Abstract
On the basis of shared emphasis on time as well as space, this paper argues for introducing principles of comic art into cartography, specifically maps depicting sequences of episodes, or snapshots. This is placed within the current initiatives relating to cartography and art, given that comics are a type of sequential art. Examples demonstrating the expressiveness of comic art principles when applied to maps (maps as comics) include a timeslice sequence of sea level rise as well as a space-time composite military map as comic strips. Furthermore, an attempt to embed the comic strip in the map is made. In this case the map is a 3D time geography cube with plotted comic strips for lifelines (comics as maps).

Introduction – Map Snapshots and Comic Art
This paper presents an argument for the use of comic design in cartography to create maps that are more expressive, specifically in representing the time dimension. Dylan Horrocks, an established comic artist, called for an exploration of “…connections between comics and … cartography” (Horrocks 2001; p.6). There is appreciable overlap between comic or cartoon principles and cartographic ones. Caricature has been linked to generalization (Jones, 1997), briefly explored in a comics context (Moore, 2004). Also, the GIS conceptualization of the snapshot, as appropriated by cartography, is conceptually close to frames in a comic strip (“maps as comics”). Furthermore, opportunities afforded by computing, such as interactivity with a map representation, can facilitate the embedding of comic strips in map contexts (“comics as maps”). These all signify that comic art has much to offer cartography. However, cartography should first be placed in the context of art as a whole.

Cartography and Art
Art was once a major part of any map or atlas produced, albeit a “decorative component” (Casey, 2005; see Potter 1999 for examples). The prevailing trend now is for science-led maps, with art an afterthought if present at all (Cartwright et al, 2008). Art has diverged from cartography to an even greater extent, from impressionism onwards, becoming more abstracted (Casey, 2005). However, there is a current reappraisal of the place of art in cartography (a conference on Cartography and Art was run in early 2008; a book was
published in early 2009; Cartwright et al, 2009), with art able to offer an alternative perspective on the world that maps alone cannot (Caquard and Taylor, 2005; Priestnall and Hampson, 2008; Cartwright et al, 2008). Krygier (1995) has argued against an art / science dualism, meaning that both art-led and scientific approaches to cartography can co-exist functionally in this way. This is echoed by comic artist Scott McCloud: “The best way to understand the nature of our environment is to return to it from as many vantage points as possible – triangulating its shape from without” (McCloud, 2000, p.19).

Caquard and Taylor (2005) in particular stress the inherent subjectivity of all maps (it is only an “image of space”) and aesthetics as the “powerful and often unacknowledged link between art and science” (p.287) as they argue for multiple viewpoints on our world. They suggest three ways in which the combination of cartography and art could be effected:

- Linking the artistic with the conventional map (“anti-map / map”). Through the suggested use of interactivity and animation this is the authors’ proposed direction.
- Integrating the methods and techniques of artists into conventional maps. This is the approach put forward in this paper using the practice of comic book artists.
- The artist develops their own vision in relation to the conventional map. For example, Caquard and Taylor cite Guy Debord’s artwork “The Naked City”, a fragmented map of only those parts of geographical space actually experienced by a person. Priestnall and Hampson (2008) presented an artwork that captured the essence of landscape and data relating to it, created in support of the typical map.

Comics and Art
McCloud (1993) defines comics as “juxtaposed pictorial and other images in deliberate sequence, intended to convey information and / or to produce an aesthetic response in the viewer” (p.9). The similar term cartoon is used by him to describe standalone panels but Eisner (1985) and Wolk (2007) link cartooning with simpler comic forms (i.e they can be single or multiframe) that are based on “distortion and symbolic abstraction” as opposed to “represent[ing] real-world beings and objects” (Wolk, 2007). The conventional view of comics as shallow and plot-driven entities has been challenged since the late 1980s with publication of sophisticated “graphic novels”, complete with subtext (McCloud, 2000), and as a result the medium is gaining increased acceptance and respect. Will Eisner (1985) was the first to argue for comics as an art form (“sequential art”) and as literature (McCloud, 1993). In the past, the comic’s accessibility has contributed to negative attitudes towards it, including negation of its right to be considered as an art and as a medium. But the very same accessibility and the comic’s ability to communicate ideas (McCloud, 2000) is what makes it so potentially powerful for cartography.
Justification for a hybrid map-comic

