Action 45: Stimulate Hybrid (Cyber-Physical) Places

Book Chapter

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Why
The emergence of virtual social media, be it Twitter, Instagram or Weibo, has stimulated many new kinds of social interaction. This has had an important effect on traditional public places in the city where conventional face-to-face and collective social interaction would take place. Increasingly, the two kinds of social interaction intersect, and new hybrid cyber-physical places are emerging as a result (de Souza e Silva 2006). Such new hybrid 'pixel-places', as O'Neill (2016) describes them, support many new kinds of interactive phenomena and effects. The possibilities of such hybrid places *in* the city are still not well understood, and new methods and approaches are required to analyse and harness them for sustainable and vibrant future cities.

What
One example of cyber-physical hybrid social interactions in the city concerns the production and experiencing of art (Tomarchio et al. 2016). Urban planners are increasingly interested in the role of art production and consumption in supporting vibrant public spaces, as well as stimulating the wider benefits of the 'creative city' (Florida 2002). The creative city vision advocates connecting local cultural projects to improved economic fortunes of particular city neighbourhoods, urban regeneration and improved quality of life (Landry 2012). When combined with the possibilities of social media and viral forms of social interaction, the possibilities emerge for a set of responsive public places (von Richthofen et al. 2019).

How
One approach to support this vision is to begin by geo-referencing art-related tweets and Instagram posts (Tomarchio et al., forthcoming a; Tomarchio et al., forthcoming b). Once assembled and geo-referenced, the art-related references (words and images) can become important indicators of certain kinds of social interaction. Relatively straightforward correlation and machine-learning techniques can then be used to explore the relationships between different types of art-referencing tweets and specific physical places, be they art galleries or cultural spaces (Tomarchio et al. 2020: Tomarchio et al., forthcoming a). This database can be supplemented with interviews with stakeholders, and from there, maps and indicators can be developed to inform the planning of urban cultural spaces (Tomarchio et al. 2020).

Evidence

DART is used for detailed three-dimensional radiation transfer simulations at different scales. This makes it possible to quantify the influence of variation in vegetation and construction materials in the radiative budget. DART has also been repurposed to compute the mean radiant temperature of urban scenes. Vegetation is modelled as voxels with defined leaf area density that can be derived from LIDAR point-cloud data.

UT&C is a novel mechanistic tool that combines ecohydrological modelling with an urban canopy scheme. The model fully couples energy and water balance and accounts for the vegetation's biophysical and ecophysiological characteristics as well as urban subsurface hydrology. UT&C computes the air and surface temperatures, humidity and all urban water fluxes including transpiration as a function of photosynthesis. Despite using a one-hour time-step, UT&C is not computationally demanding, making it possible to perform long-term simulations, which is critical in climate change studies.

This ensemble of mechanistic models is tailored to quantify the effects of vegetation amount, spatial arrangement and vegetation properties on urban microclimate and hydrology, as well as the effects of the built environment on plant well-being and performance in different climatic scenarios (Meili et al. 2019).

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# Stimulate Hybrid (Cyber-Physical) Places

We developed a set of novel planning metrics based on data science methods using Twitter data, enabling us to analyse art-related social media streams in terms of their quantity, content (topic and sentiment), spatio-temporal location, and relation to established and emerging art venues (see Figure 45.2). Based on Twitter data, we demonstrated that art venues are a dominant and ubiquitous type of hybrid place, which warrants distinct definitions and thinking.

We applied machine-learning techniques to uncover which features of art venues are most significant to their social media output (Tomarchio et al., forthcoming a). The two most important features determining an art venue's number of art tweets are the topic diversity of the generated tweets and the number of other venues within walking distance. Together, these two features have a predictive capacity of about 50%. The topic diversity has been defined and calculated as the Shannon Entropy of the output of a topic clustering analysis (Latent Dirichlet Allocation) on art-related tweets, while the Clustering Count is the number of other art spaces within 500 m.

Based on the social media output of art venues, we defined novel indicators to gauge the impact of cultural planning interventions and subsidies on an art venues' social media activity (Tomarchio et al., forthcoming a). Such indicators help support the interpretation and analysis of cultural spatial planning in Singapore.

We also analysed Instagram images by clustering them based on their content using self-organising maps (see Figure 45.1), and derived a typology of transient Hybrid Art Place use (Tomarchio et al., forthcoming b). In Singapore, the main topic of pictures shared on social media pictures most often depicts the museum's social sphere and social dimension, and not the featured art or the building's architecture.

