Planning routes around the world: International evidence for southern route preferences

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Abstract

Three studies test whether the southern route preference, which describes the tendency for route planners to disproportionately select south- rather than north-going routes, can be attributed to regional elevation patterns; specifically, we ask whether this effect replicates in three topographically disparate international regions, one of which is characterized by higher elevations to the north and lower to the south (Padua, Italy), and two characterized by higher elevations to the south and lower to the north (Enschede, Netherlands; Sofia, Bulgaria). In all cases, we found strong evidence that route planners disproportionately select south- rather than north-going routes at rates exceeding chance. We conclude that the southern route preference is driven by strong associations between canonical direction and perceived effort of route traversal; these effects are somewhat perplexing given that such associations are not founded in the reality of physical space.

1. Introduction

Navigating through complex environments involves not only the application of spatial knowledge about routes and environmental structure, but also heuristics or rules of thumb that help individuals develop and follow route plans. Thus, while navigators consider several basic spatial and temporal characteristics when selecting routes, such as path length and complexity, and traffic patterns (Bovy & Stern, 1990; Gärling, Lindberg, & Mantyla, 1983; Golledge, 1995; Seneviante & Morrall, 1986), they also show some relatively counterintuitive behaviors. For instance, navigators tend to select long and straight initial route segments when leaving an origin, and select the last available turn when approaching a destination (Bailenson, Shum, & Uttal, 1998, 2000; Christenfeld, 1995). Interestingly, these heuristics are sometimes applied at the expense of neglecting shorter route options. We recently discovered that navigators also show a consistent bias toward selecting generally south-going rather than north-going routes between an

origin and destination, even when these routes are equated for path length and complexity (Brunyé, Mahoney, Cardony, & Taylor, 2010). A series of six experiments suggested that participants might misperceive the northward canonical direction as ‘uphill’ relative to the southward direction (see also, Nelson & Simmons, 2009).

The precise source of this southern route preference remains elusive – why might participants perceive the northward canonical direction as ‘up’? One possibility is that participants from the New England region of the United States transfer their knowledge of local large-scale elevation patterns to laboratory tasks involving a degree of uncertainty. That is, participants may strongly associate canonical and vertical space because the New England region is characterized by higher elevations (mountains) to the north and lower elevations (sea level) to the south. In turn, this learned association drives the southern route preference in an effort to avoid the physical cost of locomotion through mountainous regions. The second possibility is that participants associate canonical and vertical space in a manner nonspecific to their local environments. Indeed some recent work suggests that participants may implicitly associate north with higher elevation (Brunyé et al., in press; Gagnon, Brunyé, Robin, Mahoney, & Taylor, 2011) at a level outside of conscious awareness. This association may be driven by
a somewhat pervasive links between vertical upward space and increased effort that carries over onto representations of canonical direction.

To test whether associations between canonical and vertical space extend across cultural and geographical populations, we conducted a series of studies specifically aimed at recruiting participants from international regions characterized by dramatically varied relationships between canonical and vertical/topographic space. Below we review the extant literature examining route-planning asymmetries and further detail the southern route preference as a means of elucidating this project’s motivations and our hypotheses’ supporting research.

1. Route-planning asymmetries

In many cases, navigators choose routes based on efficiency and familiarity, reviewing the relationship between an origin and destination and selecting a viable path between them (Benshoof, 1970; Golledge, 1995; Jacoby, 1917). In fact, many people believe they can perform this type of route-planning task with little effort, particularly when negotiating familiar environments or using a standard road atlas (Gärling & Gärling, 1988; Ueberschaer, 1971). However, when there are multiple route options and increased uncertainty regarding an objectively ‘correct’ decision, navigators apply a wide range of spatial heuristics. For instance, participants tend to select routes that have fewer turns and pass fewer landmarks along the way (Sadalla & Staplin, 1980; Seneviante & Morrell, 1986). Further, research regarding the least-angle strategy demonstrates that when people are presented with multiple route options from an origin to a destination, they tend to select the route that deviates minimally from the destination’s overall direction (Conroy Dalton, 2003; Hochmair & Frank, 2002; Hochmair & Karlsson, 2005). Participants also show an initial segment strategy, which describes the reliable tendency to select routes that have a relatively long and straight path segment emanating from an origin (Bailenson et al., 1998, 2000). Finally, we recently discovered that people show a southern route preference during route planning that leads to a disproportionate (approximately 63% of the time) selection of south- relative to north-going routes between waypoints (Brunyé et al., 2010). For further descriptions of heuristics and their application to route planning, see (e.g., Hölscher, Meilinger, Vrachliotis, Brösamle, & Knauff, 2006; Janzen, Herrmann, Katz, & Schweizer, 2000; Wiener, Lafon, & Berthoz, 2008).