The scheme of integrated words and pictures so typified by comics is exactly what Tufte (2001) employs in his seminal book (“words and pictures belong together” p.180). Regarding comics as Sequential Art, the medium is rich for expressively revealing aspects of the geographical world that conventional maps do not, the central impetus for Cartography and Art. A map as a comic would be an example of a non-fiction comic, which “…examine[s] a subject directly without the pretense of a story” (McCloud, 2000), though some kind of narrative may factor into it (e.g. Monmonier, 1991). Eisner (1985) emphasized the advantage that non-fiction (instructional) comics have over “rigid” photographs – this is the license to exaggerate to more quickly make the point. Maps also enjoy this freedom, exaggeration being one a process of map generalization (Jones, 1997).

Recently, maps have featured as major themes in comics, but as a metaphor. This is part of an approach that Horrocks (2004) describes as world-building, where the emphasis of the comic (he also cites examples from other arts that do the same) is not on narrative and time, but on place and space, for exploration. Horrocks’ interest in maps as well as comics is expressed in the Atlas comic book (Horrocks, 2008), where the main character is both a cartoonist and cartographer. Van Swaaij and Klare (2000) perform world-building to good effect in a literal cartographic sense in the Atlas of Experience, which contains maps that communicates aspects of a typical life. Comics also use geographic representations, but as a device to drive a story. For example, in McCloud’s book (2000), a map of Europe was used as a metaphor for European comic makers (Figure 1a). From a cartographic point of view, maps can use comic-like techniques for a more expressive effect; these are relatively common, particularly in tourist applications (Figure 1b).

Figure 1: a) McCloud’s use of a European map as a metaphor for European comics (2000); b) tourist map of Jasper, Canada, using comic-like embellishment

Comics or cartoons have already been investigated in other academic contexts, including in the geography classroom (Kleeman, 2006). Other applications gauge their effectiveness as a means of communication in the workplace (Ginman and Ungern-Sternberg, 2003),

teaching physics principles (Bennett, 1998) and as a source of data on social issues (e.g. in measuring public attitude they can be more reliable than polls – Giarelli & Tulman, 2003).

Due to their shared visual emphasis, art is the most similar medium to comics, as implied in the last section. However, it has also been linked to cinema, not only for its visual qualities but also for its treatment of narrative, though Eisner (1985) asserted that comic frames “…do not correspond exactly to cinematic frames … [they are] part of the creative process, rather than a result of the technology” (p.38). Monmonier (1991) has already appropriated the language of the theatre (the cartographer as playwright or screenwriter writing “stage plays” employing variables as “characters”, signified by hue, and dramatic pacing) for authoring graphic scripts. He uses a narration metaphor in a “how to …” script for analyzing historical trends relating to spatiotemporal change in a single variable. In the short graphic sequences produced, supporting text is an essential component; this mix of graphics and words is comic-like. Like comics, there is also an imperative to hold the user’s attention. Caquard and Wright (2009) argue for drawing from self-reflexive instances in cinema – i.e. where the narrative flow of the film has been broken intentionally through devices such as addressing the audience directly or laying bare the film-making process – in the cartographic process. In addition to the suggested methods of achieving this (e.g. montage, sound) the comic medium would be a good vehicle to achieve self-reflexivity by involving both the map and its maker in the display. Moreover, the comic shares the dramatic arts’ ability to convey tension through its visual language, as exemplified in Figure 2. The next section explores the potential of comics in such a spatio-temporal episodic scenario with a discussion of the map snapshot.