Specific analytical results aside, our overall methodology is a valid toolbox approach to map, represent and analyse Hybrid Art Places in cities; cultural
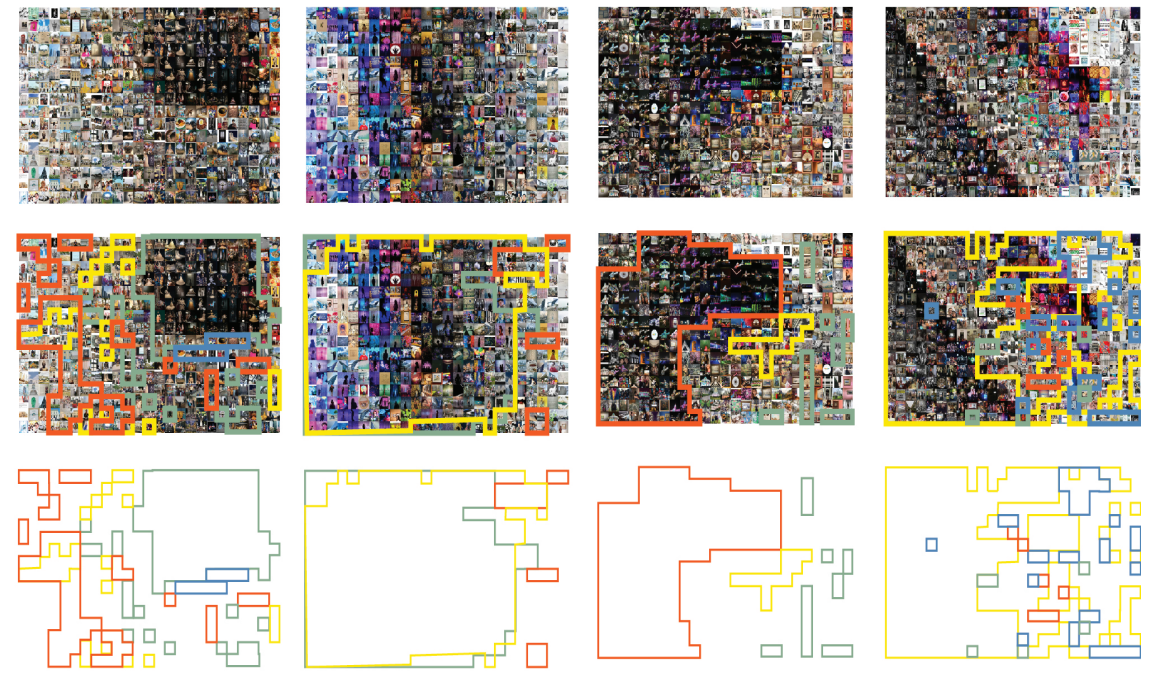
planners, media theorists, art managers and curators we interviewed confirmed the usefulness of our approach as a novel way to understand the complex relationship among venues of art and social media (Tomarchio et al. 2020).

Disclaimers

- The developed methods and tools have only been applied to Singapore.
- The range of tested cases and the span of the datasets was limited, but representative.
- This research follows a toolbox approach; the methods we developed are not an exhaustive set. Many other heuristics can be developed and proven useful for the future planning of Smart Cultural Cities and Hybrid Art Places.

Stakeholders

The actual importance of the hybrid nature of art consumption is influencing the way art and culture are conceived, almost adapting art production to the aesthetic and format necessary for social media discussion and hype (Cascone 2019; Woon 2019). Studying social media related to art production and consumption, with a focus on planning, is potentially beneficial for different practitioners. This sector of interest is very wide and it encompasses many different studies and contributions from a variety of
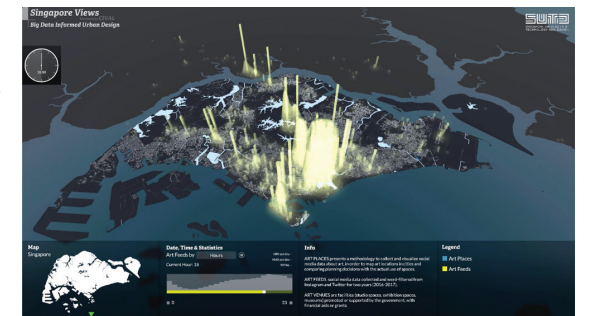

Fig. 45.1 Hybrid art museums in Singapore. The image references architectural types, providing a series of self-organising maps that show the social media content shared by users on Instagram while visiting different museums in Singapore. (Credit: Ludovica Tomarchio 2020)

Fig. 45.2 Spatial mapping of the distribution of art-related Twitter posts in Singapore in terms of their quantity, content (topic and sentiment), spatio-temporal location, and relation to established and emerging art venues (Credit: Ludovica Tomarchio 2020, made using CIVAL's Singapore Views platform)

disciplines. This includes cultural planners, curators, art managers, art directors, exhibition designers and urban planners.

