

Visual Analytics for Integrated Evolution of Physical and Cyber-Events: A Case of the World Cup in Social Media

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Background

In a stadium, teams are fighting hard while thousands or millions of people are watching the game at the stadium or on TV or are listening to live broadcast. Many of these people express their impressions in messages posted in social media services such as Twitter. They keep discussing the game, players, goals (if any), mistakes, referees, rumors, etc. before, during and after the match. Physical-world events (**PWE**) and cyber-world events (**CWE**) happen in parallel, motivating our research to investigate the relationship patterns in their evolution. We are studying the following research problems:

- How do social media users' behavior react to physical-world events?
- How does the social media reaction change when the physical world event changes?
- How do social media users' interests change when physical-world event changes?



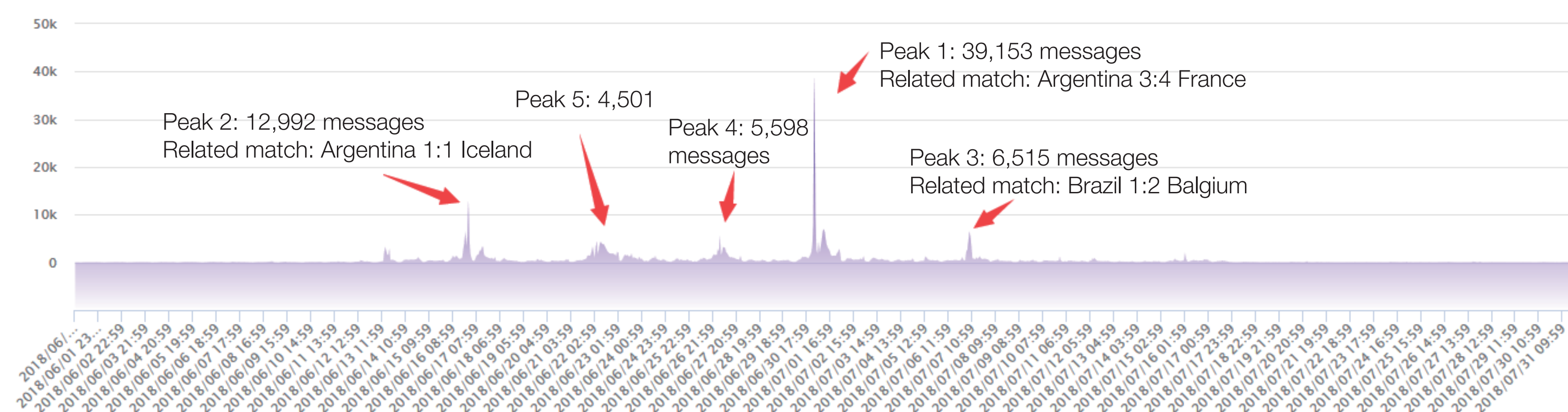
Image Source [https://www.aljazeera.com/news/2019/01/qatari-broadcaster-asks-italy-move-football-game-saudi-190110160906322.html] (Left)
Image Source [https://www.cbsnews.com/news/state-department-now-requires-us-visa-applicants-to-share-social-media-accounts-2019-06-01/] (Right)

Physical-world events (**PWE**) Cyber-world events (**CWE**)
Football teams / matches Social media discussions

Dataset

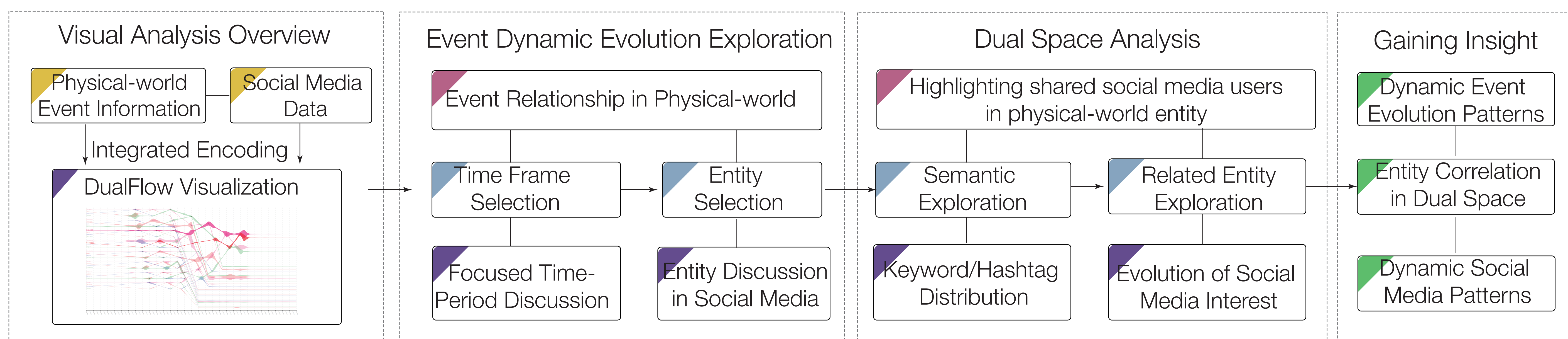
We acquired two data sets, namely the match events of WorldCup 2018 (PWE), and the explicitly related Weibo messages, specifically, the messages having the hash tag "\#WorldCup" (CWE). Weibo is the largest Chinese Social Media Service, similar to Twitter, with billions of active users. We acquired 67,871,823 related messages during the month of the World Cup. After data cleaning and removal of advertising accounts and bots, we have 7,653,986 messages from 3,297,502 social media accounts.