Snapshots and sequential art
In an extension to his definition of comics McCloud (2000) described the art form as “the artist’s map of time itself” (p.206). To move across the comic “map” across the frames of a strip is to move in time. So it would be with geographic snapshots if they were arranged on the printed page comic-style. Snapshots (or timeslices) are separate layers representing the same variable at different times when defined in a GIS context (Langran, 1992). There is a key difference between the snapshot as represented by the comic frame and the snapshot that is an episode of geographic data represented as a layer, map or in this context, a frame. The comic snapshot is carefully chosen and arranged and the geographic snapshot occurs wherever the data happens to be, which is not often the optimal time in the time line narrative of whatever attribute is being depicted. Figure 2 is an example series of snapshots of changing elevation and bathymetry over the last 10,000 years in NW Europe, as reproduced in the LOIS Overview CD-ROM (Land Ocean Interaction Study, 2000).
Don’t miss the concluding part of this epic saga!!

Figure 2: Spatiotemporal snapshots as a comic strip. This sequence expressively uses panels and text, meta-panels and closure to depict sea level rise in a stimulating way, introducing dramatic tension. Data from Land-Ocean Interaction Study (2000)
No attempt has been made to render each frame as a purpose-designed map as the action of the comic frame sequence itself will be demonstrated. This is a time sequence where most of the “action” is happening from 10,000 to 7,000 years before present (the second episode is not promising!). Furthermore, an extra frame has been inserted (regarding the typical frame rate of every 1000 years) around the time of most rapid coastline change (and the time when Great Britain became an island with sea level rise), 7,500 years before present. This is to maximize interest in the sequence, by prolonging the event that is the most interesting. However, true comic style would end the episode on a cliffhanger (probably at around 8,000 years b.p.). As it is, the use of exclamatory language has been used to inject a bit of excitement into the proceedings. As for strategies to enliven the frame sequence where the coastline moves relatively little, a change of scale may be needed, with a little comic frame inset (not obscuring any area where significant change is occurring; therefore spatial closure would be in play) representing a zoomed in area. Its place within the larger frame, which remains constant, is similar to Eisner’s use of meta-panels (1985). These strategies use the visual language of comics, all serving to heighten dramatic tension in what would otherwise be a rather dry sequence of maps.

A key concept with comic snapshots is use of the gutter (the gap between snapshots) and its employment of temporal closure. In comics the gutter is often used to spark the reader’s imagination so that the two panels it separates merge to form a single idea, promoting temporal flow (McCloud, 1993). For example, in a soccer sequence the first panel could depict a striker poised to kick for goal with the ball at his feet, the second panel may show the crowd going wild with jubilation. The goal itself is not shown but is inferred from the two panels, freeing the reader to imagine how it might have looked, and in so doing giving them a more involving role in the reading of the comic. When data is depicted as a series of geospatial snapshots you could argue that a form of temporal closure is happening on the part of the map viewer, otherwise the sense of a continuous timeline could not be established. Closure is essential if, as is often the case, salient events are not recorded in the data sampling regime. For example, it would be a coincidence if a remotely sensed image with its regular but relatively infrequent return time captured a volcano at the time of eruption. It is more likely that a ‘before’ and ‘after’ image may be the snapshots afforded and that temporal closure would have to occur to imagine the eruption itself. Recognizing the purpose of a gutter in a series of map snapshots, the cartographer can craft the existing panels to emphasize what is known to have happened but hasn’t been captured by raw geospatial data. For example using exaggeration or a zoomed in frame (as in Figure 2) can highlight the specific region that will be / has been the focus of activity.
This emphasizes a difference in the primary purpose of comics and the primary purpose of snapshots as displayed sequential maps or images. Unlike comics (which may entertain the idea), it would be inconceivable to relegate an image of a volcanic eruption as it happened to the “gutter” if it existed as part of the snapshot timeline. If it has been captured it needs to be there as part of scientific record. By way of highlighting another difference of purpose, Wolk (2007) stated that comics should be fun; while maps cannot always embrace this with the same abandon, principles of comic art can be used to make the most unpromising map topic interesting, at the very least, as has been attempted here. Conversely, this drive for maps-as-entertainment should not ignore the comic’s potential ability, as a form of art, to challenge, provoke and form an aesthetic experience in itself.

