GeoCamera: Telling Stories in Geographic Visualizations with Camera Movements

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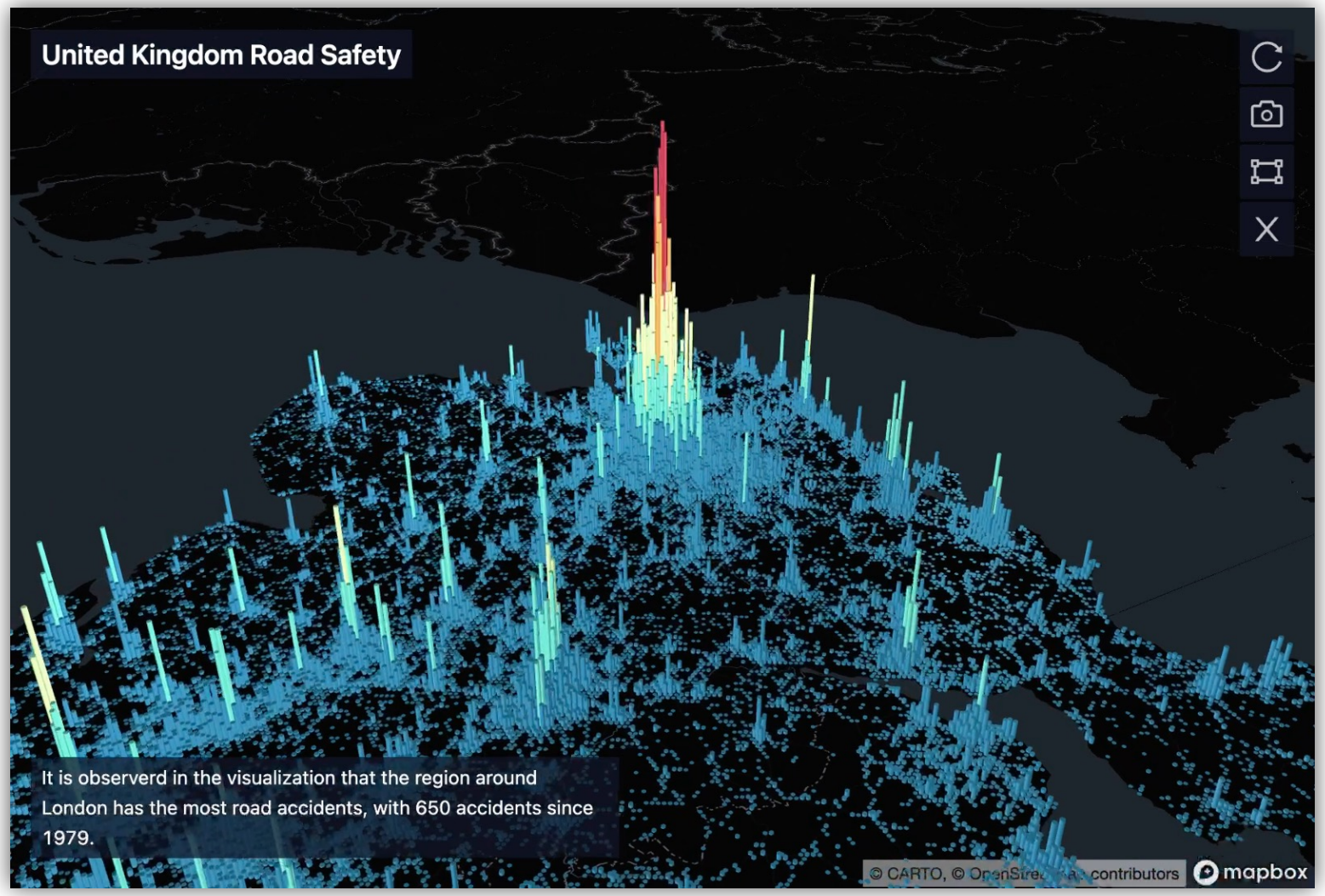
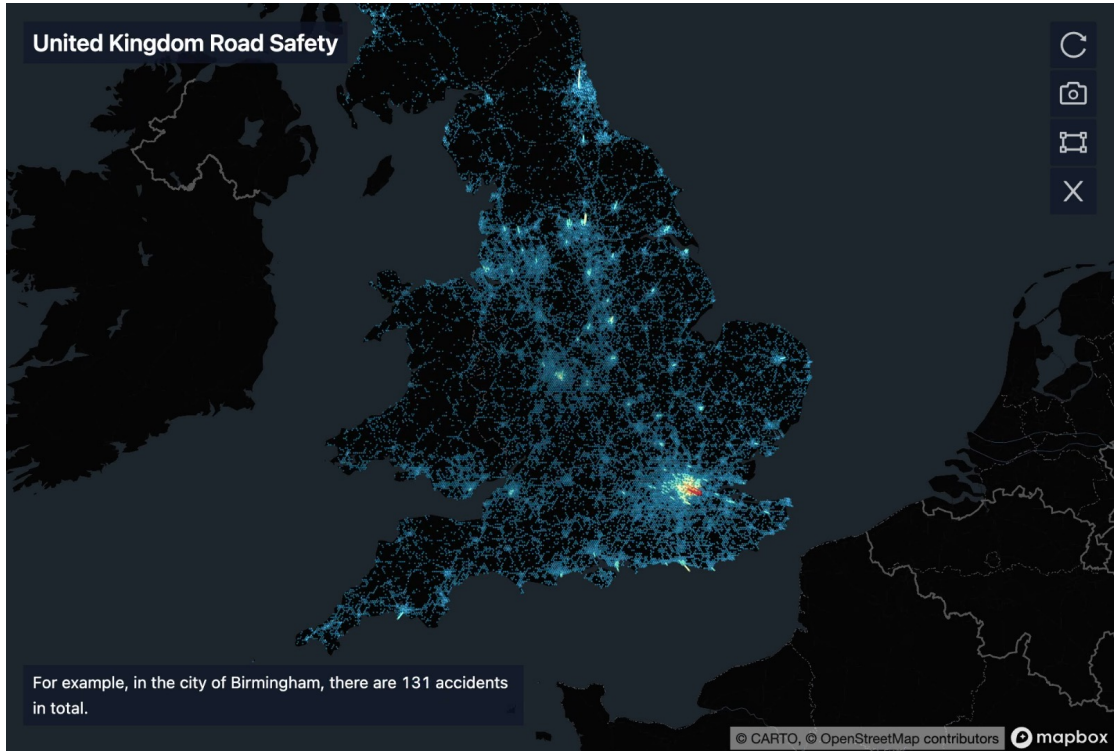
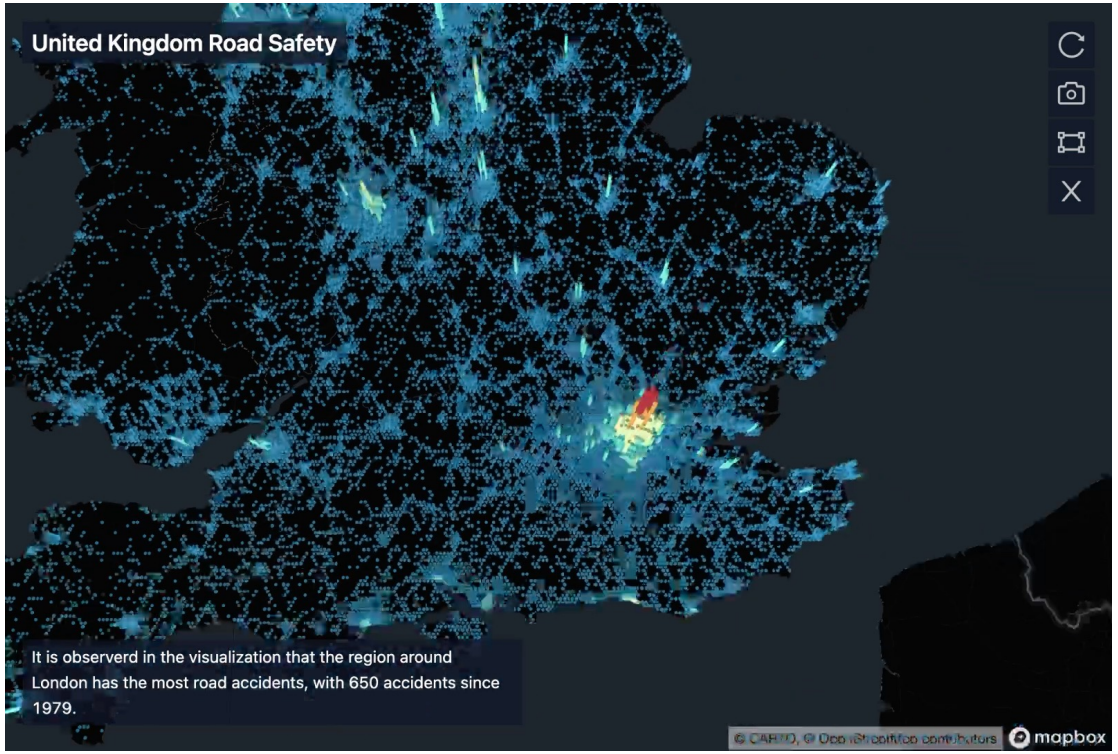
Geographic Videos



