

A VISUAL ART INTERFACE TO MULTI-TEMPORAL MAPS

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KEY WORDS: art, interactivity, multi-temporal maps, kea, habitat extent

ABSTRACT:

The role of art in relation to maps is being reappraised on the basis of a perceived ability to depict aspects of a place that maps alone cannot. Many as opposed to one perspective on a place communicates more fully the essence of that place (with art as a valuable source of qualitative geospatial data) and so maps and art should be presented in the same visualization package. This paper outlines the development and implementation of an interface where a scanned painting forms the mode of access to multi-temporal maps. The interface is used to represent the history and habitat extent of the kea (alpine parrot) in New Zealand from pre human colonization times through to their present, limited range to a speculation on their future habitat. The painting and the map (in what has been termed in the literature as an anti-map / map combination) are in their own separate layers and joined by an interactive link. The interface harnesses the ability of visual art to aggregate multiple themes, locations and times into a single cohesive image. The ability to contain many temporal instances is close to the comic strip frame (and instances of Renaissance art) in particular, with, in this case, an implicit time frame from left to right on the painting. The use of an artistic image minimizes use of text to depict events, due to the visual and narrative power of the painting.

1. INTRODUCTION

This paper describes the rationale and construction of a visual art object (a scanned painting) as an interface to multi-temporal maps. Having been a major yet decorative component in early maps and atlases (Casey, 2005), art has long been ignored as a means to convey the essence of location or the geographic phenomenon being mapped. The science-led map has been the norm for the last few hundred years, but recent years has brought a growing recognition of the potential power of art to provide an alternative perspective on the world that maps alone cannot (Caquard and Taylor, 2005; Cartwright et al, 2009).

Krygier (1995) explores the relationship of art and science in cartography in depth, considering three relationships concerning the two approaches that had emerged. The first echoes the manifesto of the science-only cartographic trend, a dualism in which one cannot exist with the other. The second relationship is that art and science can co-exist in cartography, but are fundamentally different (e.g. one view is that science is progressive; art is somewhat permanent) and perform different roles (e.g. science uses art and aesthetics as a tool, a means to an end, while art has aesthetics as an aim, and the art object is an end in and of itself; Caquard and Taylor [2005] also stress aesthetics as the fundamental link between art and science). The third relationship is one that applies to the current situation, that in light of developments in the last 20 years (GIS, geovisualisation, critical cartography), attempts should not be made to understand cartography in terms of art and/or science. From a sequential (comic) art point of view,

McCloud (2000) supports the multiple perspective approach: “the best way to understand the nature of our environment is to return to it from as many vantage points as possible...” (p.19).

Into this mould Caquard and Taylor (2005) suggest three ways in which the combination of cartography and art could be effected. Firstly, the artistic is linked with the conventional map (“anti-map / map”). Secondly, the methods and techniques of artists are integrated into conventional maps. Thirdly, the artist develops their own vision in relation to the conventional map.

The research put forward in this paper, like Caquard and Taylor’s proposed direction, is of the first kind. The art object, the anti-map, is kept in a separate “layer” from the maps, which lie underneath it. The maps are accessed through interactions with the scanned art object; in this way the art object is an elegant interface to the mapped information.

The history of the kea parrot in New Zealand has been chosen as the theme for this series of maps and the linked painting for a number of reasons. First and foremost, the bringing in of art to help cartography would lend an aesthetic hand to create a compelling interface that would increase the profile of this endangered bird. Also, the existence of historical data and research provides a rich timeline for habitat maps of the kea. The requirement for a multi-temporal dataset was paramount, as visual art (including sequential or comic art) has the ability to integrate time, space and themes cohesively, and in subtle

ways. Exploiting this property would be a good strategy to fully explore the common ground between art and maps.

The next section will give a short background to the kea, including its history and current status. This is to help interpret the painting and to gain a context for it and the maps. The painting, maps and the construction of the interface is described in Section 3. Section 4 forms an account of how the painting complements the map and vice versa, arranged along space and time themes, both literal and metaphorical, and referring to examples from the history of art. Finally, the paper will be rounded off with a conclusion.

