

What Would Cézanne Think?

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Abstract

Motivated by a “microworlds”-style approach to cognitive studies, we prepared for research in spatial cognition by developing a software construction kit based on Kevin Lynch’s “elements of the city image” [Papert 1980, Lynch 1960]. His notion of the “city image” is that of a mental map structured on five basic elements, representations of which become the basis of our design tool. Users create maps by arranging these elements into colorful layouts, thereby establishing particular spatial relationships. The software transforms these maps into series of street-levels views that maintain the topological relationships.

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Abstract: Motivated by a “microworlds”-style approach to cognitive studies, we prepared for research in spatial cognition by developing a software construction kit based on Kevin Lynch’s “elements of the city image” [Papert, Lynch]. His notion of the “city image” is that of a mental map structured on five basic elements, representations of which become the basis of our design tool. Users create maps by arranging these elements into colorful layouts, thereby establishing particular spatial relationships. The software transforms these maps into series of street-levels views that maintain the topological relationships.

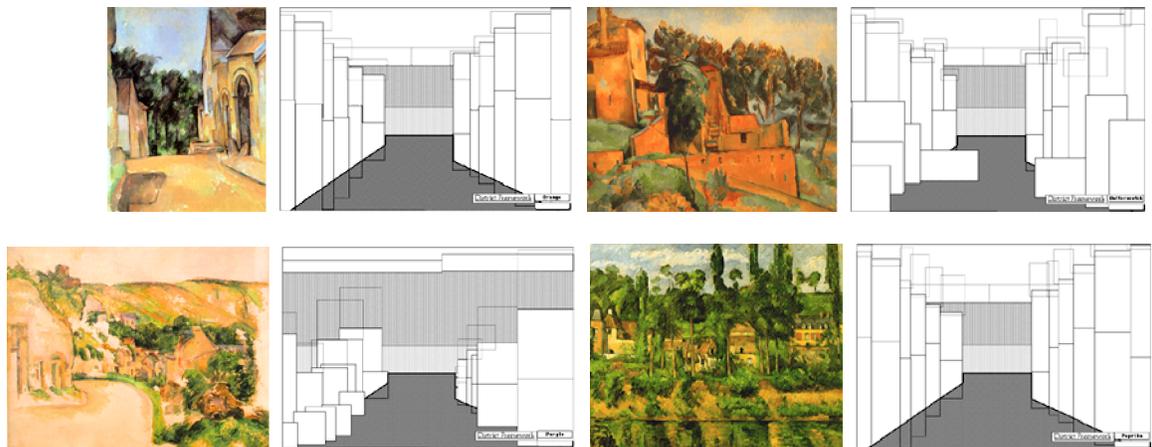
Some colleagues and I recently found ourselves in a funny situation. One reason was that we needed to simulate a virtual environment – that is, we needed to make a representation of a representation. We were prototyping a design tool for users of networked graphical environments, but wanted to avoid the cost of implementing one of these environments. Our interest was in implementing the design tool and working with users to see how it facilitated expression of their concepts of space. In order to demonstrate the tool’s effectiveness, however, we had to illustrate its output. We had to give some sense of the environment it would be designing. So, we constructed a way of automatically generating illustrations to create a sense of a virtual environment that does not really exist. Another reason why our situation became funny is that many people seemed focus on these illustrations more than the tool itself! Here are some examples:



To create such composited images, we segmented scans of paintings by Paul Cézanne:



We segmented the scans by hand, including components such as sky, ground, and building facades and rooftops. These components match parts of a two-dimensional framework that we created for each painting, to delineate a structure of the scene it represents. Each framework constitutes a perspectivist analysis of likely pathways through the scene: side planes recede diagonally and converge at a vanishing point on the horizon, to create an illusion of depth.



¹ *Maisons en Provence – le vallon de Riaux près de l’Estaque*. 1882-83. (v. 397; r. 438), 65 x 81 cm. National Gallery of Art, Washington. Collection of Mr. and Mrs. Paul Mellon.

