Heading up to Beantown: How a North-up Heuristic biases Path Selection.

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Introduction

BACKGROUND AND MOTIVATION

I always like going south.
Somehow it feels like going downhill.
- Treebeard, Lord of the Rings

Wayfinding, or moving purposefully from an origin to destination involves planning routes that are both effective and efficient. Down-selecting routes involves considering such variables as path distance, number of turns, traffic patterns, hazards, and familiarity; each of these variables is somewhat intuitive. On the other hand, people often consider unexpected or even counterintuitive variables during route selection, which include:

1.*Selecting Last Available Routes:* When multiple equivalent-length route options exist, participants often choose the last option; this effect is thought to result from minimizing physical and mental effort (Christenfeld, 1995)

2. *Least-Angle Strategies:* Route planners tend to choose routes that deviate minimally from the global direction of a designated goal (Hochmair & Frank, 2002).

3. *Initial Segment Strategies:* Route planners tend to choose routes based upon their initial straightness as they depart from an origin (Bailenson, Shum, & Uttal, 1998).

4. *Minimal Complexity:* Route planners tend to choose routes that have the fewest landmarks and turns along the way (Senevirante & Morrall, 1986).

Interestingly, some of these heuristics are relied upon even when they lead to the selection of less efficient routes.

In a series of experiments (Brunye, Gardony, Mahoney, & Taylor, in press), we provide the first evidence of a heuristic leading to a **Southern Route Preference** wherein route planners disproportionately select southern rather than equivalent-distance northern routes.

EXPS 1-2 PARADIGM AND HYPOTHESES

Our experiments had participants plan routes between origin-destination pairs using modified maps of Pittsburgh, PA and Chicago, IL. The design of the maps and wayfinding pairs created either a north/south dilemma, an east/west dilemma, or no dilemma. Filler (no dilemma) trials did not have competing route possibilities. On dilemma trials we measured the extent to which participants chose north versus south and east versus west route options, to examine whether route planning deviates from chance behavior (50/50). We expected that if participants show a southern route preference, their selection of southern versus northern routes would depart from chance.

Method & Procedures

165 undergraduates performed 20 route planning tasks per map, during which they studied the map and were told origin and goal destinations. The task was to tell the experimenter how they would move between them. In E1, we recorded the chosen route and spontaneous reference frame use; in E2 we used forced reference frames (route or survey). Across participants, origin-destination pairs were reversed and maps rotated 180deg.


Experiments 1-2: Results

Most participants used an egocentric perspective when describing routes (go forward, turn right, etc). Those who used an egocentric perspective showed a robust southern route preference (64%), but this was not found when participants used an allocentric perspective (go north, head west):
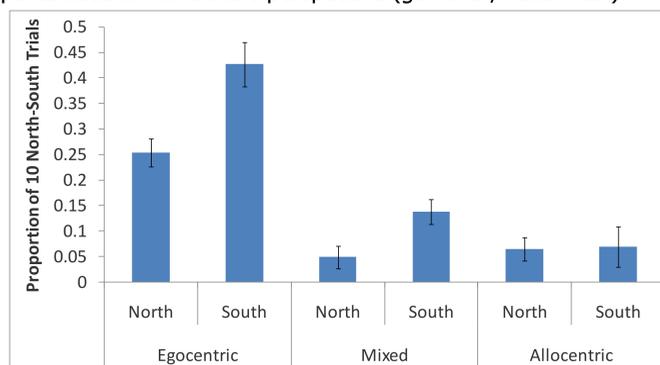
With a forced perspective, the same pattern of results was found. Those who used the egocentric perspective showed a robust southern route preference, but those who were told to use the allocentric perspective did not:
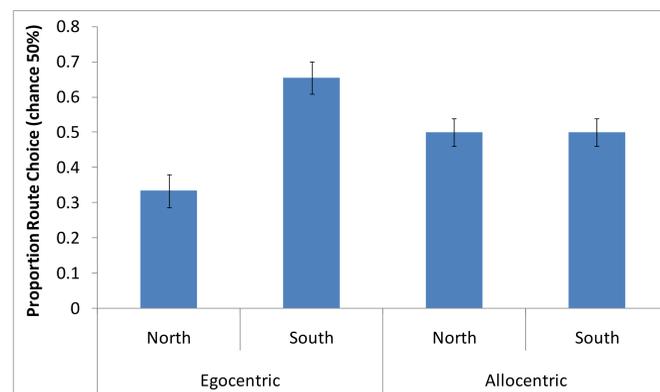
Route planners disproportionately select southern-going rather than northern-going routes, leading to northern route selections only approximately 35% of the time. This pattern was only apparent when participants immersed themselves in the environments and described routes from a first-person perspective. This pattern may be a result of them misperceiving northern routes as longer than southern ones, or conceptualizing northern routes as 'uphill' and thus relatively difficult. Exps 3 & 4 test between these alternatives.