2. BACKGROUND (TO THE KEA)

The kea (*nestor notabilis*) is a species of parrot endemic to the South Island of New Zealand. Their habitat stretches from alpine areas (i.e. the Southern Alps that extend along the major axis of the South Island) down to lowland river valleys (they have been spotted at less than 100 metres above sea level) and they favour the southern beech forests (*nothofagus*), where they also nest (Holdaway, 1993).

The kea's evolutionary ancestor is the "proto-kaka", which may have lived as long as 15 million years ago, during the Miocene epoch, when New Zealand was one large island (Figure 2). At some time early on in the Pleistocene glaciation (2 million years BP), during one of the interglacials, the proto-kaka is thought to have diverged into the kaka parrot and kea species, occupying the North and South islands respectively. Since, the kea has been joined on the South Island by the kaka, where they co-exist, the kea adapting to the alpine areas and finding its niche there (Diamond and Bond, 1999).

The kea is currently an endangered species, with over 150,000 birds killed in the 100 years before 1970, at which time their population was estimated at about 5000. Factors involved in this decline include hunting (also up until 1970 there was a bounty on kea as they were linked to attacks on sheep), the introduction of ferrets, stoats, weasels and possums (Elliot and Kemp, 2004), and the decrease in area of the beech forest habitat (through timber harvesting, the coupled difficulty in (re)occupying suitable environments, exacerbated by the action of possums) (Leathwick, 1998; Peltzer et al, 2005). The kea is now fully protected, though at risk of extinction (Elliot and Kemp, 2004).

3. CONSTRUCTION DETAILS

3.1 The Painting

A watercolour painting on paper was made that captured the history of the kea and its evolutionary descendants (Figure 1). The time of the Miocene epoch proto-kaka is depicted in the left half of the painting. The three proto-kaka hover in the background while the giant eagle-like bird hunts the two flightless moa. This bird is an evolutionary ancestor of Haast's eagle, which up until its

extinction nearly 1000 years ago was probably the largest predatory bird in the world. The proto-kaka await their chance to scavenge the remains of the eagle's meal, a common arrangement (Diamond and Bond, 1999). Later on, the Pleistocene epoch marks the initial sundering of that species into kaka and kea groups (kaka north of the Manawatu channel, kea to the south of it). The kea as depicted here (in the foreground of the painting) is representative of the time period before New Zealand was colonised by humans (some 700 years ago). By this time the kea had learnt to hunt sea bird chicks by digging them out of their burrows. The right half of the painting depicts the kea's fate post-colonisation, with a Polynesian canoe on the shore, the introduction of many predators, including rodents, dogs, cats, possums and ferrets. As a result, the number of kea declined, exacerbated by massive deforestation and hunting (signified in the painting by the hunter and human settlement). The current situation is visually described by the hovering bird over the peninsula on the right, symbolising both the reduced number of kea and their restricted habitat area.

This painting was scanned and inserted as the basis of an art-map interface built in Microsoft Expression Blend, a Flash-like tool for the construction of interactive demonstration interfaces.

3.2 The Maps

The maps were mostly derived from scanned depictions of previous New Zealand coastlines and kea habitats from the local zoological and geological literature with the exception of the future prediction map. Table 1 lists these maps and their sources.

Time	Description	Source
Miocene epoch (15 million years BP)	'Proto-kaka'	Fleming, 1979
Pleistocene epoch (2 million years BP)	'Proto-kaka' separates, to evolve into kea and kaka	Fleming, 1979
Early 20 th century (1908)	Point sightings of kea	Marriner, 1908
Late 20 th Century (1991)	Point sightings of kea	Wakelin, 1991
Future	Native forest and area above 100m as a suggestion of future kea habitat	LINZ Topo data

Table 1. The five maps, descriptions and sources.