Both temporal and spatial closure is employed here. Spatial closure is used in comics too, in displaying a small portion of a scene to convey mystery and again to involve the reader in imagining the part of the scene that is not seen. Alternatively, a scenario that combines both temporal and spatial closure is the multi gutter solution to a single complex comic frame in which a lot happens, ostensibly at the same time. In fact the events in the frame may unfold over an extended amount of time, and if those events occur in a timeline from left to right then breaking up the single frame into many would reinforce the communication of time passing (McCloud, 1993). Certain types of flow map (a combination of space and time information on the same map) would seem to be the most likely match with this strategy, but only if flow lines do not occur in complex patterns and are monotonic, which is geographically unrealistic (see Figure 3 for an attempt).

The panel itself can be an expressive comic icon (Eisner, 1985) and as in Figure 2 a sensationalist zigzag edge (“explosive action”) to the panel can draw attention to the main event occurring in the several thousand year timeline. Other strategies include widening the panel to imply a longer duration (McCloud, 1993) though this may be tricky to do with maps, which are so rooted in space. Nevertheless, Eisner (1985) suggested that height could be communicated by a taller panel. Subtler recommendations may be more effective in the map context – considering time relatively, Eisner states that wavy or scalloped panel borders indicate content that happened in the past. Both Eisner and McCloud recommend no borders to convey a “timeless” feel (McCloud also suggests extending the panel space to the edge of the page – “bleeding” – to achieve the same effect), which may be useful if juxtaposed with typical panels that are fixed in time.
Figure 3: a) A space-time composite or flow map of the WWII D-Day landings on the Normandy coast; b) Use of multiple gutters to break up the map temporally. The map has been rotated to reflect a timeline from left to right. Broadly vertical gutters have been inserted to break up time; also broadly horizontal gutters have been introduced as divisions in space to isolate the four landing beaches. Another possibility is a gutter that follows linear geographic features (such as the shoreline, in this case).

Comic snapshots embedded in the map
In discussing temporal map snapshots, the concept of which originates in GIS, our discussion of comics and cartography has borrowed from the computer realm. Indeed, technology is presented as an equal partner with art and science in the practice of cartography (Cartwright, 2009). Cartoons in a digital context have already been used to good effect in delivering wayfinding instructions (Paelke and Elias, 2007) and for demonstrating interactive multimedia environments (Rich et al, 1994). There are opportunities for both domains that are specifically enabled by computers, beyond the effects that are now simple to do (e.g. pixellating, blurring, embossing) and of course routine cartographic tasks such as lettering fall into the same category. Beyond that, for comics, we now have the choice of aping the page on the screen (not imaginative) or clicking through panel by panel (but you lose the sequential nature of comic art). More innovative and more attuned to what has been going on in cartography and multimedia atlases (e.g. Cron et al, 2008) is the use of animation and of course multimedia productions with sound and motion (where the original comic strip has been digitized but is accompanied by a wealth of ancillary support in the form of notes, videos and maps – McCloud 2000 – in the same way as the conventional film DVD product).
The modern format of comics is a product of the printed page and is constrained by it. Comic artists have learnt to make the most of it (e.g. making sure that the last frame on the page maximizes anticipation for the next page) but ultimately what is lost is adjacency from one frame row to another (McCloud, 2000). Viewing comics digitally can mean that the screen acts as a window onto an “infinite canvas” rather than as a digital page. This allows, potentially, one long sequential comic strip that maintains adjacency (a return to proto strips such as the Bayeux Tapestry) or indeed strips that can follow any configuration, such as the rhythm and rhyme of a poem (McCloud, 2000).