EXPS 3-4 PARADIGM AND HYPOTHESES

Shorter/Longer Routes: Experiment 3 used a forced-choice procedure that had participants choose either the 'shorter' or the 'longer' of two depicted routes that were either N/S or E/W dilemmas, or non-dilemmas.

Physical Demand/Elevation: Experiment 4 had participants rate single routes on a variety of dimensions, including the number of calories or fuel burned by taking the route, the amount of traffic one might experience by taking the route, and the potential for scenic vistas along each route.

Experiment 3-4: Results

Experiment 3 did not show any bias towards north, south, east, or west routes as being physically lengthier than their opposite-direction counterparts. Participants do not appear to misperceive northern-going routes as physically lengthier than southern-going ones.

Experiment 4 showed two primary results. First, participants rated northern routes as more physically demanding (in terms of number of calories burned) than southern ones. Second, participants rated northern routes as having a higher potential for providing scenic vistas, presumably due to increased elevation.
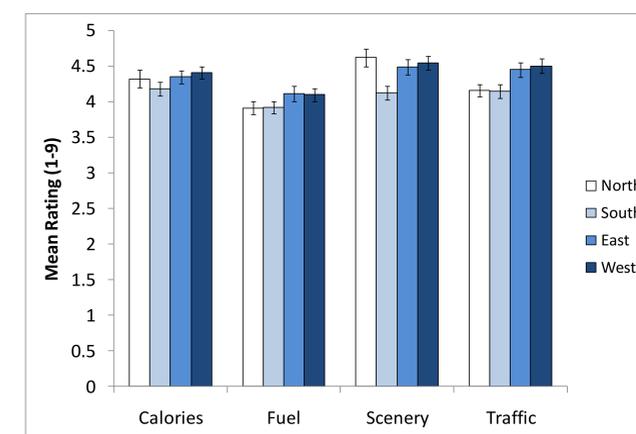
There seems to be some evidence that participants conceptualize northern routes as being associated with higher calorie expenditure and providing opportunities for more scenic vistas.

CONCLUSIONS

We add to a growing literature detailing the information people use when planning routes through environments. We demonstrate for the first time that participants prefer southern rather than northern routes when presented with equal-length alternatives going from origins to destinations that lie along the horizontal axis. We believe this preference arises due to the false belief that northern routes move to higher elevations. Participants generally do not seem to be aware of this preference, and are often surprised to learn that their decisions were biased in such a way; in contrast, some participants, much like Treebeard, exclaim that their decisions were based on the principle that north is 'up.'

This preference only seems to arise, however, when participants either spontaneously use, or are instructed to use, egocentric frames of reference to describe routes. It could be the case that adopting an egocentric perspective provides a higher degree of immersion and promotes the use of heuristics that are activated during real-world navigation (i.e., Brunye & Taylor, 2008; Brunye et al., 2009; Ditman et al., in press); future work will investigate this possibility during more naturalistic wayfinding in virtual environments.

Why might people disproportionately select southern routes? One possibility is that they apply knowledge from regional large-scale environments that have higher elevations to the north (such as found in our New England environment) to judgments regarding unfamiliar environments. This explanation would predict that the southern route preference would reverse in regions with higher elevations to the south.

References

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