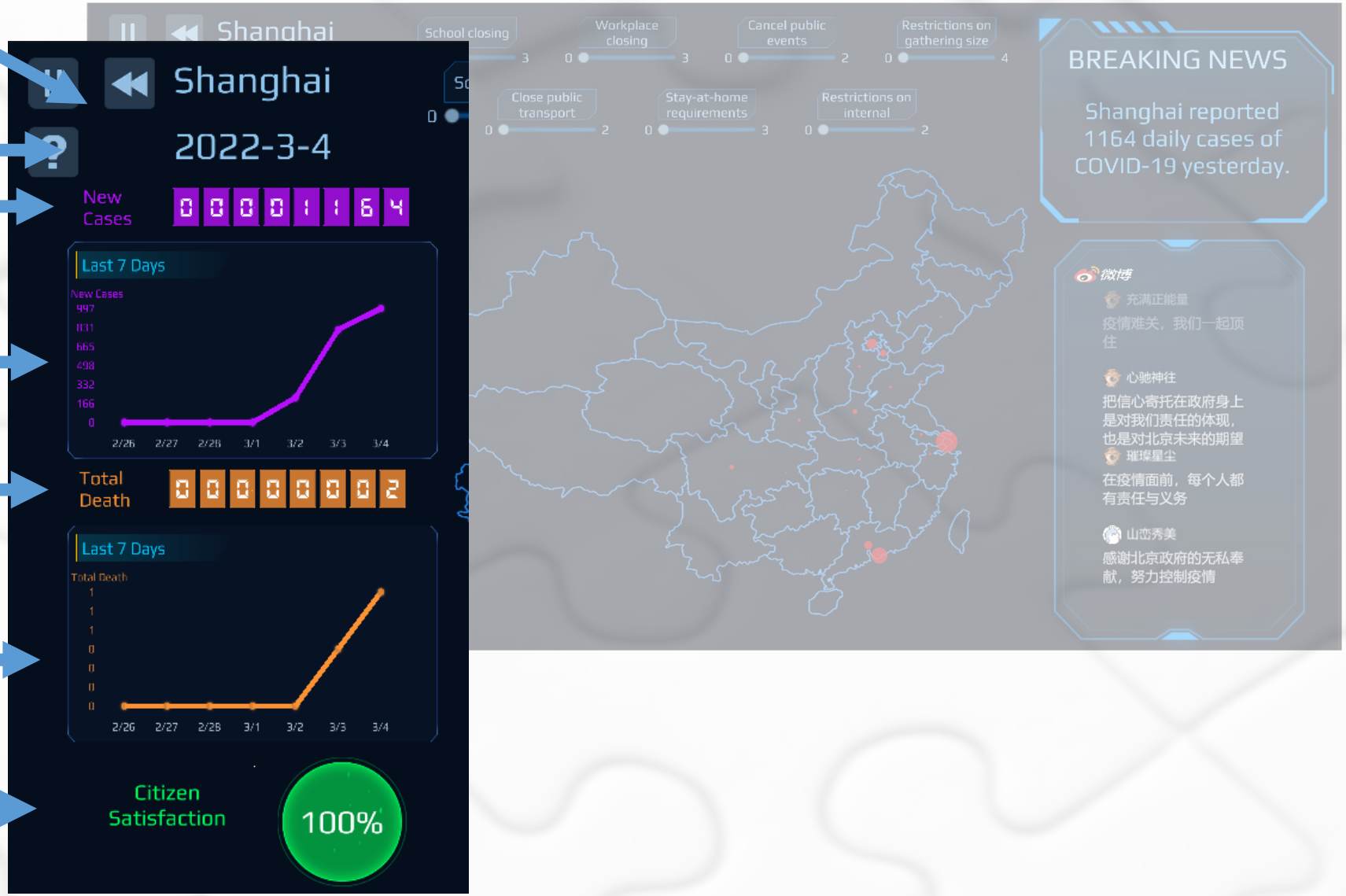
Daily new infection

Infection trend over last 7 days

Daily total death

Total death trend over last 7 days

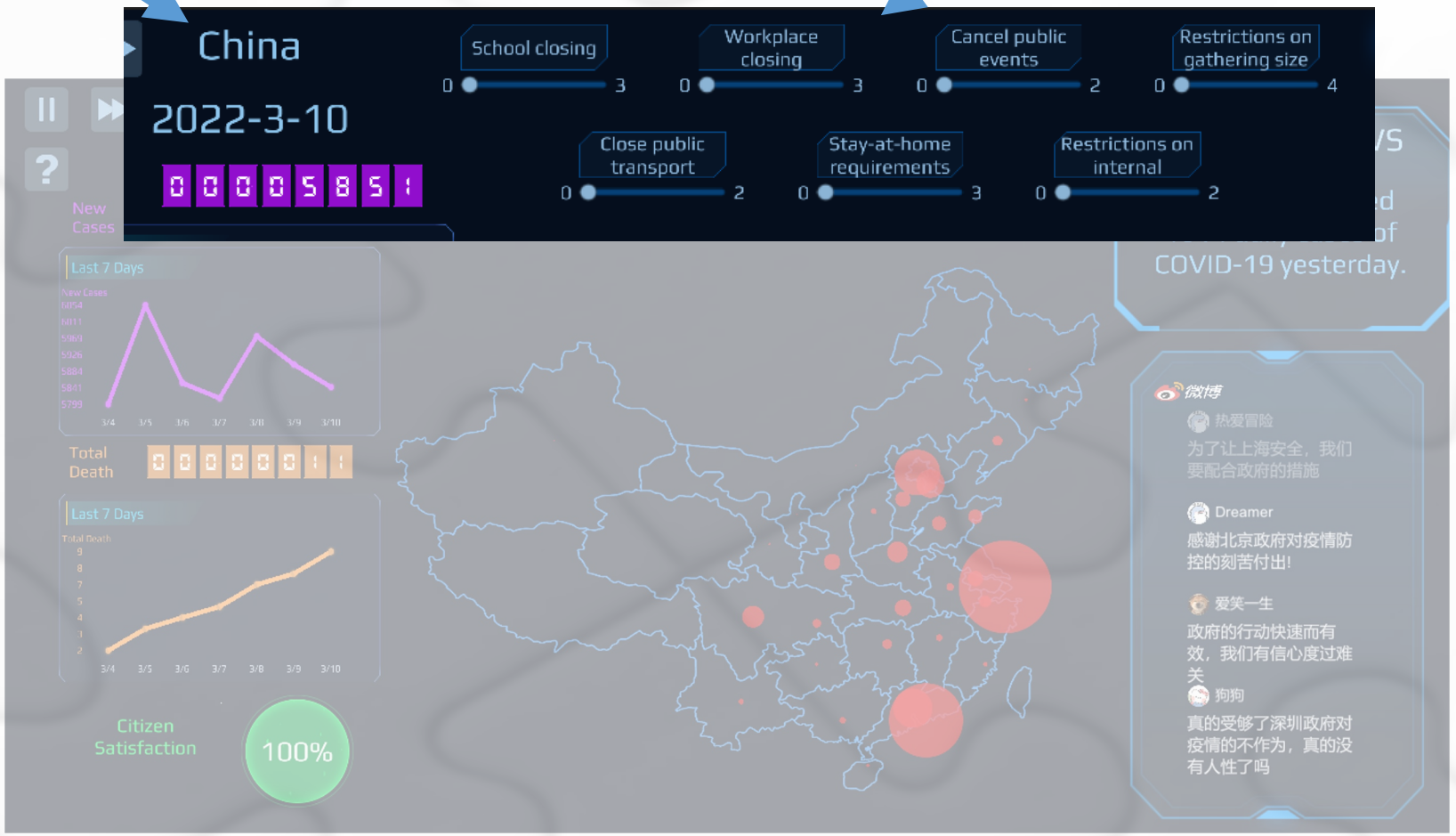
Satisfaction