Camera Movements in Geographic Data Videos



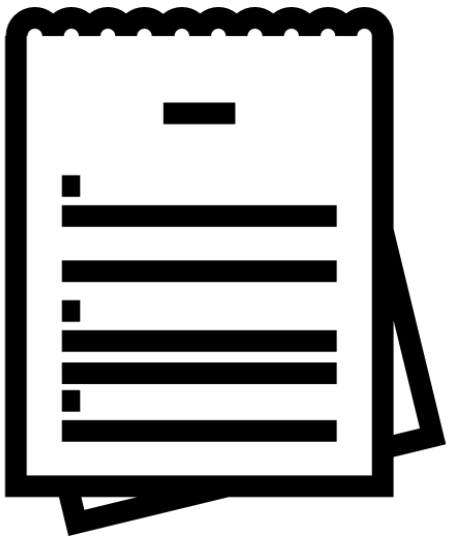


Designing Camera Movements

Challenging

Lack of expertise

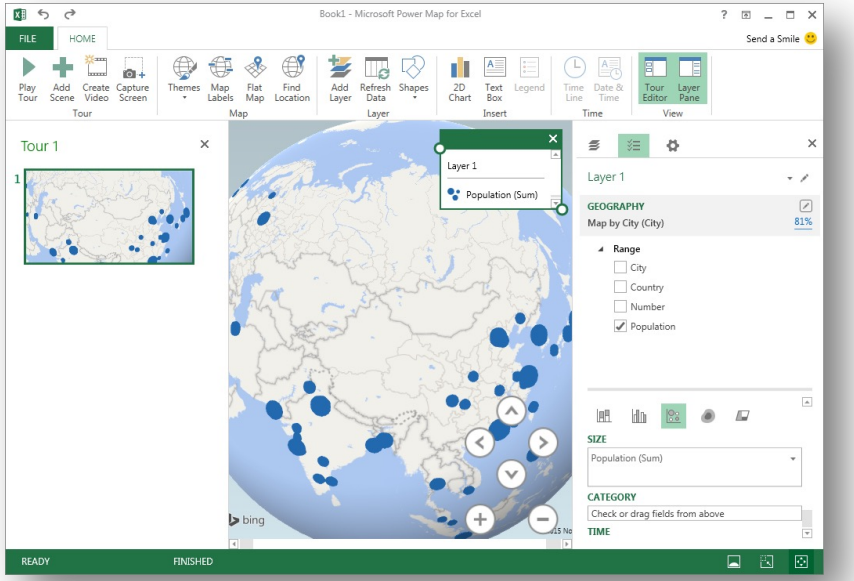
Challenges



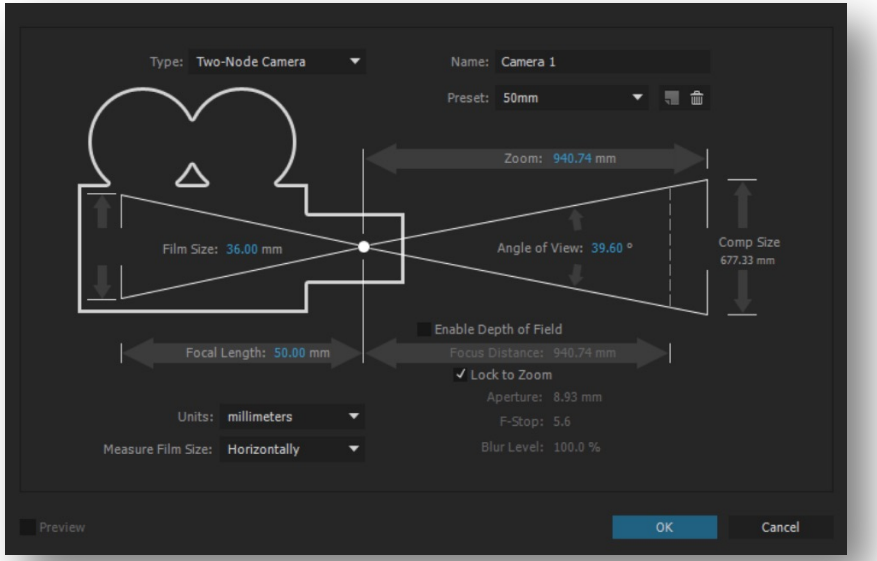
Story

Camera movements

Challenges

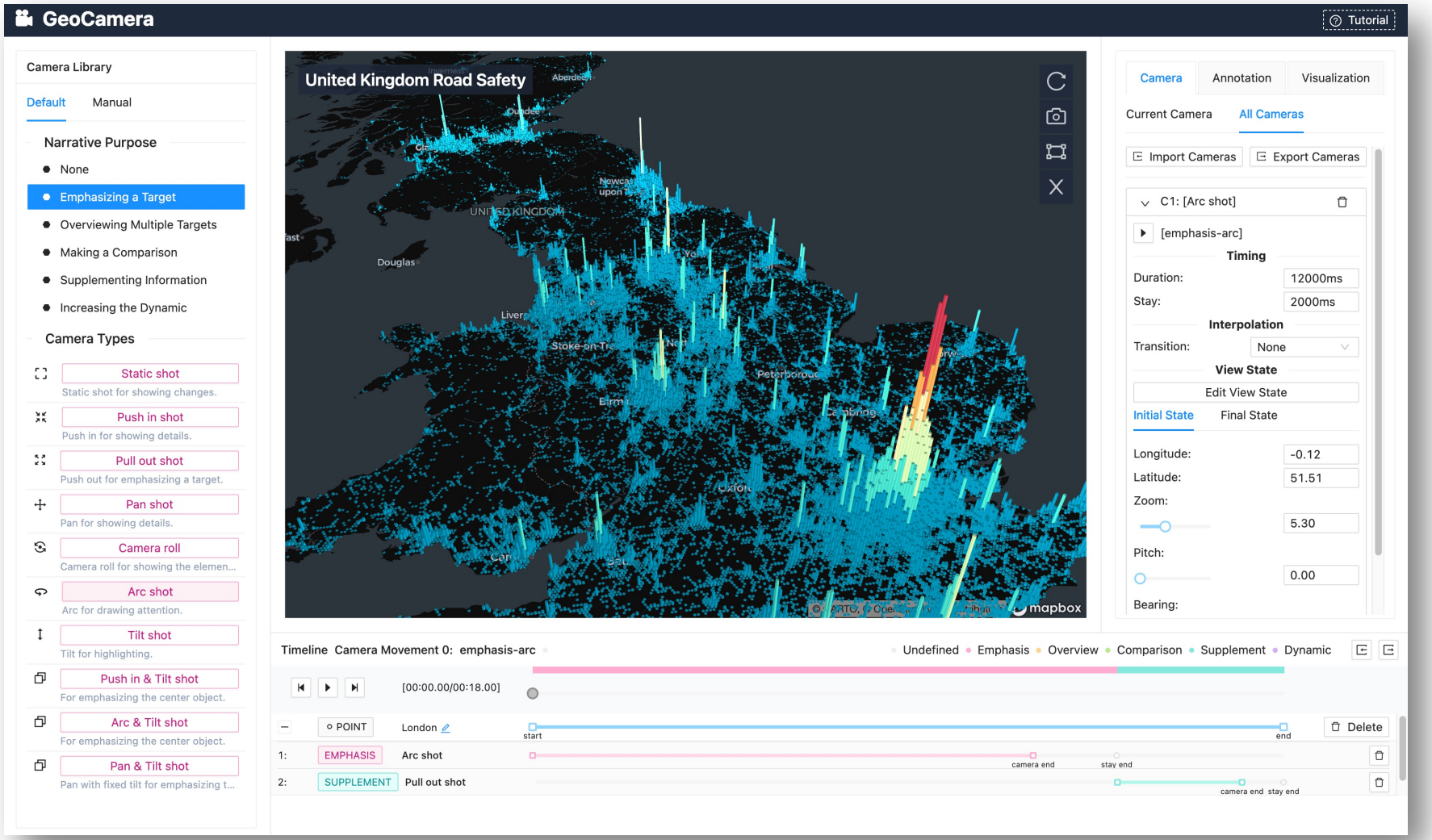


Microsoft Power Map



Adobe After Effect

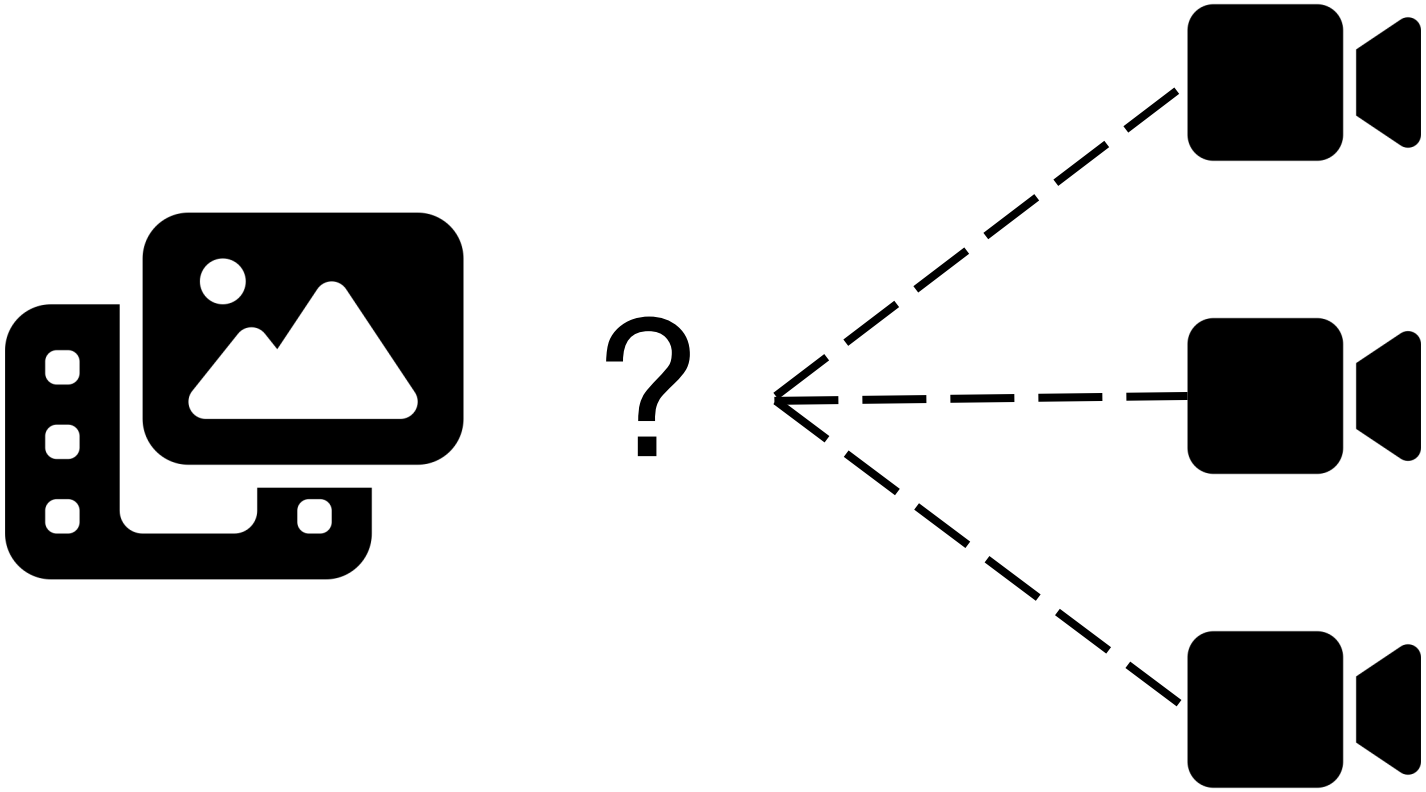
GeoCamera


GeoCamera
Tutorial
Camera Library
Default
Manual
Narrative Purpose
None
Emphasizing a Target
Overviewing Multiple Targets
Making a Comparison
Supplementing Information
Increasing the Dynamic
Camera Types
Static shot
Static shot for showing changes.
Push in shot
Push in for showing details.
Pull out shot
Push out for emphasizing a target.
Pan shot
Pan for showing details.
Camera roll
Camera roll for showing the elemen...
Arc shot
Arc for drawing attention.
Tilt shot
Tilt for highlighting.
Push in & Tilt shot
For emphasizing the center object.
Arc & Tilt shot
For emphasizing the center object.
Pan & Tilt shot
Pan with fixed tilt for emphasizing t...
United Kingdom Road Safety
mapbox
Camera
Annotation
Visualization
Current Camera
All Cameras
Import Cameras
Export Cameras
C1: [Arc shot]
[emphasis-arc]
Timing
Duration:
12000ms
Stay:
2000ms
Interpolation
Transition:
None
View State
Edit View State
Initial State
Final State
Longitude:
-0.12
Latitude:
51.51
Zoom:
5.30
Pitch:
0.00
Bearing:
Timeline Camera Movement 0: emphasis-arc
Undefined
Emphasis
Overview
Comparison
Supplement
Dynamic
[00:00.00/00:18.00]
POINT
London
start
end
Delete
1:
EMPHASIS
Arc shot
camera end
stay end
2:
SUPPLEMENT
Pull out shot
camera end
stay end

Design Goals

- G1: To produce compelling camera movements for storytelling
- G2: To lessen the barriers in authoring geographic data videos

Preliminary Study



Preliminary Study

- A corpus that includes 66 geographic data videos and 805 camera movements
- Why camera movements are employed (Narrative purposes)
- What objects are the focus of narration (Geospatial targets)
- How camera movements are designed (Camera shots)

Design Space

