UNIVERSITEIT TWENTE

Cultural Differences in Providing Wayfinding Directions

Bachelor thesis

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Abstract

This study examined differences in direction giving within western society. Our first experiment was mainly intended to compare the frequency of use of several spatial terms of reference provided by Americans, earlier assessed by Hund et al. (2008), to direction giving behavior of the Dutch population. Presenting a fictive model town, we asked 30 Dutch participants to provide wayfinding descriptions to fictional addressees in route (driving through the town) and survey situations (using a map). First, our results yielded that native Dutch speakers less frequently use cardinal descriptors than American native speakers do. Therefore we propose that cardinal concepts are less present for Dutch people. Second, significant effects of referent perspective on the mention of several wayfinding descriptors were found. Further differences in language use were yielded for both recipients perspectives. Based on these facts we conclude that, although cardinal concepts seem to be less present for them, Dutch people are able to flexibly adapt to the needs of their addressees during direction giving. In a second experiment Dutch participants conducted an adjusted version of the wayfinding task developed by Hund et al. (2008). When cardinal directions were not indicated and explicitly mentioned during introduction of the model town participants did not mention cardinal cues at all.

Introduction

We often ask each other to provide spatial descriptions of the environment, for example to inform others about the location of objects, or the location of places, such as public buildings or railway stations. Finding your way through the environment is essential for daily functioning. For the most of us finding an unfamiliar building or place is a challenging task. However, despite the widespread use of maps people frequently make use of verbal directions in finding their way to an unfamiliar location (Freundschuh, Mark, Gopal, & Couclelis, 1990). In fact, verbally providing wayfinding directions might be one of the earliest uses of language to secure human survival (Wunderlich, 2008). The primary goal of this study was to examine how language use and perspective choice in wayfinding descriptions depend on varying recipient perspectives and cultural background.

Differences in spatial descriptions: Route and survey perspective

Space has three dimensions, whereas speaking is a linear process. Hence, in order to define spatial relations and to convey the location of objects or landmarks in the environment, a perspective is needed (Levelt, 1982a). Therefore, although individuals naturally see the world

from their own perspective, for interactional purposes it is necessary to realize and talk about the environment from other perspectives.

Perspective taking in spatial descriptions involves the choice of a ***reference system*** for which one can include the choice of a ***frame of reference***, the adaptation of a ***viewpoint*** and the choice of ***terms of reference*** (Tversky, Lee, & Mainwaring, 1999). Firstly, the *frames of reference* decides about whether something is either described in relation to a person (viewer-centered), whether something is located with respect to an object (object-centered) or whether something is located in terms of the environment. For instance one can use objects or landmarks in the scene, a person in the scene, buildings, environmental frameworks or the cardinal directions as a reference system for one's spatial description. Secondly, the *viewpoint* of a perspective implicates the position and orientation of the perspective-taking person. Third, the *terms of reference* denote the spatial descriptors used to convey spatial relationships between environmental features and the addressee of the descriptions. These terms may vary across languages and across cultures (e.g. Mainwaring, Tversky, Ohgishi & Schiano, 2000; Pederson 1993, 1995).

These three components of perspective taking are not necessarily independent. Current literature theoretically separates the three components of perspective taking, into what have been called *route* and *survey perspective*. This distinction is comparable to the hypothetical distinction between route and survey knowledge. Route knowledge is procedural knowledge about the movements which are necessary to get from one point to another. In contrast, survey knowledge is configural knowledge which refers to the understanding of the organization of a spatial layout and the interrelationships of their enclosed elements (Golledge, Dougherty & Bell, 1995; Siegel & White, 1975; Thorndyke & Goldin, 1982). To convey spatial information through language a distinction is made between route and survey perspective which, along with mixes of them, provide people with different terms of language for navigational or map tasks (Golledge, 1992, Siegel & White, 1975)

In which ways do descriptions provided from these two perspectives differ in spatial language?

In the **route perspective**, objects and landmarks ideally are described relative to an observer (viewer-centered frame of reference) who is moving through the environment. This implies that route descriptions prototypically use the addressee as a referent and contain more viewer-relational terms ("you", "your"). Because the addressee is moving through the environment, descriptions adapt to the changing position of the addressee (internal changing first person viewpoint). Therefore route descriptions typically include spatial turns. As spatial terms are interpreted relative to the intrinsic orientation of the addressee, decriptions are normally given by relating objects or landmarks to the viewer in terms of front, back, left and right.

In the **survey perspective**, the speaker takes a fixed, external viewpoint and the description is given from a bird's eyes viewpoint, as if the environment is seen from above. Objects are

prototypically described relative to one another (extrinsic frame of references) depending on the environment and landmarks or the cardinal directions are used as referent objects. As objects and landmarks are related to the environment (absolute frame of reference), descriptions are given in terms of the cardinal spatial terms, (north, south, east and west) and include more environment-related terms. (Linde & Labov, 1975; Levelt, 1982a; Pederson, 2003, Taylor & Tversky, 1992b; Taylor & Tversky, 1996).