CONTROLLER PANEL

When no city is selected…

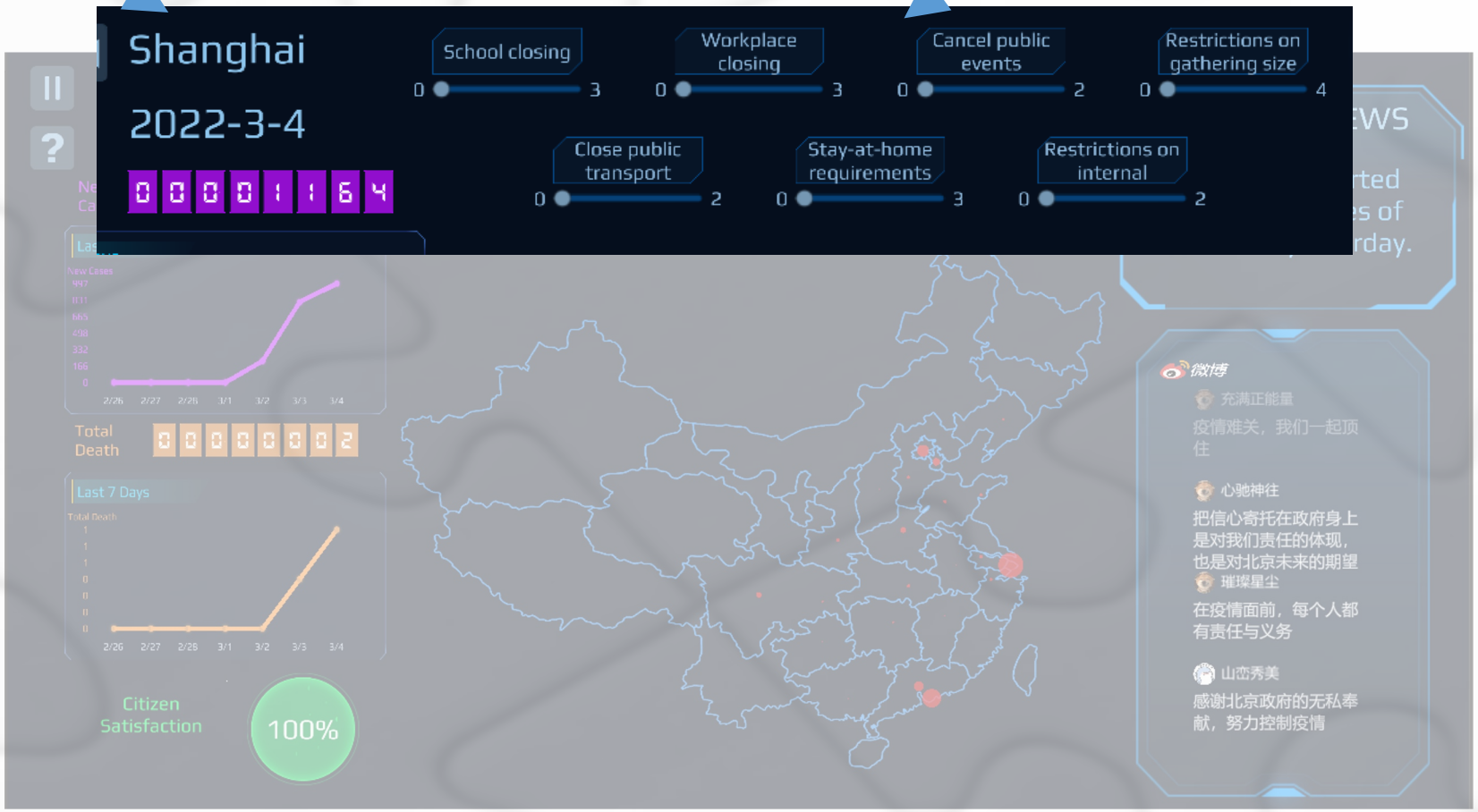
- Display average policy stringency
- Values cannot be adjusted



CONTROLLER PANEL

When a city is selected…