- Narrative purposes identification based on literature review from narrative visualization, data graphics design, and cinematic storytelling

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- Three authors coded each camera movement and iterated until all camera movements could be coded consistently

Design Space

- Narrative purposes identification based on literature review from narrative visualization, data graphics design, and cinematic storytelling
- Three authors coded each camera movement and iterated until all camera movements could be coded consistently
- Design space refinement with two professional drone photographers

Design Space

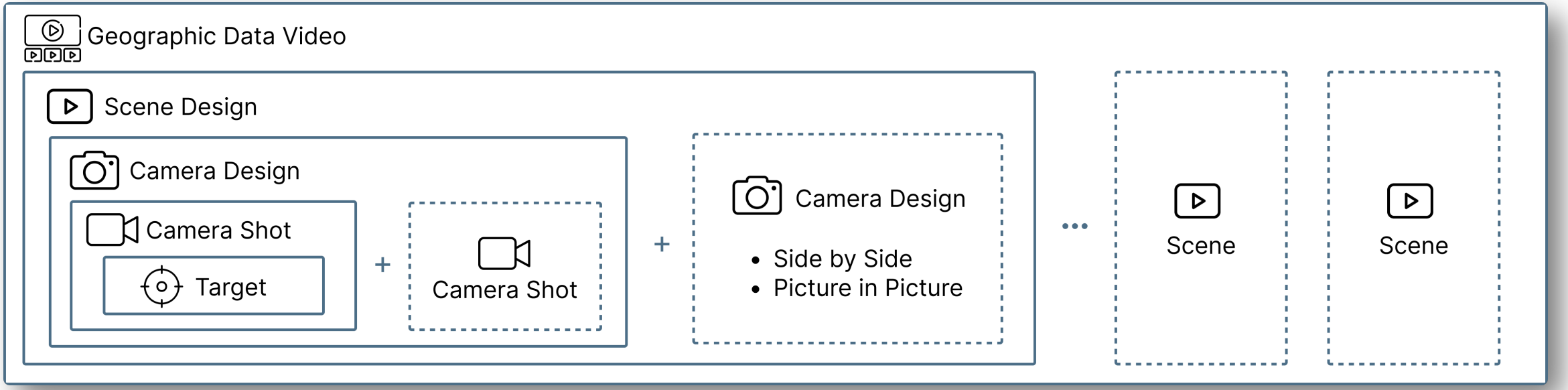
- Geospatial Targets: (1)Location, (2)Region, (3)Path, (4)Multiple Targets
- Narrative Purposes: (1)Emphasizing a Target, (2)Overviewing Multiple Targets, (3)Making a Comparison, (4)Supplementing Information, (5)Increasing Dynamics
- Camera Shots: (1)Static, (2)Push in, (3)Pull Out, (4)Pan, (5)Tilt, (6)Camera Roll, (7)Arc, (8)Tracking

Design Space

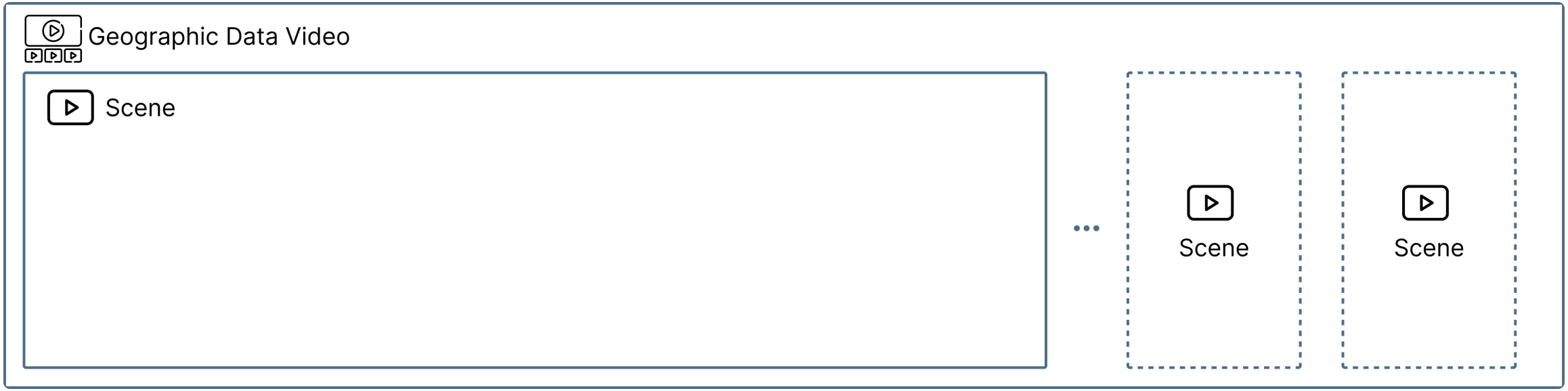
	Video Title	Link	Clip	Camera Shot	Narrative Purpose	Geospatial Target
1	Why Israel is a Tech Capital of the World	https://youtu.be/RuPx61911Oo	1:07-1:09	pan	Emphasizing a target	region
			1:09-1:11	zoom out	Supplementing information	region
			2:31-2:33	zoom out	Making a comparison	regions
			7:59-8:01	pan, zoom out	Overviewing multiple targets	regions
2	Milk. White Poison or Healthy Drink?	https://youtu.be/oakWgLqCwUc	2:10-2:12	pan, zoom in	Emphasizing a target	region
			2:14-2:16	pan, zoom out	Overviewing multiple targets	regions
3	The Economics of K-Pop	https://youtu.be/-bbfFf07WNw	2:39-2:42	pan	Overviewing multiple targets	regions
			2:44-2:46	pan, zoom out	Supplementing information	regions
					Emphasizing a target	region
					Emphasizing a target	region
				in	Emphasizing a target	region
				in	Making a comparison	regions
				in	Emphasizing a target	region
				ut	Emphasizing a target	path
				in	Supplementing information	regions
				in	Emphasizing a target	region
				in	Emphasizing a target	region
				ut	Supplementing information	region
					Overviewing multiple targets	paths
					Overviewing multiple targets	points