The four initial maps were digitized in ESRI ArcGIS and exported as bitmaps to be accessed via the kea painting in the hybrid interface. The Miocene and Pleistocene maps already had kea habitat extent represented but the subsequent 20th Century maps were mapped point sightings of kea, so they were aggregated into 90% kernel density polygons, to make their spatial data types consistent. The future kea map is based on the fact that they prefer beech

forest habitat and high ground. The current native forest habitat (derived from LINZ Topo data) was therefore deemed to be indicative of future kea habitat in a speculative sense and is represented in black. High ground is represented in grey, and is the area enclosed by the 100 metre contour (also derived from LINZ topo data). The lowest recorded altitude for a kea sighting is at around this level (Holdaway, 1993). The series of maps is shown in Figure 2.

The exported maps were sized to a consistent spatial scale and placed throughout the scanned painting according to the position in the kea timeline that they represented. For example, the Miocene map was placed in the left of the

painting and the 20th Century maps were placed in the right half of the painting. The maps were also placed so as to not interfere with the main painting elements.

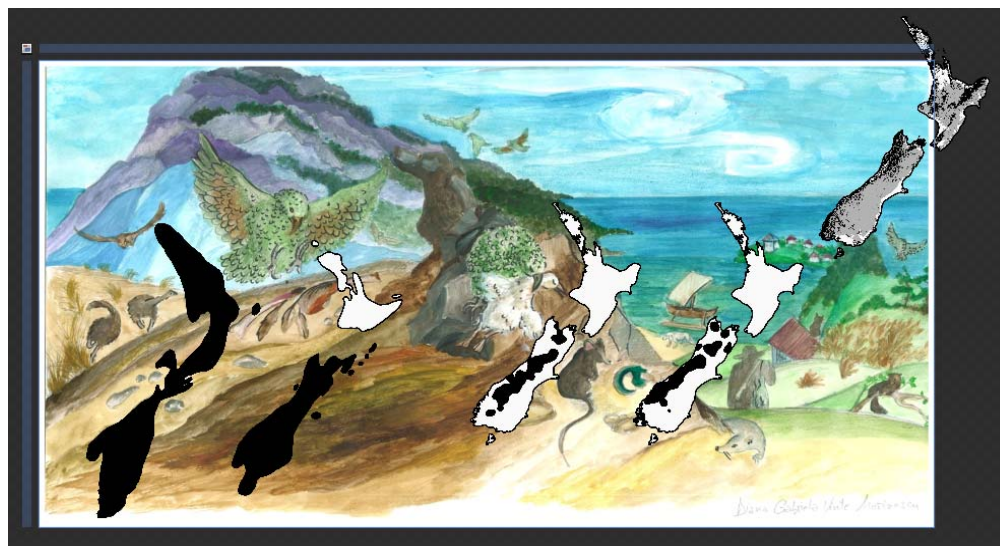
In the interface, these maps were initially hidden (all that is seen is the painting), but appear when the user of the interface passes the cursor (position of the mouse) over where the map is hidden. The map disappears when the cursor leaves the area of the map. The maps are shown in Figure 3, superimposed on the painting.



Figure 1. The history of the kea, watercolour on paper (Diana Marinescu). See text for description.



Figure 2. The five maps depicting kea range in the Miocene, Pleistocene, early 20th Century, Late 20th Century and Future speculation.



TIMELINE: 15 million years > 2 million years >>>> early 20th Century > late 20th Century >>>>>>> Future

Figure 3. View of the interface: scanned painting with the five maps superimposed

4. EXPLANATION

The key idea being demonstrated with this interface is that the painting itself forms the sole interface to the mapped content, and therefore the only entry point into

spatiotemporal interactivity. On an aesthetic level though, a decision was made to make the painting the default setting, so that it could assume the role of an art object. This is the reason behind making the maps intermittent – if the mouse is not over the map area, then the map is not shown, leaving

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November 15-19, 2010 Orlando, Florida

the full painting showing underneath. Furthermore, the visual and narrative power of an artistic image minimizes the need for other media such as text to depict events.