In many cases, heuristics, like those described above, can decrease cognitive workload (i.e., Christenfeld, 1995), and lead to effective path selection. Indeed a number of studies suggest that navigators will use heuristics to simplify route plans in an attempt to reduce the cognitive and physical costs associated with maintaining and carrying out a route sequence (Freska, 1999; Levine, 1982). In some cases, however, these heuristics can lead to suboptimal route selection. For instance, participants will place disproportionate reliance upon the initial route’s straightness even when it leads to selecting an overall lengthier path (Bailenson et al., 2000). There is thus some compelling evidence that predicting wayfinding behavior involves not only identifying the shortest or most efficient route, but also identifying and characterizing the heuristics that guide spatial decision making. Interestingly, many of these heuristics appear to be implicit, operating outside of a navigator’s awareness (Bailenson et al., 1998; 2000; Brunyé et al., in press; Christenfeld, 1995). The wide range of heuristics and their strong influence on navigation behavior illustrate the importance of continued research in elucidating the full range of spatial heuristics guiding navigation. Results from this research carry important implications for the theoretical and computational modeling of human spatial behavior (Golledge, 1995; Kuipers, 2000; Yoshino, 1991), and predicting wayfinding behavior in applied contexts (i.e., in the lost, Heth & Cornell, 1998; or for environmental engineering, Gärling & Gärling, 1988; Raubal, 2002; Weisman, 1981).

1.2. Southern route preferences

We recently reported six experiments examining navigators’ route selections under conditions of uncertainty (Brunyé et al., 2010). In our first two experiments, participants viewed maps of unfamiliar large-scale environments and planned routes between landmark pairs. The maps were presented on a standard computer monitor in front of the participants. On each map, half of the landmark pairs were diagonally across the map from one another (filler trials), and half involved a dilemma between north-south or east-west route options. On dilemma trials, participants were tasked to plan a route between two map landmarks that were horizontally (north/south) or vertically aligned (east/west), and had two equal-length route options for navigating between them. Dilemma routes were designed to promote route selection under conditions of relative uncertainty— that is, no objectively ‘correct’ route option was available. Across participants, we controlled for number of turns and landmarks, and right-on-red affordances (i.e., the ability to turn right at a red traffic signal) offered by each dilemma route option. We found that, on average, participants demonstrated a southern route preference on approximately 63% of north/south dilemma trials, but no reliable bias with east/west dilemma trials. Experiments 3 and 4 demonstrated that this southern route preference could not be attributed to misperceptions of route length, or a spatial viewing preference on the computer monitor. Experiments 5 and 6 demonstrated that participants rate north-going routes as having a higher potential for scenic vistas, require more calories to traverse, and are associated with longer travel times relative to south-going routes.

According to these results, participants seem to misperceive northern routes as moving uphill toward higher elevations. The source of this effect, however, is unknown. The fact that the northward direction is most frequently oriented upward on maps, atlases and even GPS devices may lead people to associate north with the upward direction. Of course, the upward direction relative to the vertical body axis is inherently more difficult than the downward direction (Staab, Agnew, & Siconolfi, 1992). It could be the case that participants transfer their knowledge of how gravity affects movement effort to decisions regarding unfamiliar environments. Such a possibility was raised by Shepard and Hurwitz (1984) in their examination of links between various three-dimensional spatial axes. If so, participants may use effortful attempts to reduce predicted workload and thus strategically avoid traveling through what they (mis)perceive as physically demanding areas. Some recent evidence from our laboratory provides support for this hypothesis: when using an adapted implicit association task (IAT; Greenwald, McGhee, & Schwartz, 1998) we find strong implicit directional associations between north/south cardinal directions and vertical spatial axes (Brunyé et al., in press).