Narrative Purposes	Geospatial Targets	Camera Shots (ranked by frequency)
Emphasizing a Target	Location	Push In(8), Pan(8), Arc(4), Camera Roll(2), Pull Out(1)
	Path	Push In(19), Pull Out(17), Pan(12), Camera Roll(6), Tracking(4), Tilt(3), Arc(2)
	Region	Push In(182), Pan(112), Pull Out(29), Tilt(20), Arc(16), Camera Roll(14)
Overviewing Multiple Targets	Multiple Targets	Pull Out(39), Push In(33), Pan(31), Tilt(7), Arc(5), Camera Roll(1)
Making a Comparison	Multiple Targets	Pull Out(15), Pan (13), Push In (6), Tilt(1)
Supplementing Information	Location	Pull Out(2)
	Path	Pull Out(2), Tilt(2)
	Region	Pan(45), Pull Out(33), Tilt(11), Push In(4), Arc(1), Camera Roll(1)
	Multiple Targets	Pull Out(12), Tilt(3), Push In(1)
Increasing Dynamics	None	Push In(54), Pull Out(16), Tilt(4), Pan(3), Camera Roll(1)

Video Model for GeoCamera



Video Model for GeoCamera



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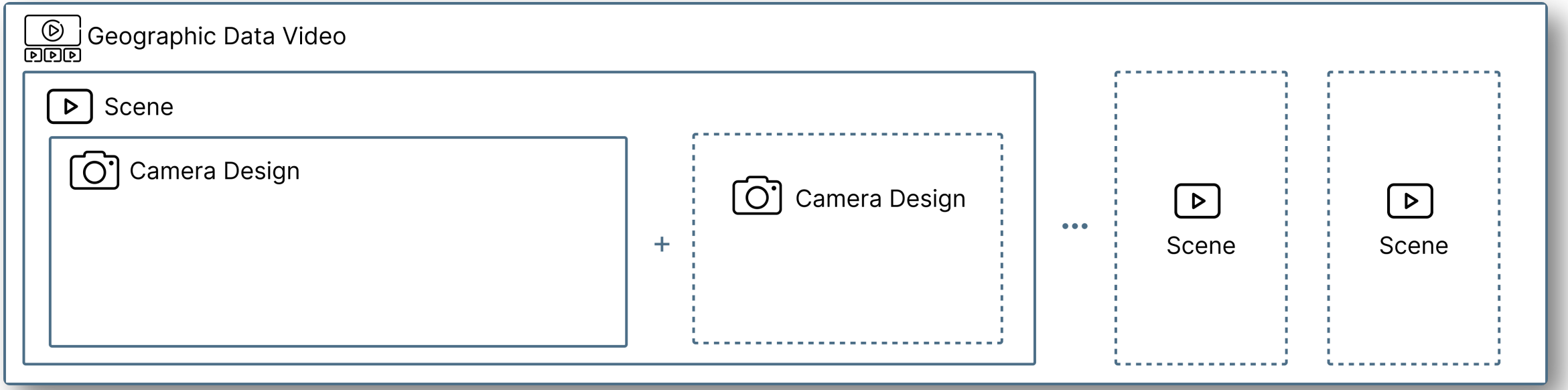

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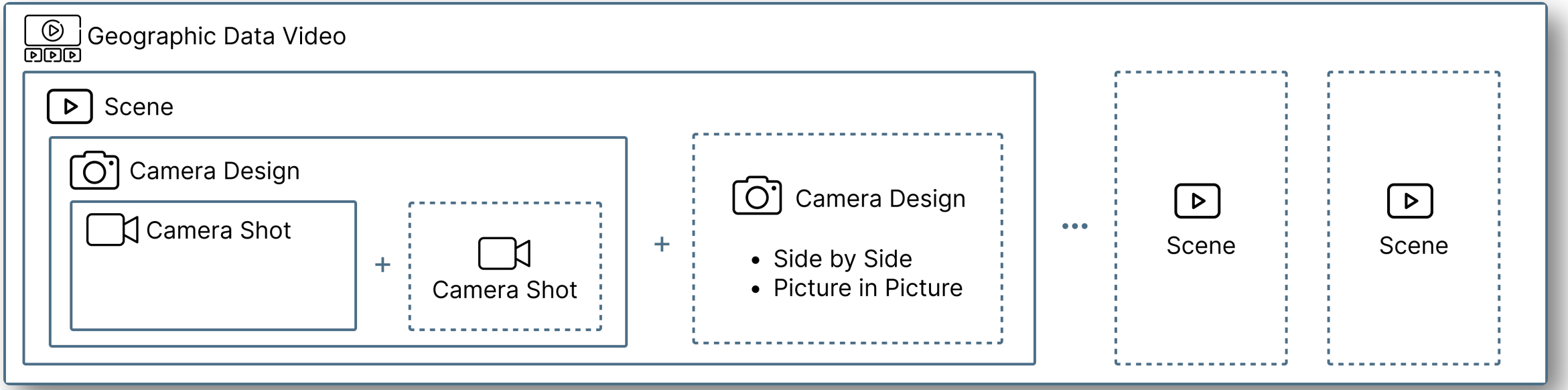
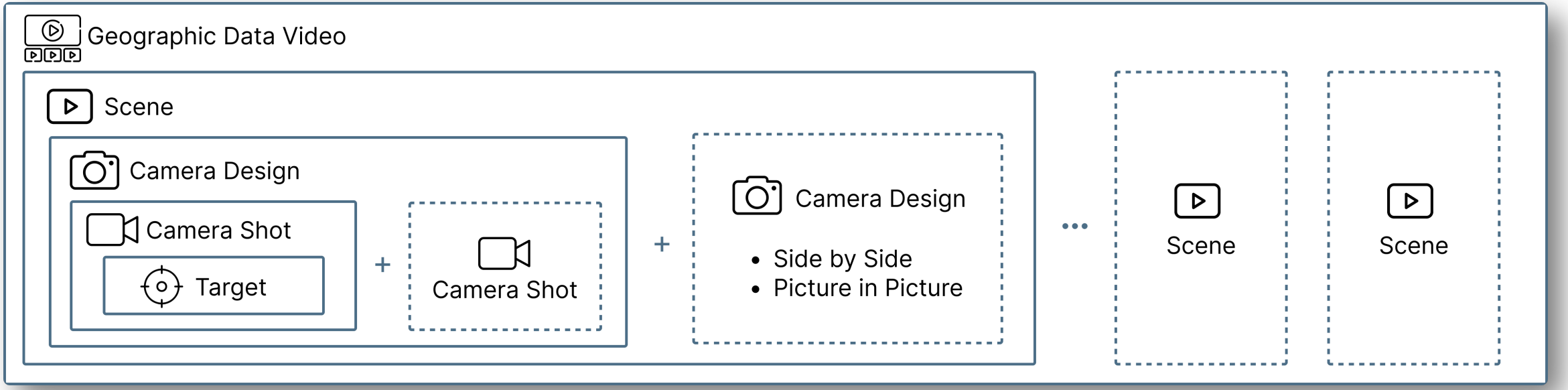
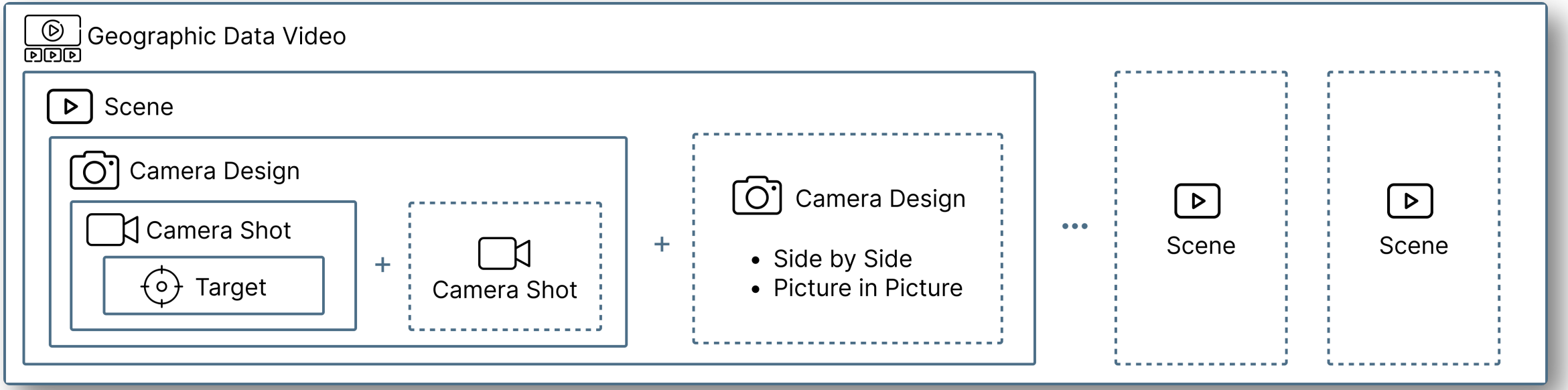
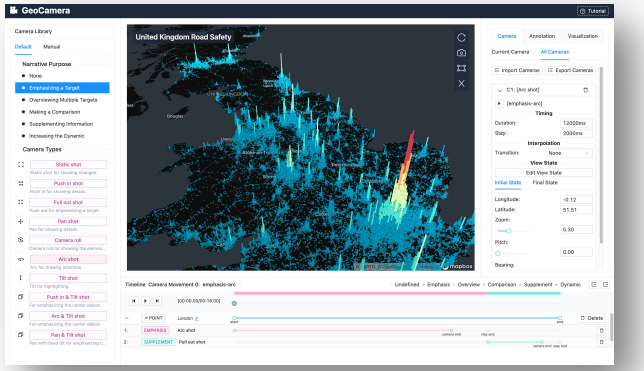