- Display policy stringency of the city
- Values can be adjusted



Social Media & News Panel

News about the Pandemic

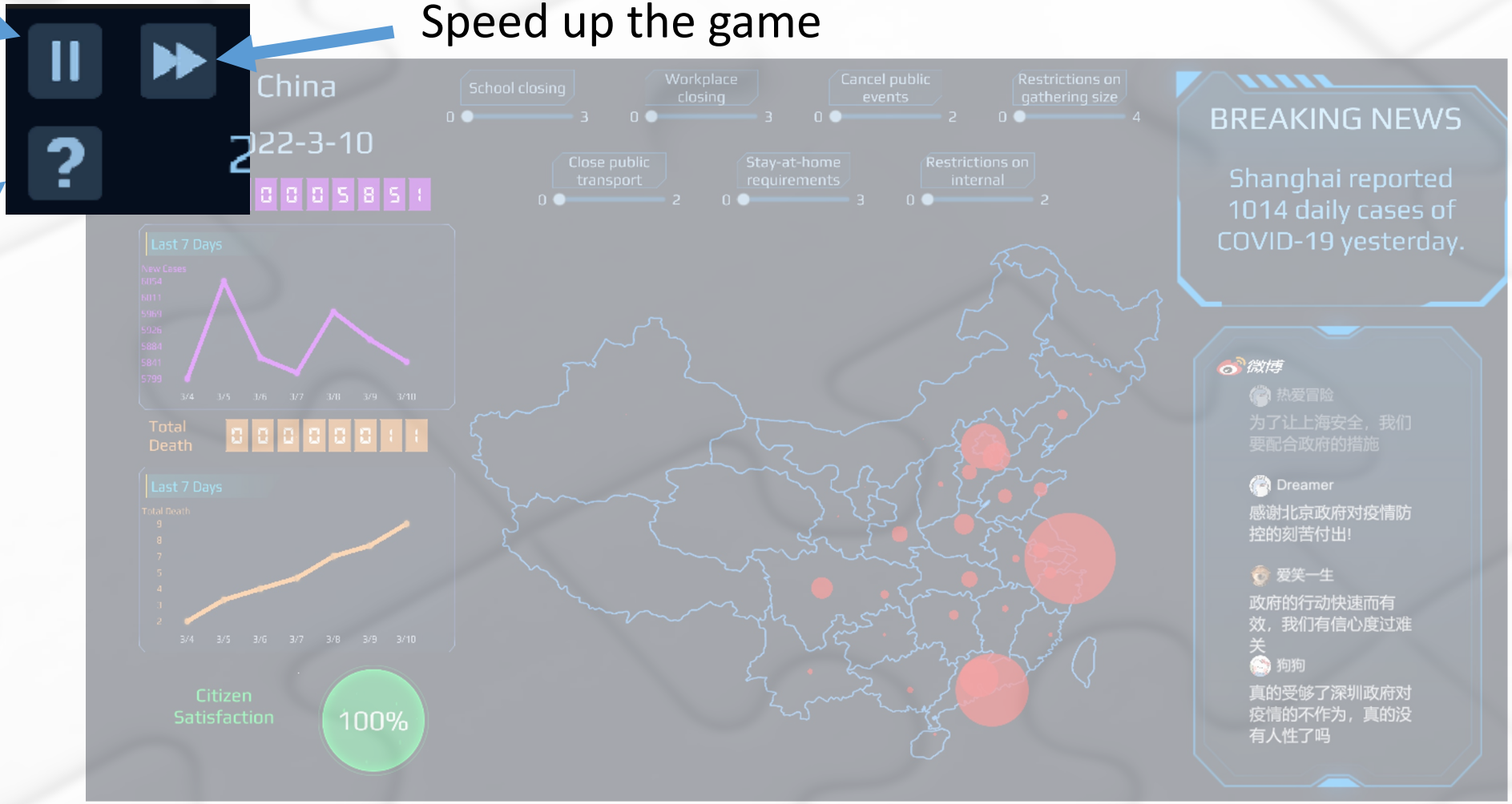
Social Media (Weibo) Comments about the Policies