However, much of the evidence for the southern route preference is gathered from students at a New England university. The large-scale topographical patterns characterizing New England show dramatically higher elevations to the north (i.e., the White and Green Mountains in NH and VT, respectively) than to the south. Participants may thus transfer their knowledge of regional topography to decisions regarding unfamiliar space. In our earlier work, we proposed that it remains to be discovered whether the southern route preference will replicate in areas with different or even opposite elevation patterns (e.g., mountains to the south, lower
elevations to the north). The current work accomplishes this goal by replicating our earlier route-planning experiment in three international regions suitably characterized by different elevation patterns (see Fig. 1): Padua, Italy (1a), Enschede, Netherlands (1b), and Sofia, Bulgaria (1c). Similar to New England, Padua is characterized by mountains (the Italian Alps) to the north, and relatively low and level terrain to the immediate south. Enschede is characterized by level areas to the immediate north and south, but higher elevations to the terrain to the immediate south. Sofia is characterized by topography that is decidedly opposite to that of the New England area, with level areas to the immediate north and a dramatic mountain range to the immediate south.

1.3. Hypotheses

If the southern route preference is due to transferring knowledge of regional elevation patterns to route-planning decisions regarding unfamiliar environments, then such an effect should be replicated in the Padua, Italy sample, diminished in the Netherlands sample, and perhaps reversed in the Bulgaria sample. In contrast, if the southern route preference is due to strong associations between coordinate axes and vertical space, then such an effect should replicate in all regions. Specifically, if people more generally associate north with the upward direction and south with the downward direction, then the southern route preference should replicate in all international samples, regardless of local topography.

2. Method

2.1. Participants & design

A total of 146 students volunteered at the three data collection sites, 50 at the University of Padua, Italy (30 female; age \(M = 20.8\) years), 47 at the University of Twente, Netherlands (37 female; age \(M = 19.3\) years), and 49 at the New Bulgarian University, Sofia, Bulgaria (41 female; age \(M = 23.6\) years). The vast majority of participants spent most of their lives residing within a 150 mile (141 km) radius of the respective data collection sites (Padua 41/50; Twente 41/47; Sofia 42/49).

We used a repeated-measures design with three trial types: north/south dilemma, east/west dilemma, or no dilemma. We recorded which route option the participant chose during dilemma trials (north/south, east/west).

2.2. Materials

All experimental materials matched those used in our earlier work (Brunyé et al., 2010), with the exception of translated map labels for the Sofia, Bulgaria stimuli (see Fig. 2b).

2.2.1. Maps & routes

Two maps were developed using Google™ Maps imagery from suburban Pittsburgh, PA and Chicago, IL. Each map was 1200 × 793 pixels in size and depicted thirteen labeled landmarks (e.g., dance club, hotel, café) and a compass rose in the lower right corner (see Fig. 2a and b); no scale was provided. Twenty trials were developed for each of the two maps, each connecting two depicted landmarks (e.g., dance club to hotel). Ten of these trials had one obvious efficient route choice, and 10 were dilemmas forcing the participant to choose between a northward versus southward or eastward versus westward route. In an east/west dilemma trial, the two most efficient route options went east and west, and in a north/south dilemma they went north and south. More specifically, north/south dilemma trials had route options that went generally above (north) or below (south) the laterally-aligned vector connecting the origin and destination; similarly, east/west dilemma trials had route options that went generally to the left (west) or right (east) of the longitudinally-aligned vector connecting the origin and destination. In most cases, the initial path segment of each dilemma route option went in the primary direction of interest (north/south/east/west); when it did not, the route options deviated in the second path segment. Each dilemma route option was equated for length. Within each map, each landmark was referenced as an origin or destination at least once across the 20 trials.

For each map, origins and destinations were swapped to create two versions of the routes; these versions were used across participants to control for initial segment length and direction (i.e., Bailenson et al., 2000) and the possibility that participants would preferentially select routes that contained more right turns (i.e., right-on-red affordances; Scharine & McBeath, 2002). To control for route complexity, we also created two map versions, one in the original orientation and one rotated by 180; this control was intended to account for the possibility that a given dilemma route might contain fewer turns, relatively oblique turning angles, or lower landmark density. It also allowed us to balance the global coordinate frame’s natural (original) orientation with the egocentric vertical (up/down) axis.