Video Model for GeoCamera

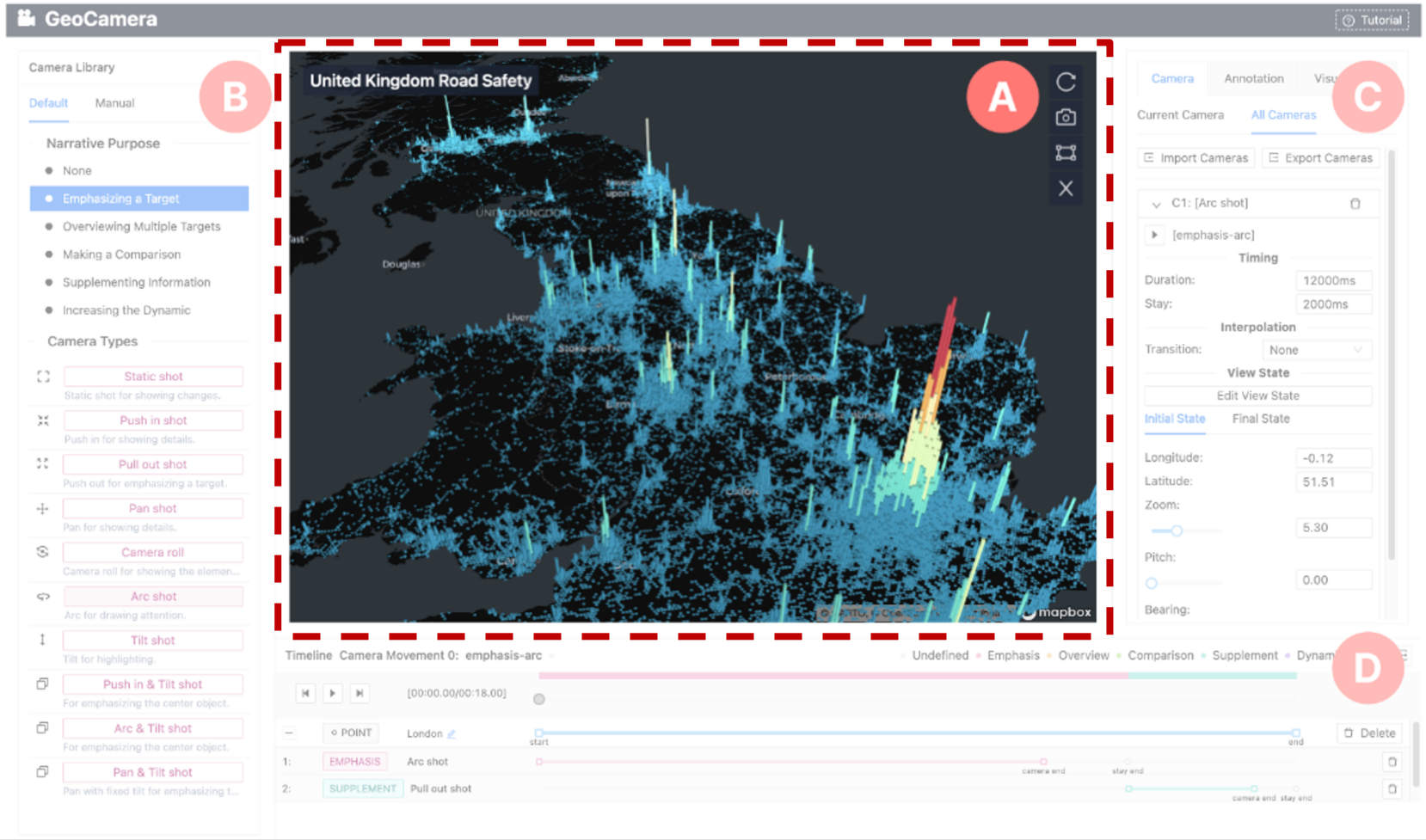


Video Model for GeoCamera





GeoCamera



An interactive canvas for geospatial target selection

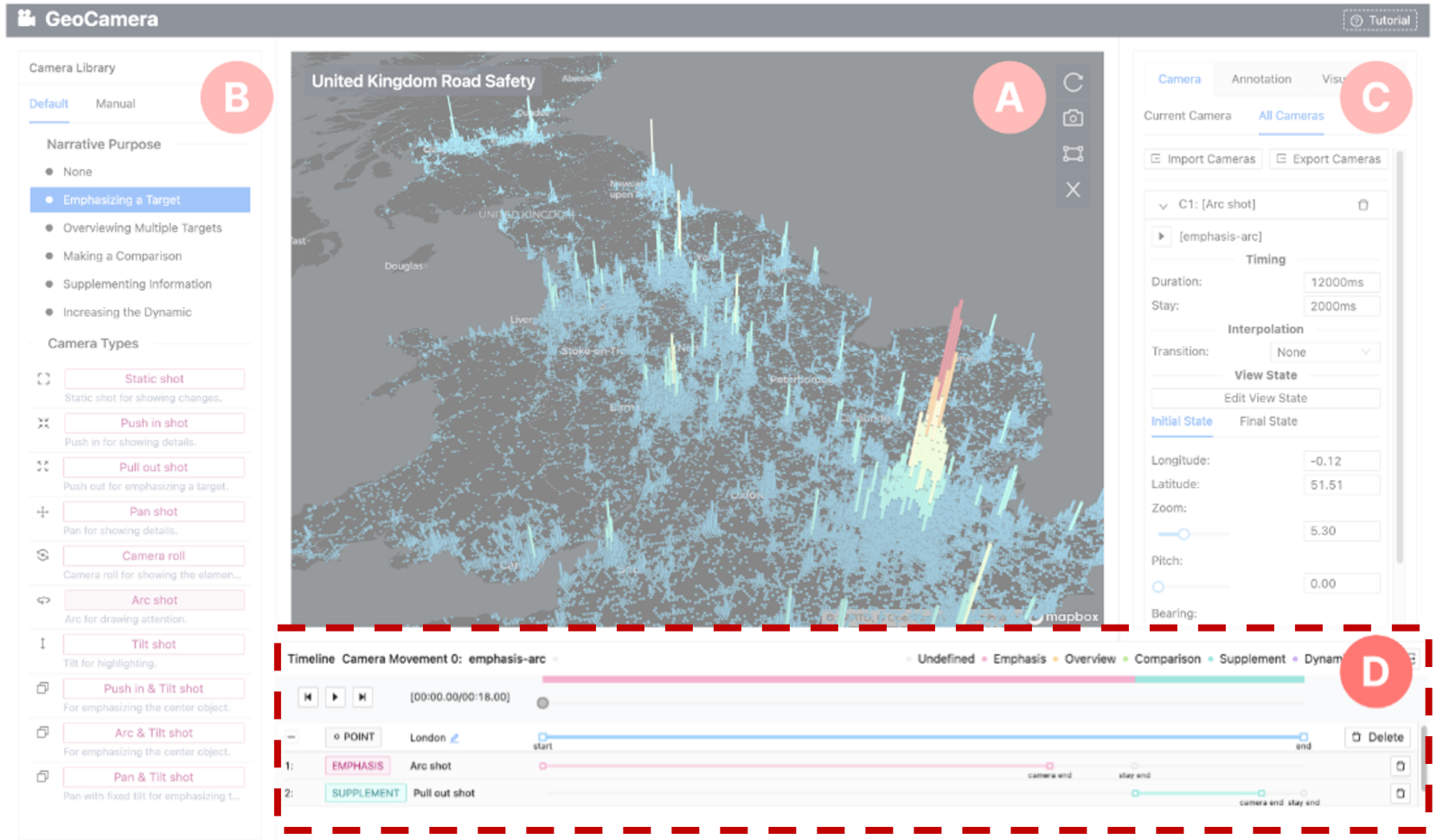
GeoCamera

A library of camera movements

GeoCamera