² *Route tournante à la Roche-Guyon*. 1885. (v. 441; r. 539), 62 x 76 cm. Smith College Museum of Art, Northampton.

³ *Haneau à Payennet près Gardanne* (formerly *La Sainte-Victoire, Environs de Gardanne*). 1885-86. (v. 435; r. 572), 63 x 92 cm. Pres. to U. S. Government in memory of Charles A. Loeser, on loan to National Gallery of Art, Wash.

⁴ *Les Marrioniers du Jas de Bouffan en hiver*. 1885-86. (v. 476; r. 551), 74 x 93 cm. Institute of Arts, Minneapolis: The William Hood Dunwoody Fund.

⁵ *Ferme à Montgeroult*. 1898. (v. 656; r. 833), 64 x 52 cm. Lloyd H. Smith, Houston.

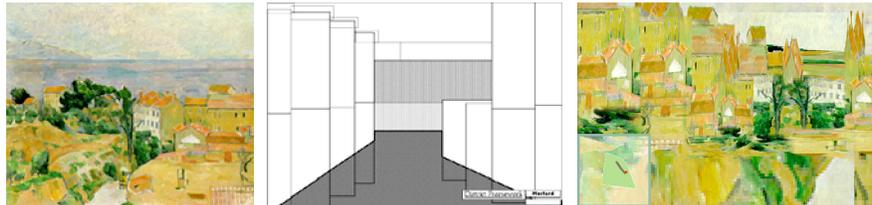
⁶ *Le Moulin sur la Coulevre à Pontoise*. 1881. (v. 324; r. 483), 73 x 91 cm. Nationalgalerie, Berlin.

⁷ *La Maison de Bellevue*. c. 1890. (v. 655; r. 691), 60 x 73 cm. Musée des Beaux-Arts, Geneva.

⁸ *L’Eglise Saint-Pierre à Avon* (formerly *Une rue à Aix*). 1891-92. (r. 327), 47 x 31 cm. Collection Phyllis Lambert on loan to the Centre Canadien d’Architecture, Montreal.

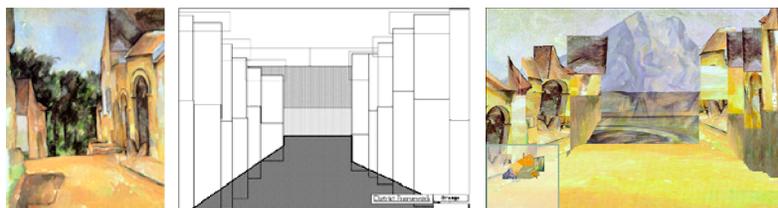
⁹ *Le Château de Médan*. 1879-80. (v. 325; r. 437), 59 x 72 cm. Glasgow Museums: The Burrell Collection.

For example, the painting below (at left) portrays a scene that is hilly and asymmetrical. The framework (at center) reflects these characteristics with a relatively high ground plane, relatively high bases, and varying treatments of the side panels in the left and right halves of the scene. Imagery segmented from the painting fills appropriate parts of the framework to produce a composited illustration (at right).



This framework effects shifts of scale and view as it anticipates a street-level scene. Because this particular painting depicts a nearly aerial view, its segmented imagery tends to yield an overview of the township in the composited scenes. However, this overview is still more of a close-up than the view depicted in the painting. In the cases of other paintings, the composited scenes are more pronounced as street-level views.

Below, for example, the original painting depicts a street-level view, so the framework is a more direct analysis of the scene, and the composited images form whimsical views that one could imagine seeing if walking along a path through the depicted village.



Such composited scenes reflect characteristics of the framework variably, by fluctuating the numbers and measures of the side panels and other components. These variations are contained within parameters that we specified to establish a consistent character of the scenes' structure.