![Fig. 1. Terrain maps illustrating differences in regional elevation patterns amongst the three data collection sites, Padua, Italy (1a), Enschede, The Netherlands (1b), and Sofia, Bulgaria (1c). Each map was generated at a viewpoint eye elevation of approximately 200 miles, using the Google Earth™ mapping service and topographical data from the CGIAR Consortium for spatial information (CGIAR-CSI; http://www.cgiar-csi.org/). Note that white indicates ocean/sea, and progressively darker areas indicate higher elevations.](image-url)
2.3. Procedure

Participants were consented in accordance with institutional review board procedures of each data collection site. Participants completed two experimental blocks (one for each map), each containing 20 trials. Map order was counterbalanced across participants, and maps were presented on a standard computer monitor positioned in front of the participants. The first map was presented for a brief 2-min study period, during which the participant confirmed each landmark location to the experimenter. The experimenter then presented the 20 corresponding trials, one at a time, and asked the participant to describe the best route from...
the [origin] to the [destination], which was explained as the route that was shorter and/or faster. The experimenter recorded each dilemma trial response as going either north or south, or east or west. This procedure was then repeated (study, then testing) for the second map. Participants were then thanked for their time and dismissed from the study.

3. Results

3.1. Scoring & analysis

On non-dilemma filler trials, the route was not associated with direction of conflict, and thus not further analyzed. For dilemma trials, described routes were categorized as either north- or south-going (in north/south dilemmas) or east- or west-going (in east/ west dilemmas). In the vast majority of cases, participants selected one of the two intended routes during dilemma trials; when they deviated from the intended routes (fewer than .5% of all trials) we excluded the trial from further analysis. For each participant, two proportions were created: the proportion of north/south dilemmas wherein the participant selected a south-going route, and the proportion of east/west dilemmas wherein the participant selected a west-going route. As in our earlier work (Brunyé et al., 2010), one-sample t-tests compared the proportion of dilemma trial routes selected as south, and west, against expected odds (50%). We then compared proportions across the three data collection sites. For all analyses, we collapsed across map (Pittsburgh, Chicago) and map version (original, rotated 180°). The distribution of proportion data approximated normality (Fisher, 1930; skewness = .03) and thus data were not transformed. Effect size is reported using Cohen’s d.

3.2. Route choices at each data collection site

Our first set of analyses focused on the extent to which participants deviated from chance (50%) during north/south and east/ west dilemma trials. For Padua, Italy, during north/south dilemma trials, we found a southern route preference of 58.6% (north: 39.8%), significantly departing from chance, t(40) = 3.04, p < .01, d = .43; east/west dilemma trials approximated chance (east: 54%, west: 46%), t(49) = 1.51, p > .10, d = .21. For Enschede, Netherlands, during north/south dilemma trials, we found a southern route preference of 60.2% (north: 39.8%), significantly departing from chance, t(46) = 4.46, p < .01, d = .65; east/west dilemma trials approximated chance (east: 53.3%, west: 46.7%), t(46) = 1.37, p > .10, d = .20. For Soφa, Bulgaria, during north/south dilemma trials, we found a southern route preference of 62.9% (north: 37.1%), significantly departing from chance, t(48) = 5.66, p < .01, d = .81; east/ west dilemma trials approximated chance (east: 51.3%, west: 48.7%), t(48) = .45, p > .10, d = .06. Overall, collapsed across the three sites, there was an overall weighted southern route preference of 60.6%.

3.3. Route choices by participant demographics

Our second set of analyses tested whether the above results maintain after excluding participants who have not spent the majority of their lives residing within a 150 mile (141 km) radius of the respective data collection sites. The 150 mile radius was determined after considering the approximate distance from each data collection sites that would result in an opposite topographical pattern. For instance, 200 miles north of Padua, Italy (as the crow flies) is a valley just south of Munich and north of the Italian Alps (thus characterized by higher elevations to the south and lower to the north, opposite of Padua). After excluding 9 participants from the Padua data set, 7 from the Soφa data set, and 6 from the Enschede data set, we again measured the extent to which participants deviated from chance (50%) during north/south and east/ west dilemma trials. If the southern route preference persists, it would present strong evidence that the topography characterizing the region an individual resided in for the majority of their life does not contribute to the southern route preference. For Padua, Italy, we replicated the southern route preference (56.8%), t(41) = 2.12, p < .05, d = .33; east/west dilemma trials again approximated chance (west: 45%), t(40) = 1.63, p > .05, d = .25. For Enschede, we replicated the southern route preference (58.7%), t(40) = 3.51, p < .01, d = .55; east/west dilemma trials again approximated chance (west: 48%), t(40) = .76, p > .05, d = .12. For Soφa, Bulgaria, we also replicated the southern route preference (62.1%), t(41) = 4.9, p < .01, d = .76; east/west dilemma trials again approximated chance (west: 48.5%), t(41) = .50, p > .05, d = .08.