We approached different actors in Singapore and introduced our tools and results to them, by means of interviews (Tomarchio et al. 2020). The interviews revealed a strong interest in the topic and the tools from practitioners in different fields, and resulted in ideas for potential new applications. The general feedback on the value of the research was

very positive, and pointed out particular areas of interest for future impact, such as placemaking, museum planning, and events impact calculation. Our definition of Hybrid Art Places was well accepted by interviewees, as it encapsulates the concept property 'Instagrammable', which is widely used by institutional and commercial clients. The concept encompasses visual identity, with multimedia and digital experiences. We also implemented an online interactive visualisation to make the results of the research visible to a wider audience and to have a greater impact.

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Improve Visual Storytelling

Singapore Views has been used by research modules at the Singapore-ETH Centre (SEC) and in research projects under the Intra-Campus for Research Excellence and Technological Enterprise (CREATE) programme funded by the National Research Foundation of Singapore. It has also been used by researchers from Singapore University of Technology and Design (SUTD) and the National University of Singapore. Additionally, collaboration with Singapore's Housing and Development Board and Singapore Land Authority has produced several proofs of concept that will be part of future collaborations with those agencies.

The 'Cooling Singapore' research project used Singapore Views and knowledge visualisation for the visualisation of urban heat island (UHI), as shown in Figure 46.1. This depicts the results of increased liveability, improved health and direct economic impacts of UHI reduction. The team have also based their decision support system on it by utilising its visualisation and presentation functionality.

The platform has also been utilised by the 'Dense and Green Building Typologies' research module for interactive storytelling (see Figure 46.2) between architects, urban planners, landscape architects and the public on the integration of green building typologies in high-density cities. In particular, Singapore Views demonstrates how dense and green building typologies can improve urban environments by mitigating negative effects of high density.

Researchers from the 'Natural Capital Singapore' project (see Figure 46.3) used Singapore Views during their opening and technical workshops to present a coherent story of the overall mission and objectives of the project. The platform has been further extended to fulfil additional needs of the project, including support for point clouds and the ability to modify land-cover types.
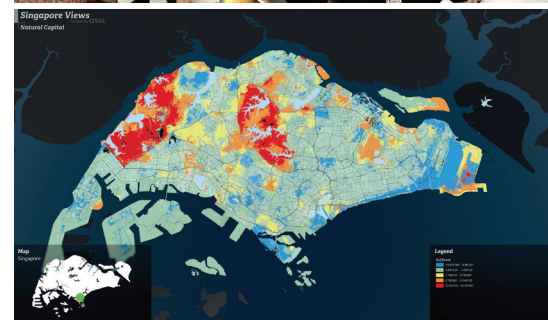

Fig. 46.1   'Cooling Singapore' (urban heat island) module presented via Singapore Views at ValueLab Asia

Fig. 46.2   'Dense and Green Building Typologies' module presented via Singapore Views at ValueLab Asia

Fig. 46.3   'Natural Capital: Technical Workshop' module for Singapore Views, in collaboration with Natural Capital Singapore

Fig. 46.4   'National Science Experiment: Happy Moments' module for Singapore Views, in collaboration with SUTD

SUTD opted to use Singapore Views as a way to present results of the 'National Science Experiment', an islandwide outdoor science experiment conducted by primary and secondary school students in Singapore (see Figure 46.4). Data points representing spatial and temporal behaviour of those students were displayed on a three-dimensional map of Singapore.

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Repurpose Game Engines for City Design

There has been growing interest by researchers and city makers towards the creation of prototypes and applications for advanced data visualisations, digital twins and VR near-life experiments. The Unity game engine has been used by several research modules at FCL in the development of real-word data visualisation and analysis platforms such as Singapore Views (see Figure 47.1) and ur-scape (see Figure 47.2). In particular, ur-scape, a visual and interactive planning support tool that integrates data at multiple scales to support efforts to make more sustainable and resilient cities and regions has already been adopted in the planning processes of four major cities in Java, Indonesia.