Some Buttons

Pause the game

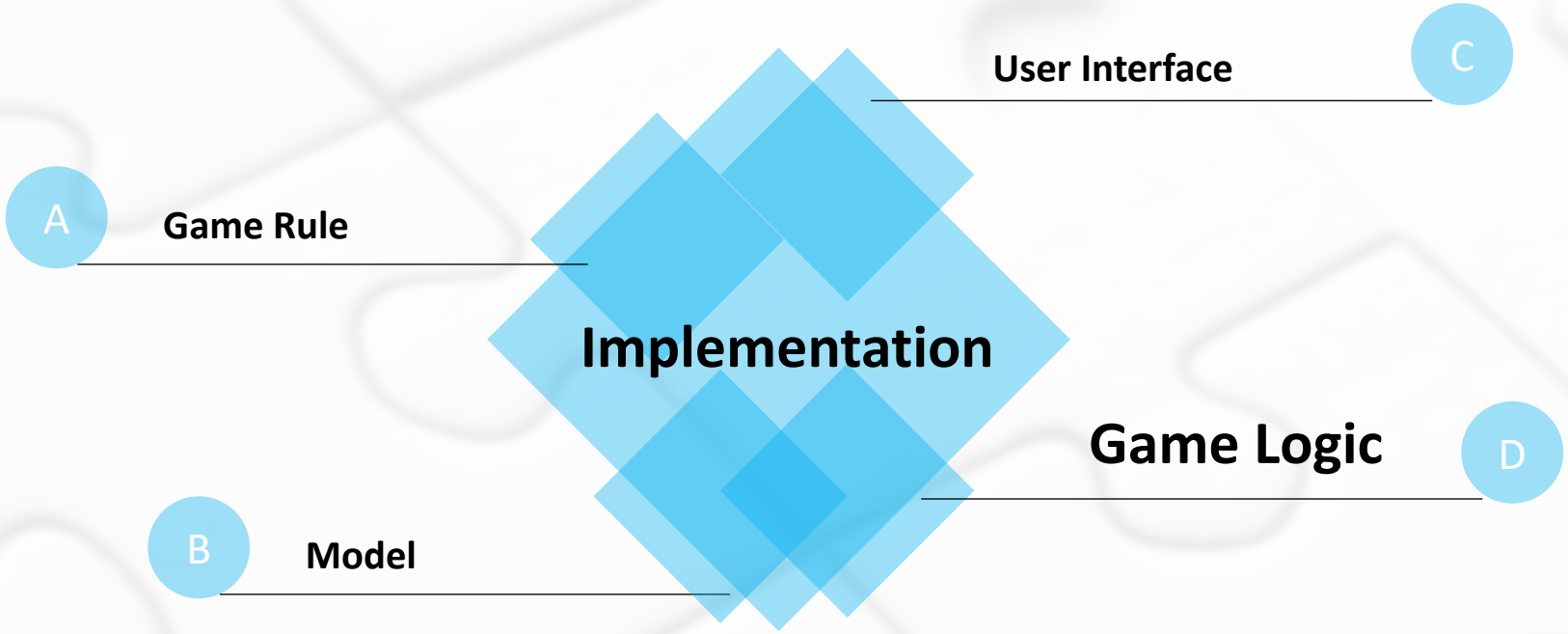
Speed up the game

Show the tutorial

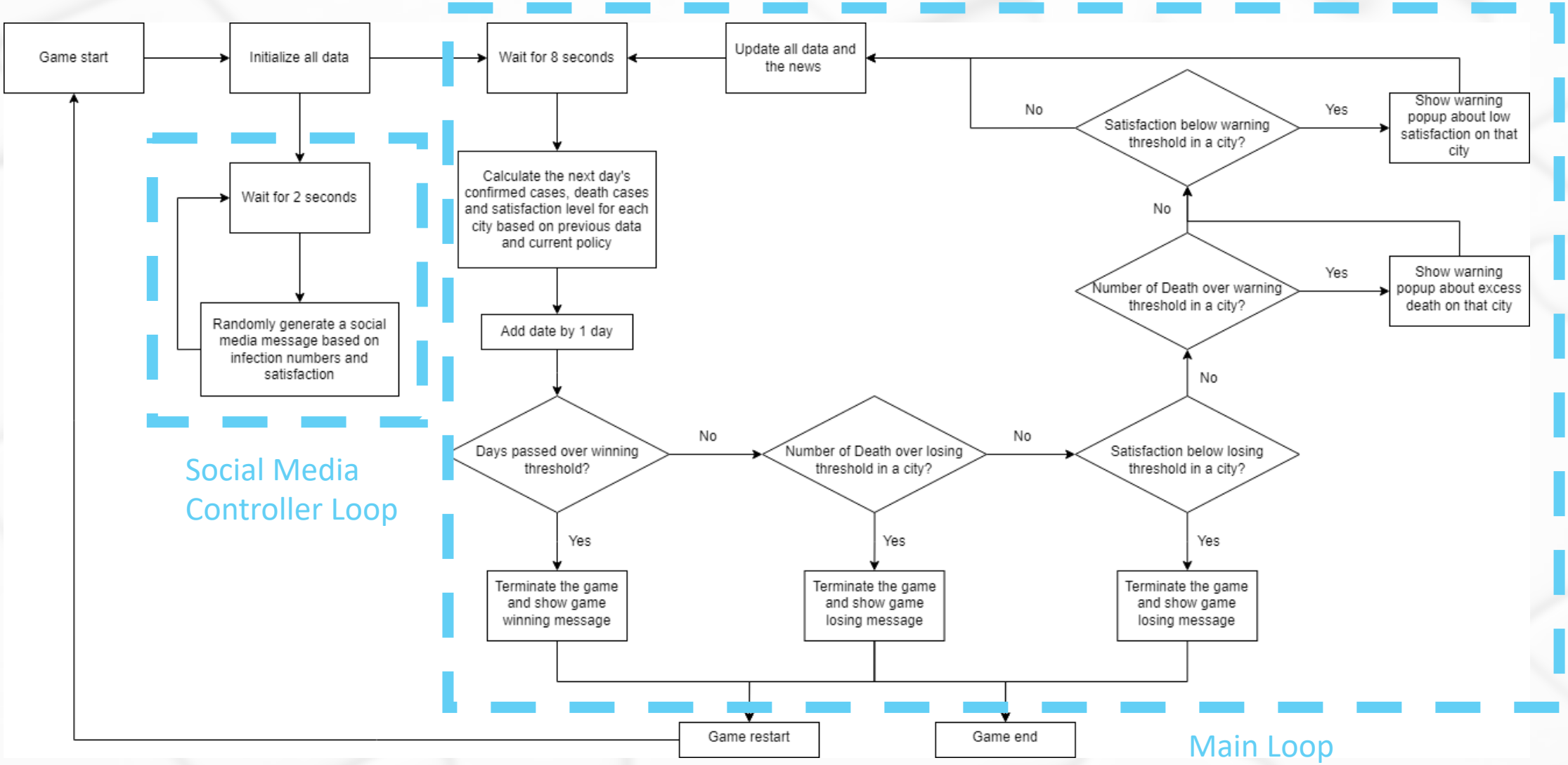


Game Over Display

IMPLEMENTATION



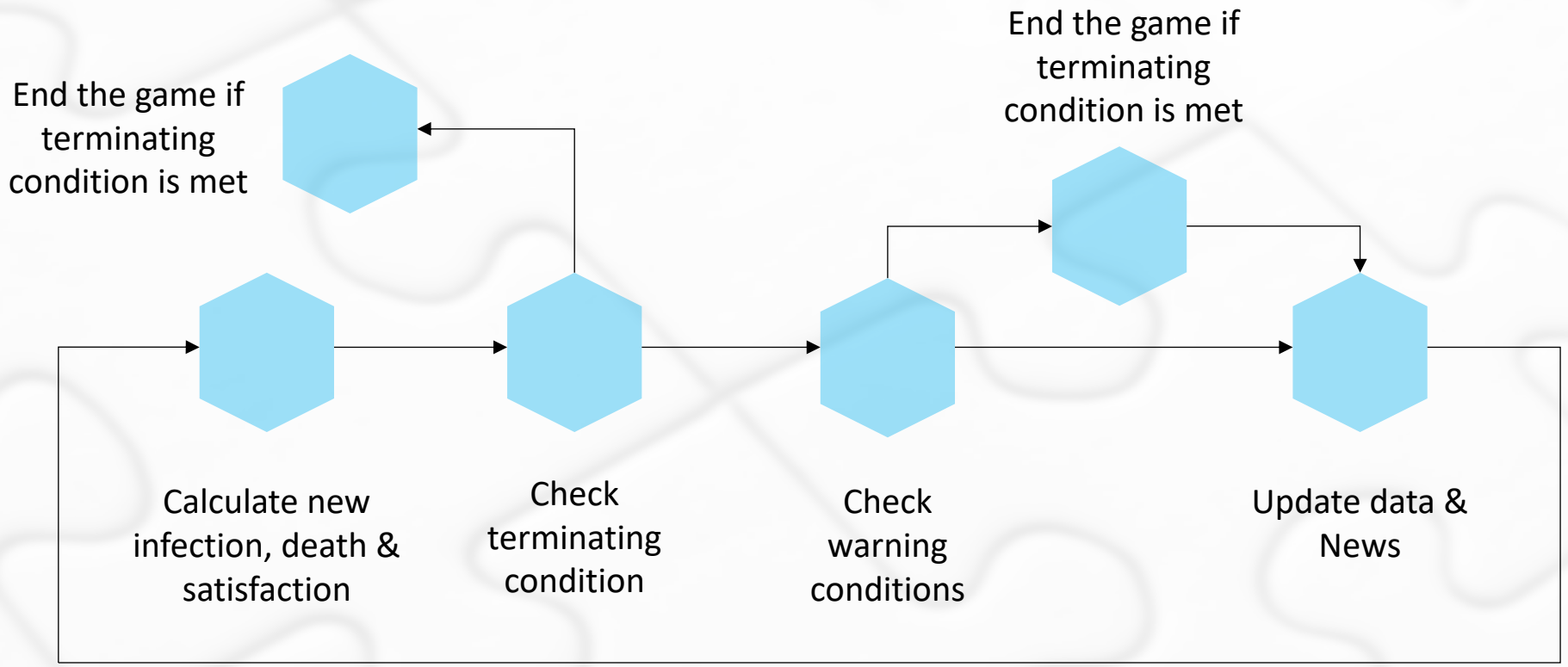
Game Logic Overview



Main Loop

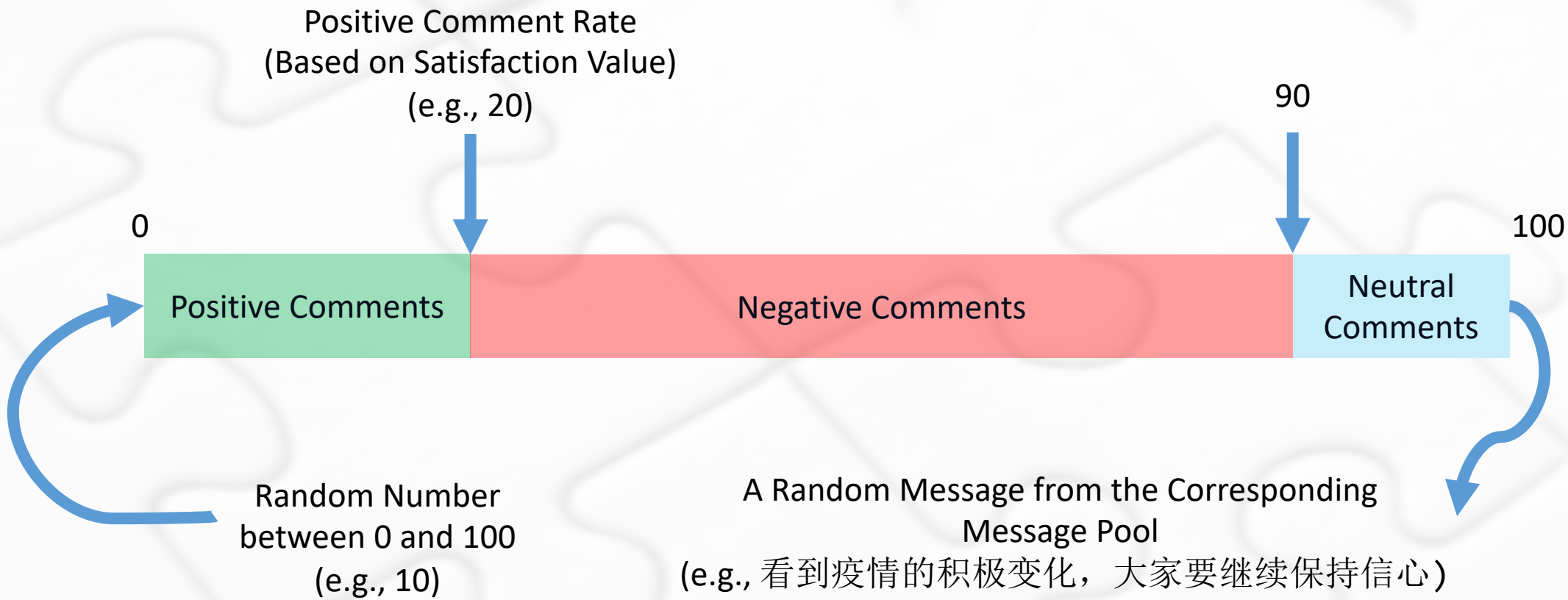