A panel for configurations

GeoCamera



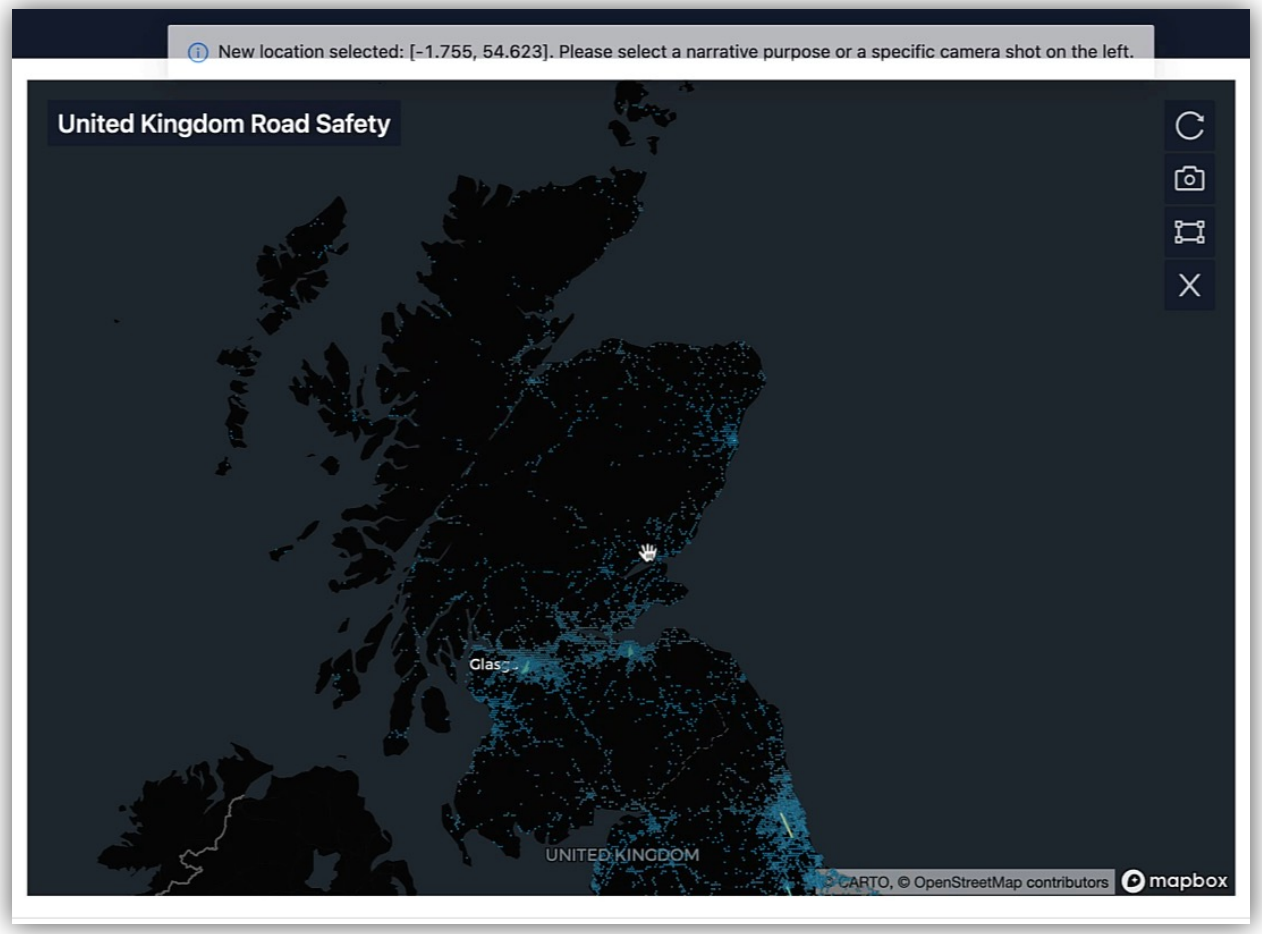
A location-camera hierarchical timeline

Target Selection

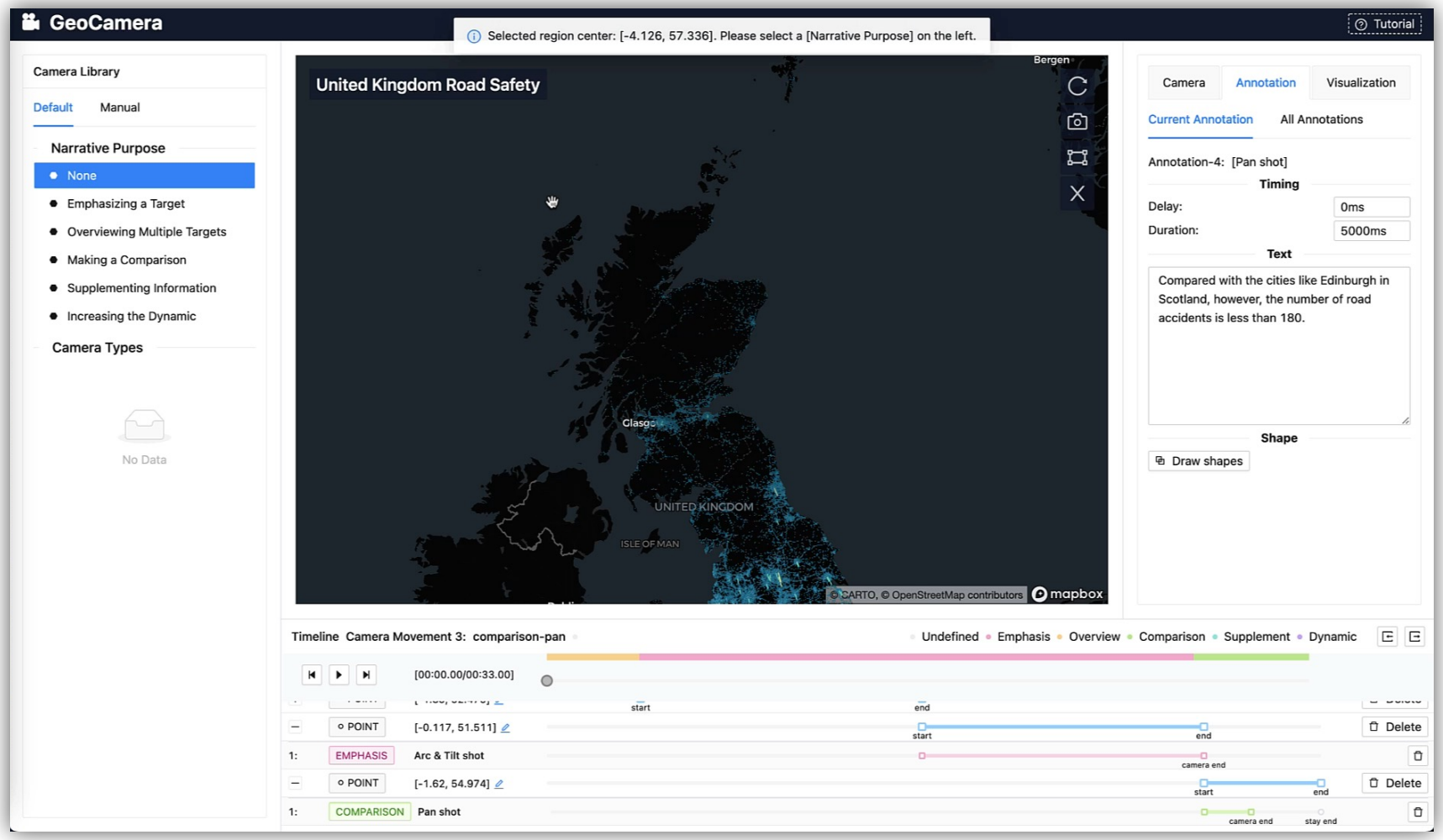
Point

Path

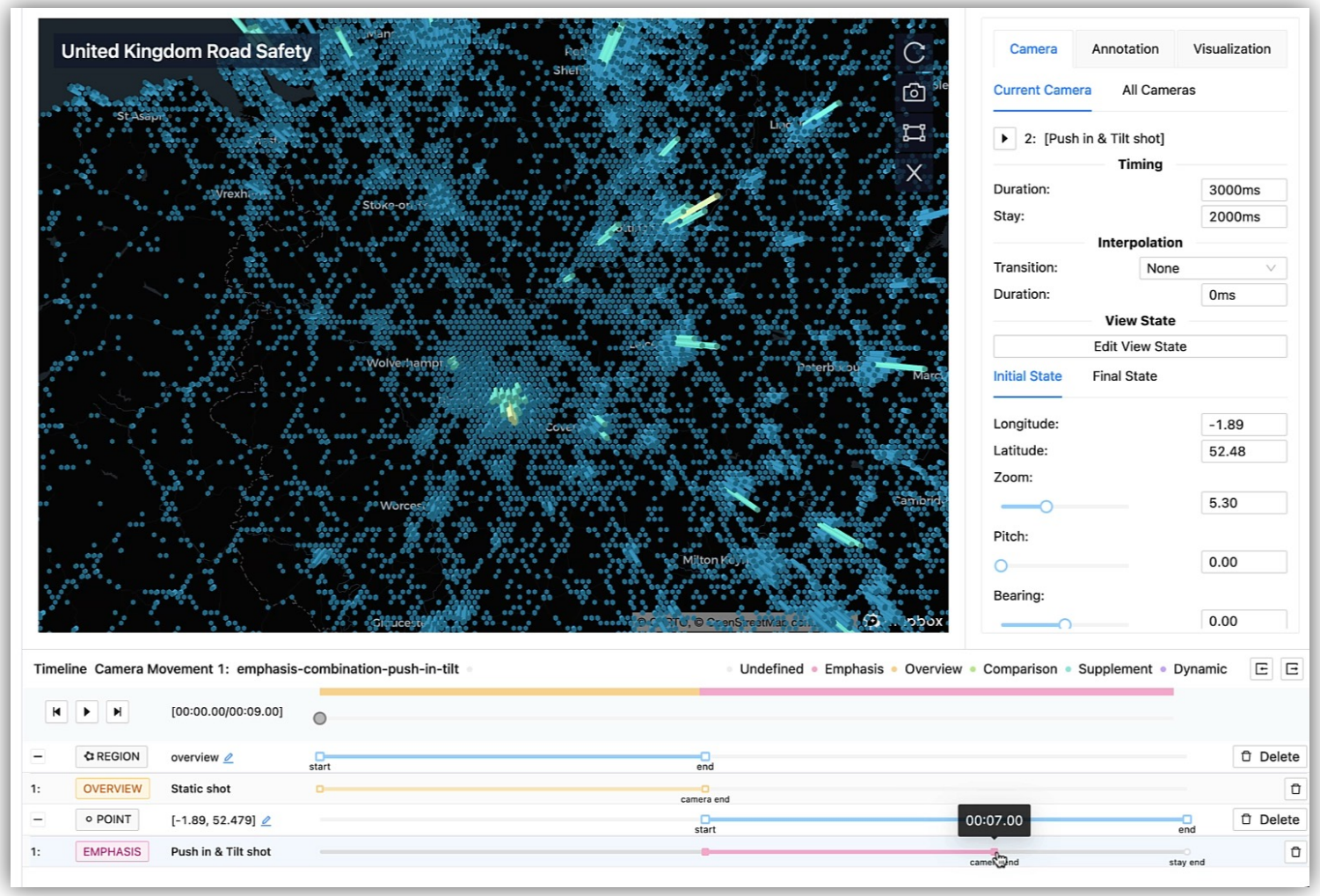
Region



Narrative Purpose Selection