The software displays series of composited views to illustrate pathways through the environment. These pathways are established by the user, who represents them through construction of a map. Like frames in an animation, the numerous views simulate a stroll through the mapped environment. There is no 3D model; the views are simply 2D illustrations of scenes along the pathways. Likewise, there is no model of a camera; the user indicates a direction along a chosen path, thus providing the viewpoint [c.f. Horry et

al.]. We have developed Cézannesque imagery, but scans of any 2D images could become the basis of image segments and frameworks for use with the software.

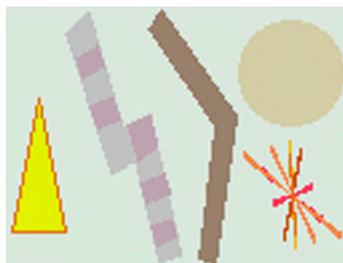


As it assembles each view, the software simultaneously displays a miniature version of the map, so that users can orient themselves according to the layout they have created. The map indicates each view's location along a chosen path in the virtual domain.

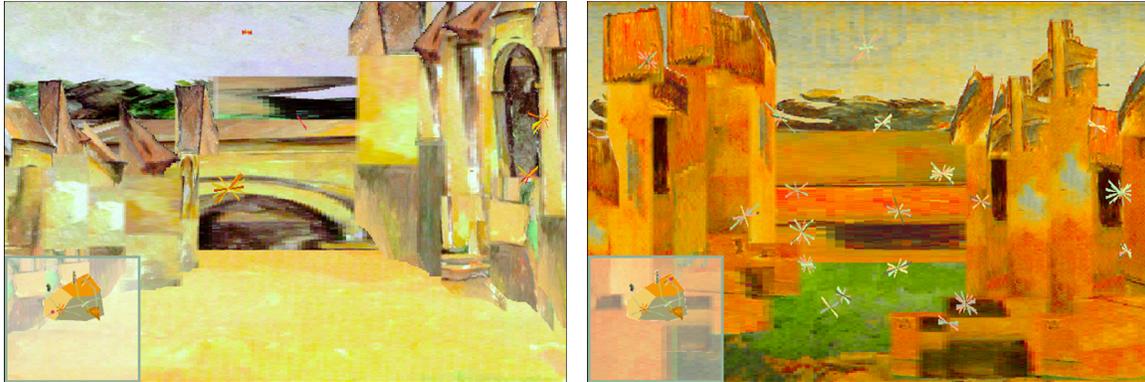
Users construct the maps within another display, which includes a menu area containing map elements and function buttons, a work area in which elements can be manipulated, and the miniature version of the map, which reflects changes as the construction grows.



Lynch's five elements – landmarks, paths, edges, districts, and nodes – are represented by geometric symbols.



The user can specify attributes for these elements, which appear in both the map and the street-level views. For example, a landmark may be represented by a tree, tower, or bridge rather than the generic triangle. Paths can take on different earthy colors; edges may be mountains, walls, or the like; districts appear in colors associated with the various Cézanne paintings; and starbursts denote flavors of activity in the nodes. At any time, the user can click the miniature map to trigger the software's construction of composited views through the mapped domain.



A red dot on the miniature map indicates the viewer's position along a pathway. As the dot progresses from view to view within a given district, the software varies the associated framework and fills it with image segments excerpted from the associated painting. When the dot enters a new district, the software gets that district's associated framework, fills it with image segments from the corresponding painting, and continues to vary and fill the framework until the dot enters yet another new district.

At any time, the user can click the miniature map to return to the construction screen and modify the representation. Clicking the map again triggers construction of new views through the designed domain.

The composited scenes effect shifts of view, scale, and representation, but maintain the topological relationships among elements of the cityscape. The simultaneous display of composited scenes and the miniature map helps users to consider discrepancies between what they expected and what they see. Discussion of these discrepancies can reveal aspects of their thinking about the place they have designed or represented, and about space in general. Comparison of these data with data from studies of understandings of smaller-scale environments can further enrich our knowledge of how people experience and think about space [Strohecker et al.].

Acknowledgments

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