Control the basic logics of the game

- Feed the data into the model for calculation and update the data
- Check the terminating & warning conditions based on game rule



Social Media Controller Loop

A separate loop to generate social media (Weibo) messages from message pools at its own pace based on satisfaction value




4
Evaluation

User Study

Evaluating how well our game fulfill the initial objectives

- Relieving mental health problems
- Enhancing policy compliance

8 participants (mean age: 20.37)

Procedure

Pre-study Questionnaire

Tutorial

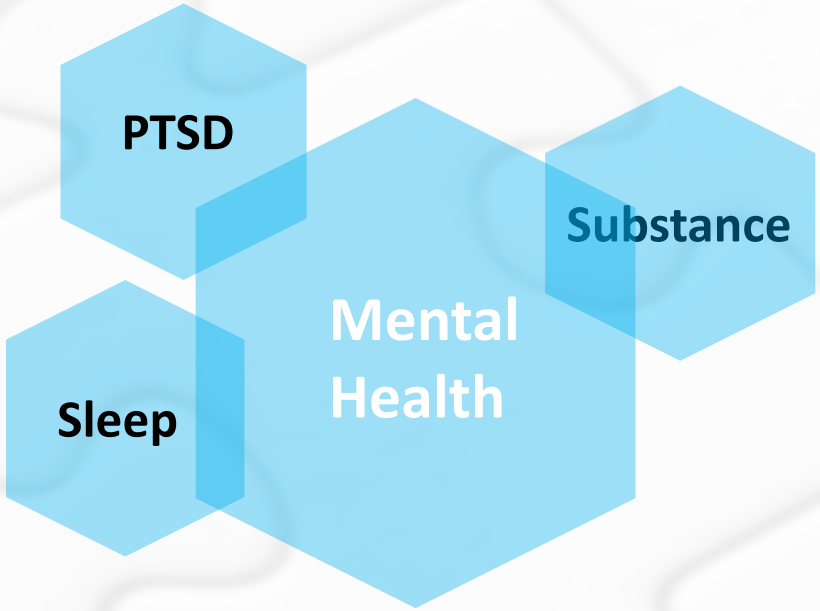
Gameplay

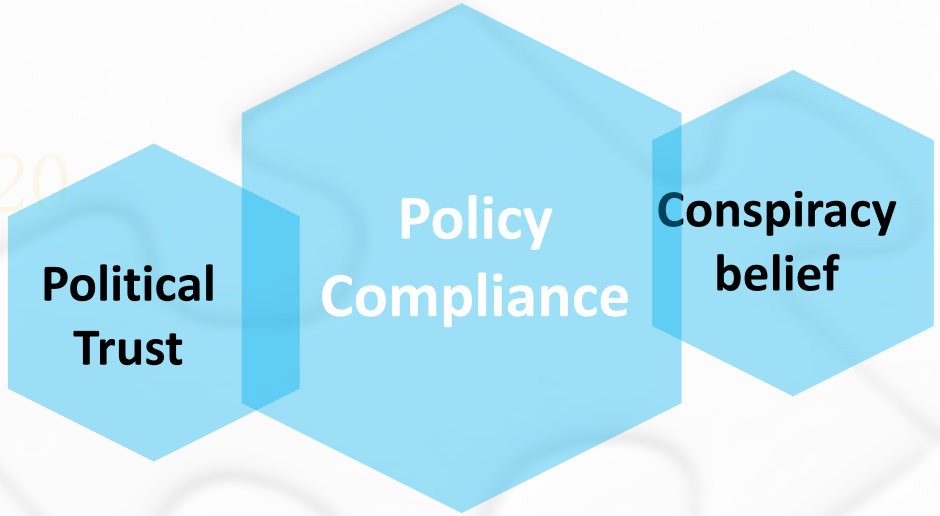
3-day interval

Post-study Questionnaire

QUESTIONNAIRE

Developed to quantitatively evaluate the mental health and policy compliance of participants, all items were assessed using 7-point Likert scale questions.