Editing A Camera Movement



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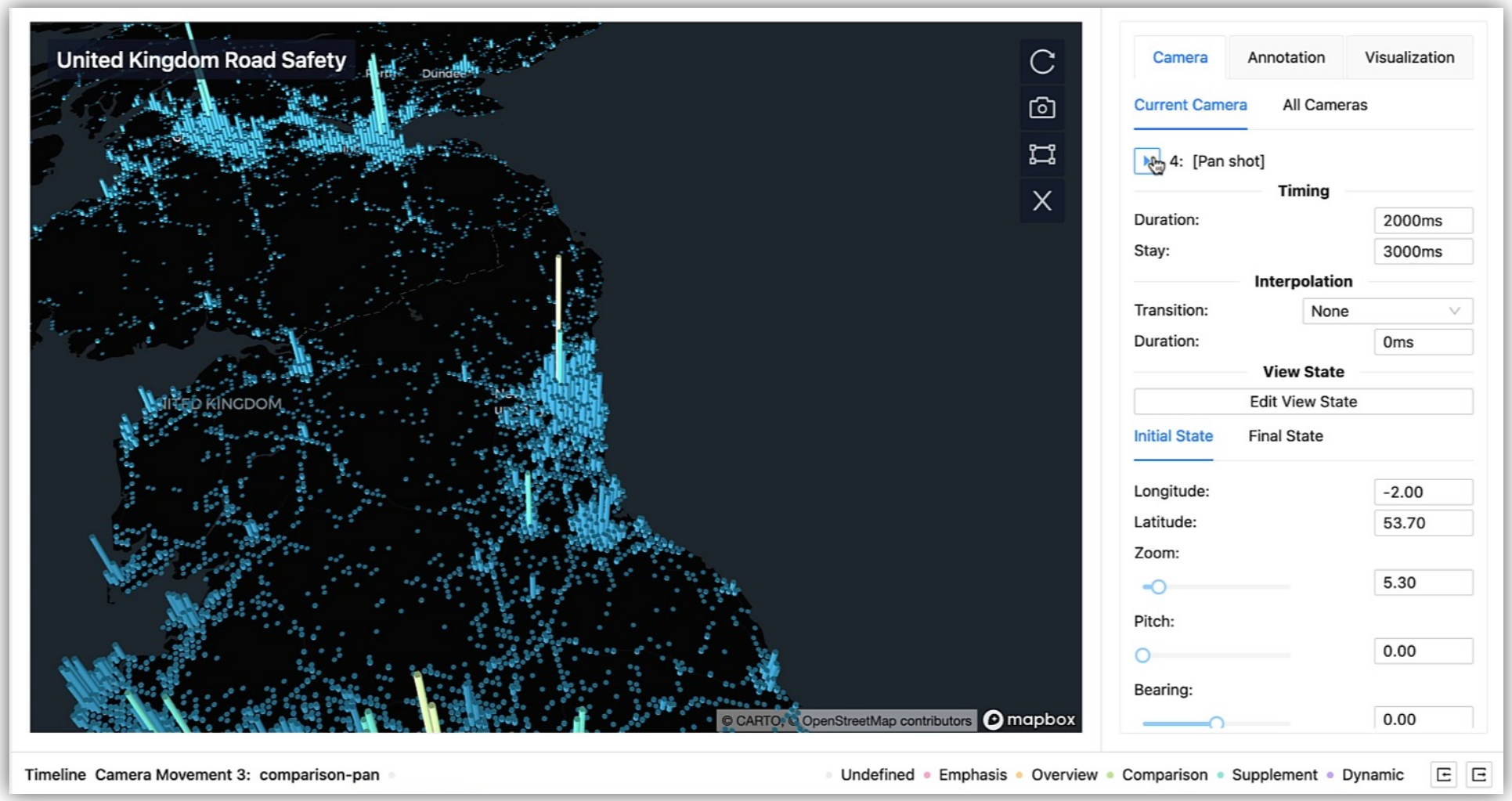
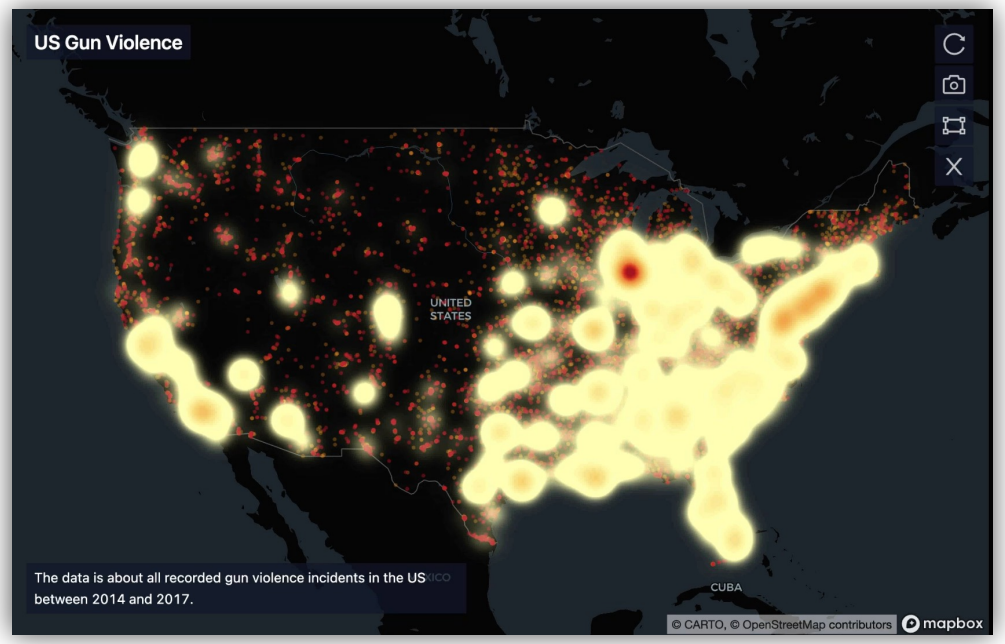
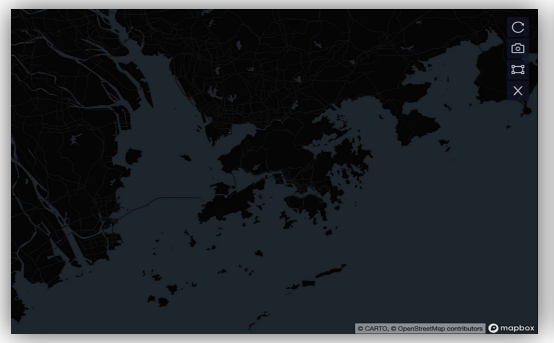
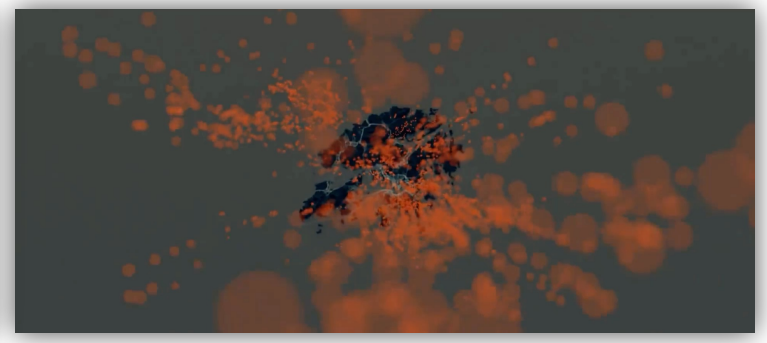