4.1 The Multi-temporal Nature of Art

The painting is a seamless integrator of objects and activities occurring at many different times and locations. There are examples from Renaissance art of the painting's ability to do this, for example Raphael's Liberation of St. Peter (Figure 4), a single painting encompassing a number of scenes detailing St. Peter's rescuing from a Roman prison by an angel. Also, turning to comic or sequential art (Eisner, 1985) many times can be represented in the same panel to promote narrative flow (McCloud, 1993), which the comic artist can choose to break up through subpanelling (Figure 5). It can be seen that time and space as represented in the kea painting and the classic / comic art examples does not correspond in any accurate or precise way to time and space as measured in the real world and as represented on 'scientific' maps.



Figure 4. *The Liberation of St. Peter* by Raphael
http://mv.vatican.va/3_EN/pages/x-Schede/SDRs/SDRs_02_02_013.html

4.2 Timelines and Flow in Paintings

However, what is promoted is a topology of time that maintains events in the correct order, read from left to right like a true unidirectional timeline (Raper, 2000), even if the intervals have little measurable temporal meaning. Having said this, some attempt has been made to convey the gulf of time from a human perspective (i.e. relative to recorded history) between the Pleistocene map and the 20th Century maps. Also to reflect the differing nature of the map sources, offsets have been made to the classic straight-line nature of the timeline, to reflect the difference between data from modeled conjecture (Miocene, Pleistocene), collected data by observation (the 20th Century maps) and a marked offset to represent the otherness of the speculative map. The left to right nature of the timeline has been maintained throughout (refer back to Figure 3), therefore the painting is an intuitive representation of time.

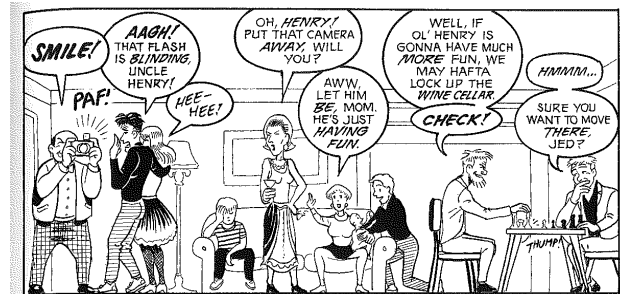


Figure 5. How a comic strip panel represents different times in the same frame. The man on the left taking the photograph causes reactions that must have happened at later times as you move across the panel (from McCloud, 1993).

To further reinforce motion through time, the future map has been deliberately cut off at the edge of the interface display. The intention is to lead the interface user off the display, continuing the timeline implicitly. This is an idea borrowed from the Toulouse-Lautrec lithograph in Figure 6 (Le Jockey). The two racing horses in the painting have been deliberately cut by the frame to suggest that they are entering the frame, in turn suggesting motion. Whereas the painting (actually flipped across the y-axis) is edited to place the horses and their jockeys at the start of the timeline suggested by the display frame, the cutting of the future map occurs at the other end of the timeline suggested by the interface display.

As mentioned before, although not consistently employed, time is also suggested by depth in the painting. Despite the size of the kea subspace being linked mostly to kea abundance, there is an arc that starts off far away in the Miocene, comes to the foreground in the Pleistocene and early 20th Century, starting to recede in the late 20th Century, with the future speculation map firmly situated over the background sea.

This is reinforced by the role of the sea as a metaphor for the future. This is used to good effect in Friedrich's painting, the Stages of Life (Figure 7). In the painting there are five figures on the shore, Friedrich as an old man, his nephew and three of his children. Corresponding with the human figures are five ships moving away from shore. Based on this understanding, a future reading can be made by distance of the ships over the sea: Friedrich's own ship is in the misty distance, while the two children's ships have just begun their journey in the foreground (Isham, 2004). Therefore there is an implicit timeline into the painting and it is this metaphor of future time that is borrowed for the art map interface.