We also tested to confirm that, as in our earlier work, there were no gender differences in the extent of the southern route preferences. In all three data collection sites, the proportion of routes selected as south-going during north/south dilemma trials was similar across males and females (all p’s > .69 in independent-samples t-tests). Means by site and gender: Padua, Mmale = .59, Mfemale = .58; Enschede, Mmale = .60, Mfemale = .62; Soφa, Mmale = .63, Mfemale = .63.

3.4. Differences across data collection sites

Our third set of analyses focused on the extent to which participants differed in their route preferences across the three data collection sites (see Fig. 3). All participants were included in this analysis. A multivariate analysis of variance (MANOVA) with data collection site as the single fixed factor (3: Padua, Enschede, Soφa), and dilemma types (2: proportion south, proportion west) as the dependent measures, demonstrated no reliable difference between route preferences at the three sites, F(4, 286) = .64, p > .10, n² < .01. To ensure this null effect was not due to insufficient sample sizes, we conducted a sample size estimation using our earlier effect size (d = .85; Brunyé et al., 2010), and desired alpha of .01 and power of .95. This analysis estimated a sample size of 25 participants per data collection site.

4. Discussion

The present experiments assessed whether the southern route preference, as identified in our earlier work (Brunyé et al., 2010), would replicate in areas with dissimilar elevation patterns to the New England region of the United States. We hypothesized that if
the southern route preference is driven by the application of local
cognitive associations. Furthermore, the northern United States, the
north may be associated with warmth, sun and vacations, and the
north with relatively cold areas that might be less associated with positive experiences. However, there is no reason to believe that large-scale regional characteristics that have strong affective associations would transfer to route planning in a relatively small-scale and unfamiliar environment. Further, in Sofia, Bulgaria the distant south holds relatively negative connotations (extreme heat, poverty); if these types of associations were driving the southern route preference, one might expect the preference to be diminished in the Sofia, Bulgaria sample. We also note that a number of studies have consistently demonstrated that people associate upward (not downward) areas with positive affect and experiences (Meier & Robinson, 2004; Schubert, 2005). As such, affective valence appears to be an unlikely factor driving the present results.

A more likely explanation comes from our earlier work, wherein we discovered that participants tend to rate north-going routes as more difficult to traverse and holding more potential for scenic vistas relative to south-going routes (Brunyé et al., 2010, experiments 5–6). Perhaps such a result is not entirely surprising, given the strong associations between canonical and vertical space in our daily lives. In accordance with Lakoff’s (1987) experientialism, categorical links between canonical and vertical direction may result from our bodily experiences in the world. Consider the fact that north is arbitrarily oriented upward on most maps, road atlases, and globes, as first demonstrated in Ptolemy’s map renderings in Geographica (i.e., Thrower, 1999). Shepard and Hurwitz (1984) propose that the convention to depict the north pole as upward on maps may be a result of many early global navigators and map makers originating in the northern hemisphere and using the north star for navigation. This typical upward orientation may drive the development of automatic associations between the vertical upward direction and the northward canonical direction. Indeed such associations may also form the basis for linguistic expressions such as “heading up north” or “down south” (or vice-versa; Koerner, 2002). Interestingly, some recent work suggests that metaphorical links between canonical direction and vertical space also may play a role in people’s conceptualization of sociopolitical power (Gagnon et al., 2011) and affluence (Meier, Moller, Chen, & Riemer-Peltz, 2011).

Movement in the vertically upward direction is more physically demanding relative to the downward direction (i.e., given gravity; Shepard & Hurwitz, 1984; Staab et al., 1992), and participants may thus implicitly avoid traveling through what they misperceive as more physically demanding areas of a map. In fact, even a map positioned flat on a table in front of an individual will depict north as farther away from the body than south (i.e., more effortful to access; Cacioppo, Priester, & Berntson, 1993; Tversky, Morrison, Franklin, & Bryant, 2004). Interestingly, however, north-going path segments are always offset by subsequently south-going path segments; in other words, if an origin and destination are laterally aligned on a map, northward initial path segments would be offset by later southward path segments. Thus, our results might be best described as a southern preference specifically applied to initial path segments (Brunyé et al., 2000) in an attempt to minimize perceived effort.