Exploratory Study



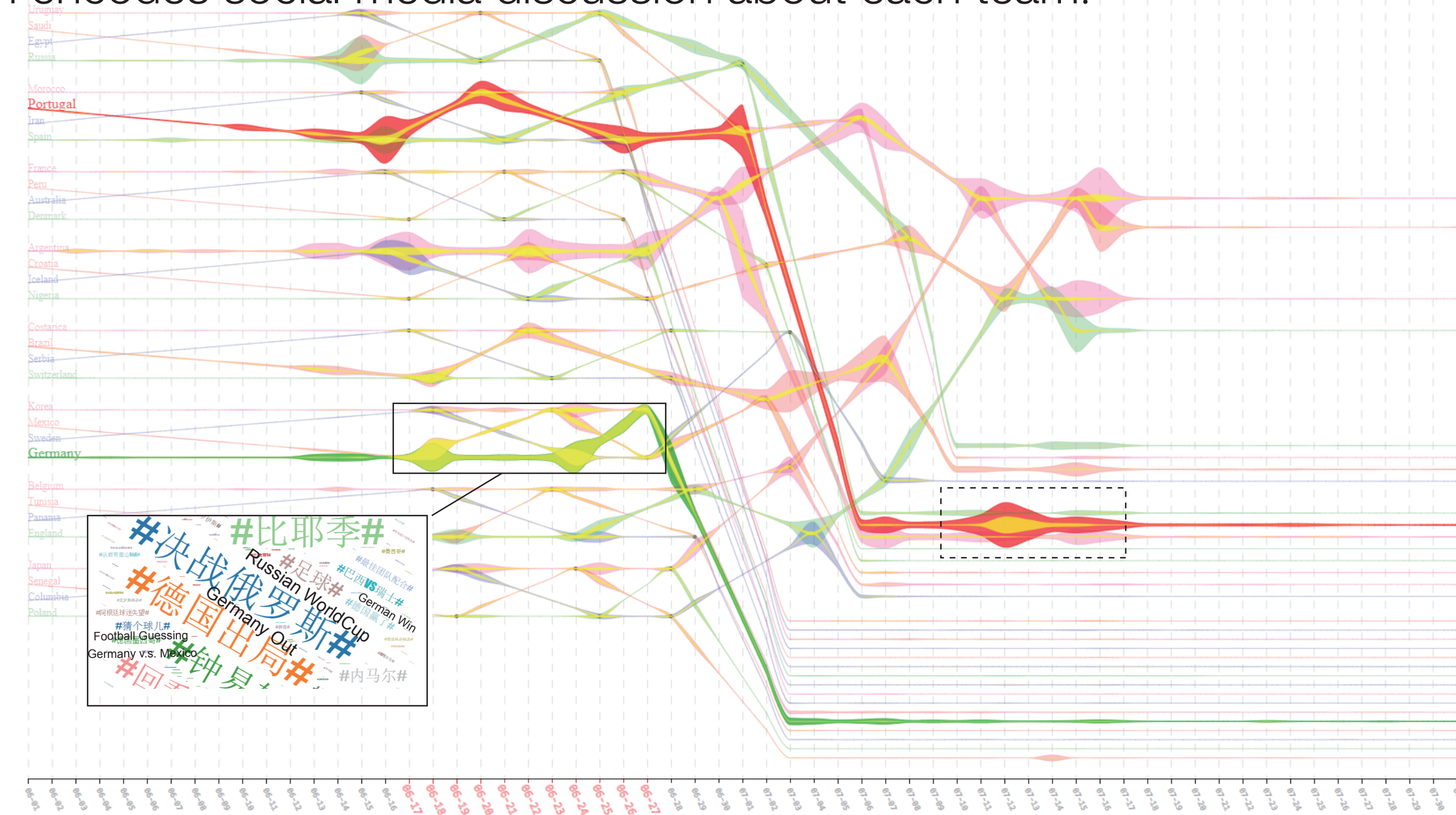
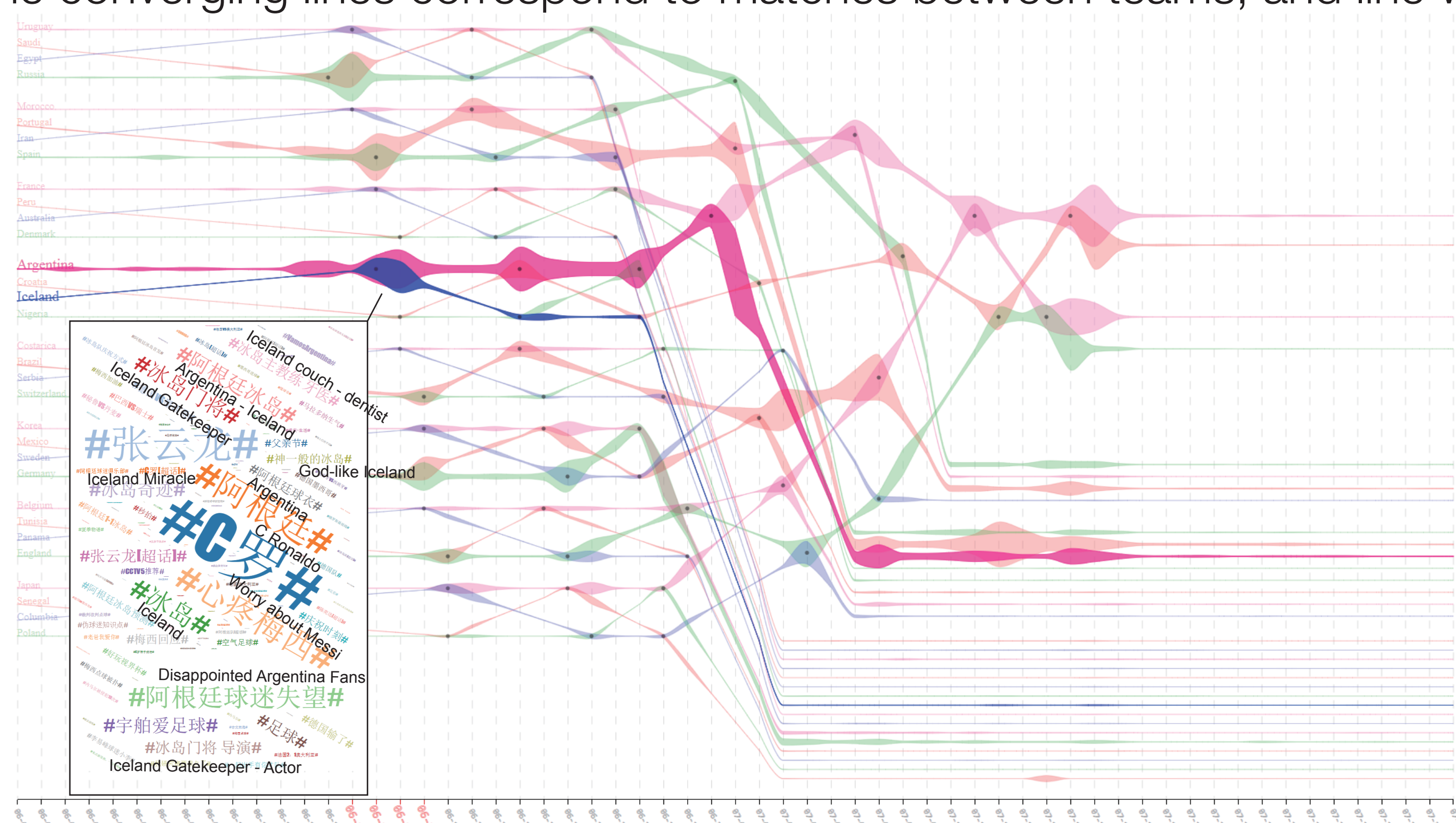
In our exploratory study, we investigate how relationships between PWE and CWE are reflected in data; that is, we look for evidence that significant changes or sub-events happening in a PWE can be matched to significant changes in the CWE. We detect 5 largest peaks and find out that the top 3 of them are related to specific world cup games of Argentina.

Visual Analytics Workflow



Visualization and Usage Scenarios

Each entity in PWE has a line going from left to right along the x-axis which represents time. When multiple entities interact in the physical world during some periods, their lines converge and go parallel. To visualize the social media discussions corresponding to the PWE threads, we use the width of each line to encode the amount of the related discussion in social media. In the World Cup example, each team is represented by a line, the converging lines correspond to matches between teams, and line width encodes social media discussion about each team.



Case 1: Basic Exploration

The wordle of hashtags for a selection of an entity and a time period. Iceland gained a peak attention in social media because of the draw in the match against Argentina.

Case 2: Integrated Analysis

People who discussed Germany from June 17 to June 27 are selected. Their participation in discussions concerning other teams during the whole world-cup period are highlighted in yellow.

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