Figure 6. *Le Jockey* by Henri de Toulouse-Lautrec, 1899. (http://www.britishmuseum.org/explore/highlights/highlight_objects/pd/h/henri_de_toulouse-lautrec_le.aspx)



Figure 7. *The Stages of Life* by Caspar David Friedrich, 1834. (<http://www.mdbk.de/start.php4?id=12&sid=128>)

Finally, sticking with the subject of metaphor, the interface uses a visual metaphor of time rendered as space. In fact, all of the borrowings from visual art outlined so far are based on this: the comic strip-like mapping of episodic

narrative exemplified by Raphael, the motion into the painting frame of the horses suggested by Toulouse-Lautrec and Friedrich's timeline of life from sea to shore. The use of space as a metaphor for time is typical, used commonly in language (e.g. "It is getting close to Christmas") as well as visually (Lakoff and Johnson, 2003).

4.3 Representing Geography in Art

The representation of geography in the painting is limited to generic pictorial suggestions of the kinds of places that feature in the kea's history, while not trying to depict somewhere specific. Hence, the rugged hill country and beech forest that is the kea's main habitat and the suggestion of human occupation through depiction of fixed shelters. It has been mentioned that the finger of land to the right symbolizes the kea's current restricted range. The sea is there to suggest the mode of arrival of the human settlers, but also has a role rendered through art as a temporal metaphor which will be elaborated upon later.

The elements in the painting that suggest place and the passage of time are populated with an array of actors and props. The main actors are the keas themselves at various stages in their evolution, along with their prey. Some attempt has been made to depict their size proportional to their abundance (as a loosely applied proportional symbol in cartographic terms), though in the passage from the Miocene to the Pleistocene this has been replaced by a more distant Miocene scene to suggest distant time, even though proto-kea were most abundant then. This could be justified by the fact that proto-kea are not kea, but another species: the need for a consistent symbolization according to size is lessened, in this particular time interval.

The arrival of humans to New Zealand is suggested by the hunter in the right half of the painting and introduced species, such as rodents and dogs. The means of immigration is also represented, a Polynesian canoe, or waka, the presence of which on the sea reinforces the maritime mode of travel of the first settlers.

5. CONCLUSION

This paper has described an interface that uses a scanned painting to access maps depicting the habitat loss of the kea parrot in New Zealand. The painting has the ability to integrate concepts of space, time and multiple themes in complex yet parsimonious ways, an unusual way of accessing spatiotemporal maps.

The research reported here has been an exploration of ideas that explore this property. The painting has been created as a reaction to the history and current status of the kea but it is only one realization of this. Other plausible visual ideas that could have been used include the use of a river to support the notion of the timeline. Thus river flow is a metaphor for time flow as well as being representative of the forested river valleys that the kea favour. Introduction of other elements that reinforce notions of place may include a glacier to explicitly signify the Pleistocene Ice

Age. Turning to cartographic ideas, there could be the use of perspective projection to emphasise the South Island, the kea's current home. There could also be more consistent use of kea in the painting as a loose proportional symbol to represent abundance over time.

These suggestions imply differing amounts of input from artist and cartographer and throws open related questions such as: is it right to compromise artwork to meet some cartographic aim? Conversely, should the challenge of making maps be as a reaction to the artwork and have to fit around the artwork? This particular collaboration was a bit of both, agreeing on the approximate content of both painting and maps a priori, without explicitly defining the form of either (let alone in tandem).

Other areas that need exploring include:

- Investigating the ways in which the user can move between painting and map(s). A couple of ideas include having a subsection of the painting morph into a map element as the result of some stimulus; alternatively displaying the map as an impression, appearing to crease the digitized painting from beneath
- Looking to methods artists have used to communicate ideas in the past through their paintings. Ideas from three paintings and comic art have featured in this paper but there is a huge resource (the whole of art history) to choose from.
- investigation of whether a work of art could be the basis for more general purpose interfaces. What would a fully fledged GIS art interface look like? Could your spatial data be represented as a painting and you pick on the appropriate part to select the database element you want?