Interestingly, if you explicitly ask a participant why this they show a southern route preference, or why they rate north- versus south-going routes are more physically demanding, they are often unaware of their behavior and even puzzled that they would make such a determination. This result, in conjunction with recent data suggesting that participants find it difficult to associate the north with low elevation and the south with high elevation during a speeded categorization task (Brunyé et al., in press), suggests that the southern route preference may partially emanate from implicit associations between canonical (north/south) and vertical topographical (up/down) space. In this work, we found that participants showed difficulty using shared response keys to categorize incongruent canonical and topographical concepts (e.g., south, mountains) relative to congruent concepts (e.g., north, mountains) during a task designed to measure implicit associations. This finding is in line with research investigating other spatial heuristics, which tend to find little or no evidence of heuristics being applied at a level of conscious awareness (Bailenson et al., 1998, 2000; Christenfeld, 1995).

The present work contributes to knowledge regarding the application of the southern route preference during route planning in three primary ways. First, we demonstrate that associations between canonical and vertical space are not affected by the extent to which a person’s regional elevation patterns promote an association between north and the upward direction. Second, we demonstrate that the effects of the present spatial heuristic may affect decision making in a highly generalizable manner, given the strong evidence for the southern route preference in diverse international samples. Finally, we support the notion that spatial heuristics, in particular the southern route preference, may be driven by real-world exposure to co-occurring spatial dimensions that are both abstract (canonical direction) and inherently concrete (verticality). Future work may assess the extent to which different components of spatial information co-occur in the real world may predict their pervasiveness on human decision making.

The present findings also point to several opportunities for future research. It remains to be seen whether the heuristics that are reliably evoked in laboratory settings may manifest during route planning in real-world environments. There is some compelling evidence to think that the present results would transfer to realistic ground-level navigation; first, most studies examining spatial heuristics have used maps of real-world environments such as towns or college campuses (Bailenson et al., 1998, 2000; Christenfeld, 1995). Second, some have replicated spatial heuristics in natural environments (Christenfeld, 1995; Gärling & Gärling, 1988; Shum, Bailenson, Hwang, Piland, & Ullat, 1998). However, it could be the case that participants may only show a southern route preference while planning routes using maps or retrieving map-like spatial memories of environments. Indeed there is evidence that, in unfamiliar environments without access to a map, spatial heuristics may yield differential influences on route planning (i.e., Hochmair & Karlsson, 2005). Future work is planned to examine whether the southern route preference manifests in both familiar and unfamiliar virtual environments, and with or without access to area maps. Further, it remains to be seen whether the present results would maintain in participants sampled from the southern hemisphere (e.g., New Zealand, Australia, Southern Africa). Given that maps from these regions
generally depict north at the top of a map (with the exception of novelty maps; McArthur, 1979), participants sampled from the southern hemisphere are likely to associate north with the upward vertical direction. In fact, all early evidence of south-up maps in the southern hemisphere are likely to associate north with the upward vertical direction. In fact, all early evidence of south-up maps suggests that this is not the case: even in regions (i.e., Sofia, Bulgaria and Enschede, Netherlands) characterized by higher elevations to the south, we found compelling evidence that route planners preferentially select south–relative to north-going routes. In many cases, these types of heuristics are thought to minimize cognitive effort while maintaining a degree of accuracy during decision making; however, we also know that in certain cases heuristics can have adverse effects on human performance under conditions of uncertainty (Newcombe, Huttenlocher, Sandberg, & Lie, 1996; Tversky, 1977; Tversky & Kahneman, 1983). It is thus critical to identify the full range of heuristics and characterize the scope of their influence on human behavior in an effort to fully understand and predict human navigation.

Given the reliability of the present findings across cultures and regional topographies, future work might attempt to integrate the north-up heuristic into formal models of route planning, such as those that consider larger-scale environmental features as predictive of navigation behavior (e.g., Leiser & Zilbershats, 1989; Wiener & Mallot, 2003). The coarse-to-fine route-planning hypothesis (i.e., Chown, Kaplan, & Kortenkamp, 1995) defines the developmental progression of route plans as beginning with a coarse plan that considers relatively global environmental characteristics, and then breaking this plan down into relatively fine-grained route plans. These fine-grained plans dictate movement between locations along defined paths. We propose that the north-up heuristic is possibly applied during the relatively coarse and abstracted phase of the route-planning process. During its application the heuristic becomes instantiated as a regional bias that preferentially orient towards southern regions during the early phases of route selection. In effect, optimal routes become more likely to be sampled from southern regions. These possibilities open the door for future research examining patterns of visual attention during the early versus later phases of route planning.

References