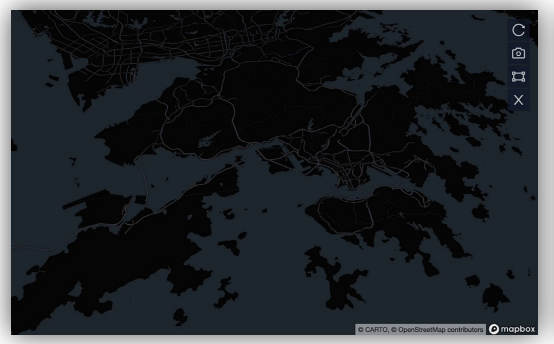
Case Study

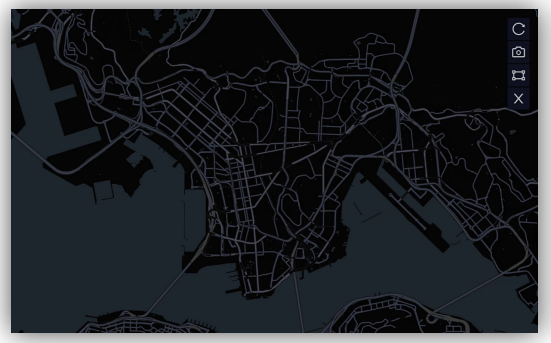


(Data video clip)









(Ours)

(Example video)

User Evaluation

- 8 participants
- Slides that introduced each category of our design space with examples as teaching material
- Tutorial: 15-min introduction + 20-min demonstration
- Creation: 15 - 30 mins
- Post-study Survey and Interview: usefulness, ease of use, and satisfaction of GeoCamera
- Compensation with a gift card worth $15

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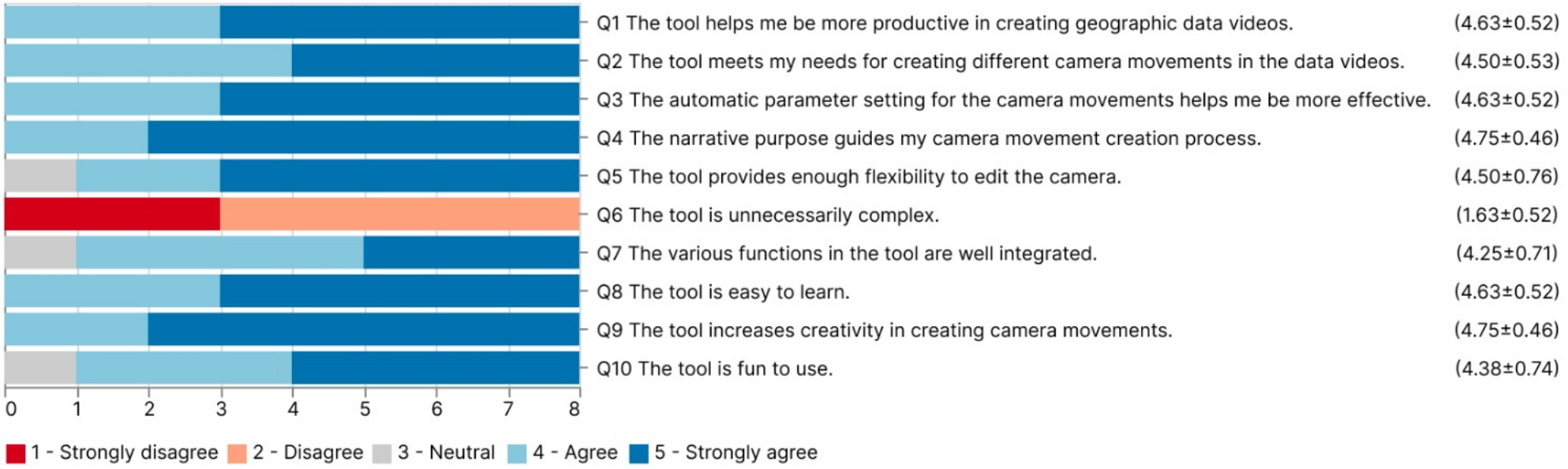
User Evaluation Results



Ratings for system usability on a 5-point Likert scale

Discussion

1. Understanding the best practices in authoring geographic data video

Discussion

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   - We treat our design space as a probe for camera movements

Discussion

1. Understanding the best practices in authoring geographic data video
   - We treat our design space as a probe for camera movements
   - The camera movement recommendations in GeoCamera are based on the statistical frequencies of the combinations from the corpus

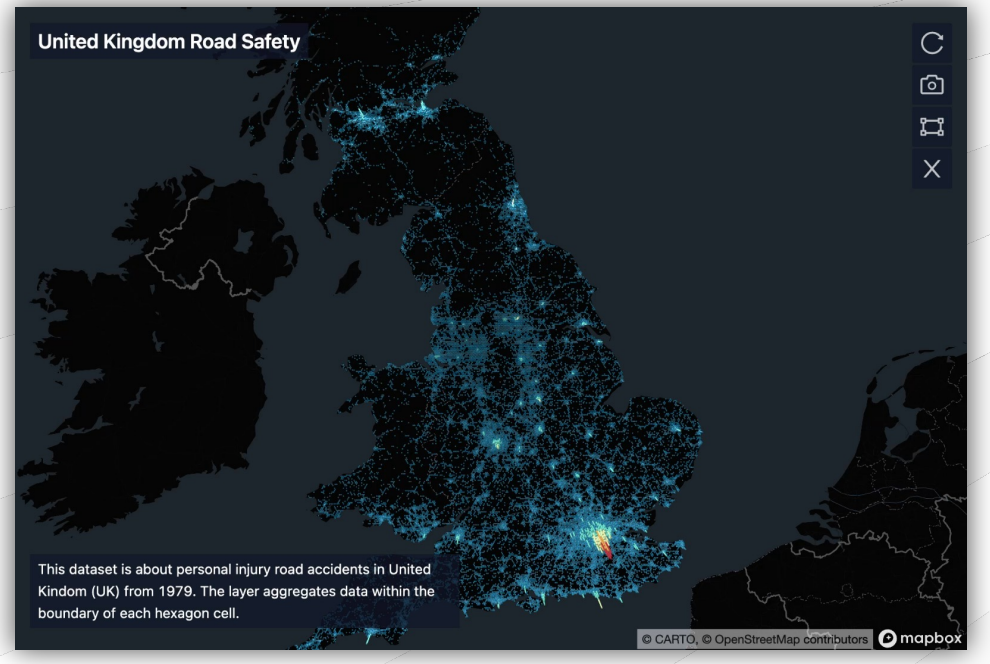
Discussion

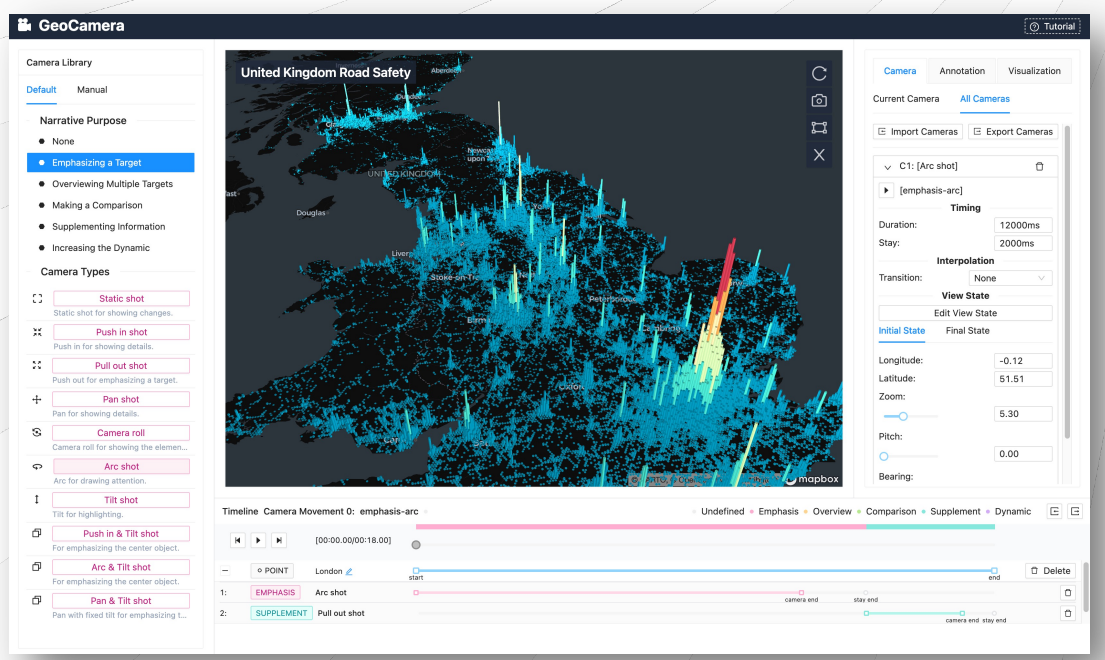
2. Data insights and story structures recommendation

Discussion

3. Enriching editorial layers for storytelling
   - Visual embellishments
   - More animation
   - More cinematic effects

GeoCamera: Telling Stories in Geographic Visualizations with Camera Movements





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