It may be worth expanding on that last point a little, given the current and increasing emphasis on qualitative GIS. Along with interview data, sketch mapping and photography, drawings (this could be expanded to include paintings) are regarded as valuable sources of qualitative geospatial data (Jung, 2009). As an attempt to growing trend amongst geographers to conduct mixed methods (i.e. qualitative and quantitative) research, Jung adapted the conventional GIS structure to devise the "imagined grid". This is simply a matrix of large format grid cells superimposed on quantitative GIS data that are capable of displaying everyday photographs of the area that they are displayed over. It is a way of seamlessly integrating qualitative media (and has the potential to include works of art) into standard GIS structures. An initiative of this kind, like the art-map featured in this paper, would fit into Krygier's (1995) third category, as outlined in the introduction.

This approach shows great potential as a way of communicating complex spatiotemporal ideas at an intuitive level. This would make it a particularly effective display to use in education, whether educating children or the public on some issue of importance.

REFERENCES:

Caquard, S and Taylor, D R F. 2005. Art, Maps and Cybercartography: Stimulating Reflexivity among Map-Users. In D R F Taylor (ed.) *Cybercartography: Theory and Practice*. Amsterdam, Elsevier, 285-307.

Cartwright, W, Gartner, G and Lehn, A. (eds.) 2009. *Cartography and Art*. Berlin, Springer.

Casey, E S. 2005. *Earth-Mapping: Artists Reshaping Landscape*. Minnesota, University of Minnesota Press.

Diamond, J and Bond, A. B. 1999. *Kea, Bird of Paradox: The Evolution and Behaviour of a New Zealand Parrot*. Berkeley: University of California Press.

Eisner, W. 1985. *Comics and Sequential Art*. Tamarac, FL, Poorhouse Press.

Elliot, G and Kemp, J. 2004. *Effect of hunting and predation on kea, and a method of monitoring kea populations: Results of kea research on the St.Arnaud Range*. DOC Science Internal Series 181, Department of Conservation: Wellington.

Fleming, C.A. 1979. *The Geological History of New Zealand and its Life*. Auckland: Auckland University Press.

Holdaway, R.N. 1993. First North Island fossil record of Kea, and morphological and morphometric comparison of Kea and Kaka. *Notornis* 40(2): 95-108.

Isham, H. 2004. *Image of the Sea: Oceanic Consciousness in the Romantic Century*. New York: Peter Lang.

Jung, J-K. 2009. Computer-Aided Qualitative GIS: A software-level integration of qualitative research and GIS. In: M Cope and S Elwood (eds.) *Qualitative GIS – A Mixed Methods Approach*. Sage: Los Angeles, p.115-135.

Krygier, J B. 1995. Cartography as an art and a science? *Cartographic Journal*, 32, 1, 3-10.

Lakoff, G and Johnson, M. 2003. *Metaphors We Live By*, 2nd ed. University of Chicago Press, Chicago.

Leathwick, J.R. 1998. Are New Zealand's Nothofagus species in equilibrium with their environment? *Journal of Vegetation Science*, 9, 5, 719-732.

McCloud, S. 1993. *Understanding Comics*. New York, Harper Collins.

McCloud, S. 2000. *Reinventing Comics*. New York, Harper Collins.

Marriner, G. R. 1908. *The Kea: A New Zealand Problem*. Marriner Bros. and Co: Christchurch.

Peltzer, D.A., Allen, R.B. and Rogers, G.M. 2005. *Dieback and recruitment of the forest dominants Nothofagus fusca*

and Libocedrus bidwilli, central North Island, New Zealand. Science for Conservation 255, Department of Conservation: Wellington.

Raper, J.F. 2000. *Multidimensional Geographic Information Science.* Taylor and Francis: London.

Wakelin, M.D. 1991. *Analysis and Review of National Kea and Kaka Databases.* Science and Research Internal Report No.99. Department of Conservation: Wellington.