RESULTS

We adopted **Wilcoxon signed-rank test** to analyze the results.

- For mental health, we identified the significance of certain PTSD symptoms.
- For policy compliance, we observed significant changes in most of the measurements.

Aspect	Measurements	Before Mean/S.D.	After Mean/S.D.	Statistics W	Statistics p-value
PTSD symptoms	Upsetting pandemic dreams	4.25/1.49	3.63/1.19	0	0.059^{+}
	COVID-19 flashbacks	4.38/0.92	3.63/0.74	0	0.034*
	Internal avoidance	4.13/0.64	3.63/0.52	0	0.102^{-}
	External avoidance	3.88/0.35	3.63/0.52	0	0.157^{-}
	Hyper-vigilance	3.63/0.52	2.88/0.64	0	0.014*
Sleep disturbances	Sleep onset difficulties	4.00/1.69	3.63/1.06	4.50	0.408^{-}
	Sleep maintenance difficulties	3.63/1.06	3.38/0.92	2.50	0.317^{-}
	Early morning waking	3.00/0.76	3.13/0.83	2.00	0.564^{-}
Substance use	Excessive alcohol consumption	4.25/0.46	4.25/0.46	0	1.000^{-}
	Increased drug use	4.00/0.00	4.00/0.00	0	1.000^{-}
	Chain smoking habit	4.25/0.89	4.00/0.53	1.50	0.414^{-}
	Strong addiction cravings	4.38/0.92	4.13/0.35	1.50	0.414^{-}
	Loss of substance control	4.25/0.46	4.13/0.35	0	0.317^{-}

Aspect	Measurements	Before Mean/S.D.	After Mean/S.D.	Statistics W	Statistics p-value
Political and institutional trust	Trust in political leadership	2.63/1.30	4.88/0.64	0	0.019*
	Confidence in democracy	3.38/1.19	4.38/0.74	0	0.046*
	Trust in public institutions	2.50/1.69	4.88/0.83	0	0.018*
	Perceptions of media transparency	2.13/1.25	4.25/1.39	0	0.027*
	Trust in politicians	2.63/1.41	.63/0.92	0	0.017*
Conspiracy beliefs	Distrust in media	5.13/0.64	4.25/1.28	2.00	0.068^{+}
	Belief in alternative explanations	5.75/1.16	4.00/1.20	0	0.009*
	Biological weapons	4.13/0.99	2.63/0.52	0	0.016*
	Superpower competition	4.13/1.36	3.00/0.53	0	0.059^{+}
	Population reduction	3.88/1.13	2.63/0.74	2.00	0.040*

The quantitative results of participants' mental health and policy compliance, where the p-values (-: $p > .100$, +: $.050 < p < .100$, *:$p < .050$, **:$p < .010$) are reported

Discussion

Content Enrichment and Playability

- Relatively monotonous gameplay for *Policidemic.*
- Social media panel receive compliment.
- Design considerations: playability, storyline, interactive features.

Visualization Techniques

- Visualizations should be simple and clean.
- Visualizations should be integrated with the game logic and have interactions with other game elements.

Perspective-taking

- Participants experienced the difficulty of controlling the pandemic and managing public sentiment.
- A valuable design consideration.

Limitations

- Model constraints.
- Participants' age bias.
- Evaluation constraints of some mental health issues. (e.g., "I have difficulty sleeping through the night due to the COVID-19 policy-related experience)

5

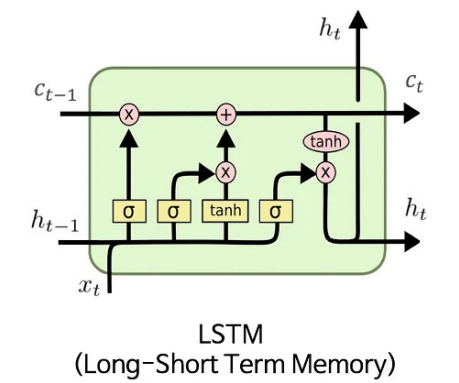
Conclusion

SUMMARY

In this project, we…

- Examined ways to promote policy understanding & Purposed the serious game solution
- Devised design requirements & design choices
- Implemented the game
- Evaluated the effectiveness of the game via survey

Future Improvements



LSTM
(Long-Short Term Memory)

Data prediction can be improved via machine learning with models for processing sequential data (e.g., LSTM) to…

- Improve prediction accuracy
- Enable the comparison between the player's performance & the real world

The data visualization techniques can be improved for the China map

- Possible Visualizations from mature games can be adopted

Acknowledgment

- Special thanks to Prof. Ma for supervision.
- Special thanks to communication tutor, Ted, for valuable suggestions.

Demo

Backup link: https://youtu.be/0V0pzeusrtA

Q&A