Ultimately, the large format of the digital comic canvas is a step towards the large format map (McCloud even calls for a “spatial model” to accommodate the large format comic). This can be taken literally. Firstly the comic strip can be regarded as a line in a GIS sense. One can imagine the path of a road trip or even a walk to work being represented by a comic strip on a map instead of an unexpressive line (i.e. the strip would exist in xy space). This would be a way of imbuing what is inherently a geometric feature, representing scientific cartography, with a human dimension to the journey (the alternative viewpoint offered by cartographic artists). Comic strips of different people could intersect on the map and the reader would choose which strip to follow; in this way they would explore the map both spatially and in a human dimension. Of course, with the strips from just a few people the map would start to get messy, particularly along popular routes. Adding the time dimension as a vertical dimension in a 3D representation would remove much of the clutter and would effectively turn the map into a space-time cube and the lines into the lifelines of time geography (Hägerstrand, 1970). Comic strips in 3D space echoes a suggestion for digital comics from McCloud (adjusting the orientation of frames in 3D space to convey a narrative element, 2000); in effect it would be an annotated lifeline and would enrich the space-time representation (Figure 4). The recent practice of collecting personal space-time diaries in support of community GIS (e.g. see Chew et al, 2007) would feed well into this.

An overriding consideration in all this is interactivity to foster usability. Ostensibly, the entire map or space-time cube will look like a typical example of its kind when viewed in its entirety. To use the map and view the comic strip the user would have to zoom in on a line to enter a strip and align the strip for optimal reading. Simultaneously, the user should also be made aware in a peripheral sense of the surrounding features in space or space-time for the map to achieve its hybrid potential. These peripheral features (other strips, map elements) could be de-emphasized (e.g. by blurring) to avoid a “busy” view for the user.
Figure 4: The comic strip embedded in a 3D time geography map (map from Chew et al, 2007). See text for details.
Explaining Figure 4: with time as the z-dimension the yellow line is a person’s lifeline in a typical day as he occupies and travels between “stations” (the vertical poles that denote home, office and lunch places). The comic strips are what would be seen if a user zoomed into the lifeline; they would be able to follow the lifeline as a story. The frames in the comic strip are aligned to the direction of the lifeline (vertical strips are always from bottom to top; strip 2 reads from left to right; strips 4 and 7 from right to left). As a second strategy, the strip can be constrained by area. For example, the outline of a country enclosing a comic strip can lend an overriding and specific geographic ambience to a narrative that would be long-winded to achieve with words or even other types of image (see similar example with faces from McCloud, 2000, p.227). Ultimately, these solutions, in their requirement of comic art, may entail the cartographer to collaborate with such an artist. The extra complication may be a barrier to some, though there are semi-automated comic strips becoming available on the web (e.g. Pixton™, 2009, which formed the strip in Figure 4), which require little artistic skill on the part of the user, just a script and the choreography of the stock characters, props and scenes provided. In the end, geography may prove even more constraining than the printed page for comic strips but there is no more effective way to communicate geography than with maps.

Conclusion
The art of the comic strip has been applied to cartography with powerful, expressive and dramatic effect. As such, comic art has the potential to form an alternative and compelling viewpoint on the world, complementing maps well. Two contexts are illustrated here, the map in comic form (snapshots and space-time composites captured in comic strip frames and gutters) and the mapped comic, with the strip literally being turned into a plotted line and placed in a 3D time geography context. The other major link between sequential art and cartography – that of caricaturing and generalization – has been ignored in this paper, but along with further investigation of spatiotemporal collaborations of maps and comic art, the abstraction link is rich with possibility (and to some extent it has already started with the comic-like principles employed in non-photorealistic rendering, Döllner, 2007). With the visual imagination that comics have on show, the question could be how far we can “subvert cartographic convention” (Caquard & Taylor, 2005), with comic art as inspiration.

References


Land Ocean Interaction Study (LOIS), 2000. *LOIS Overview CDROM*, Ver 2.0, Windows, NERC.