Taylor and Tversky (1996) asked individuals to provide written spatial descriptions of previously studied fictitious environments. These descriptions were rated in terms of survey, route or mixed perspective. Detailed analysis indicated that spatial descriptions, provided from two different perspectives can differ in additional aspects, e.g. in verb use. As descriptions provided from a survey perspective use one single viewpoint, they typically included more stative verbs (e.g. forms of *to be*). This is in contrast to route descriptions adapting a changing viewpoint, which were including more active verbs (e.g. *run, go, cross, turn).* Further, route descriptions more often included orientation changes. That is because in the route perspective the adressee is turning in the environment, whereas survey descriptions typically adopt a single orientation from above. It could also be observed that survey decriptions are more likely to be hierarchical, with known targets mentioned first, prior to new targets, whereas typical route descriptions are more likely to be linear.

To sum up, if we are asked to give a wayfinding description, we may either give information in terms of the route perspective from a first-person view, adopting a perspective taken during navigation (e.g. while driving in a car) or in terms of the survey perspective, from the bird's eyes view, like the perspective which is usually taken while looking at a map. In western societies, the typical form of a spatial description is a route or mental tour (Levelt, 1982b, 1989, Pederson, Danziger, Wilkins, Levinson, Kita & Senft, 1998) and when asked to describe environments for listeners, people often prefer route descriptors to survey descriptors (e.g. Hund, Haney & Seanor (2008); Linde & Labov, 1975; Taylor & Tversky, 1996).

However, in several studies it has been shown that giving spatial descriptions, people frequently switch between these two prototypical perspectives and mix the corresponding terms of reference, as in the case with the expression "north of you" ("north of" is a prototypical survey descriptor whereas "you" is a viewer-related term; e.g. Taylor & Tversky, 1996, Tversky, Lee & Mainwaring, 1999). Other studies conducted by Taylor and Tversky (1992a) indicated that individuals providing descriptions of various spatial environments mixed descriptional terms from both perspectives in about 50 percent of all cases. Correspondingly, when people memorise extended spatial descriptions they can respond with similar accuracy to both, inference statements from a new perspective (different from descriptional perspective) and to statements from the same perspective (Taylor & Tversky, 1992b). This suggests that it is not necessary to continuously use descriptors from the same perspective to ensure coherency of

spatial descriptions. Moreover, individuals seem to be able to distance themselves from their own perception and their own perspective. For example people often describe their memory images as including themselves, thus from from an external perspective, rather than from the perspective of experience (Nigro & Neisser, 1983). A study by Schober (1993) revealed that speakers often take the perspective of their adressee to decribe simple environmental scences rather than providing the description from their own perspective.

Accordingly, when giving wayfinding descriptions it is possible for individuals to adapt to the perspective of their adressee. People giving directions not only consider, but even prefer to adapt to the perspective of the recipient and tend to allow for the perspective of their addressee in the choice of descriptional features. Hund, Haney & Seanor (2008) examined how recipient perspective affects the descriptive features people provide when giving wayfinding directions. Participants provided directions to destinations for recipients looking at a map of a fictional town (survey perspective) or driving through the town (route perspective). The results yielded that participants used significantly more cardinal descriptors (e.g. north, south) when addressees were looking at a map (survey perspective) but provided more left-right and landmark cues when addressees were driving through the town (route perspective).

This study aims to point to differences in the traditional manner of giving wayfinding descriptions between western cultures. In particular we intended to investigate whether the abovementioned results of the study of Hund et al. (2008) hold as well for the Dutch population.

Cross-cultural differences

The notion of spatial reference frames has expanded from psychology to other related fields. Linguistic and anthropological aspects might act an important part in verbal wayfinding descriptions. Strategies of lexical choice bear upon the overall use of semantic notions available in a languages and spatial reasoning is affected by the spatial lexicon in everyday use in a community (Bowerman, 1996; Brown and Levinson, 1993; Levinson, 1996a, Pederson et al., 1998). In descriptions of the environment, language schematizes space by selecting and emphazising certain aspects of a scene while other aspects are neglected (Talmy, 1983; Tversky & Lee, 1998). It has been suggested the the selection of a frame of reference could in large parts be lexically driven (e.g. Pederson et al., 1998; Talmy, 1983; the corresponding relevant vocabulary available will not be able to use a particular frame of reference. For example, Pederson observed the Bettu Kurumba, a hunter-gatherer society in South India, who do not have native terms for cardinal directions and traditionally make extensive use of local landmarks for navigation (Pederson ,1993; Pederson et al., 1998).

Levinson (1996b) mentions variation in spatial language across cultures, too. He emphasizes that systems of spatial description can be quite divergent across (non-western) cultures. He observated the Tenejapans in the Mexican state of Chiapas, speaking the Mayan language Tzeltal.

This language only provides an 'absolute' frame of reference (survey perspective) and cardinal descriptors for spatial descriptions. Levinson argues that this preference for the cardinal direction system might be due to linguistic aspects. In the Tzeltal language descriptors like “to the left”, “to the right” are not available and ‘downhill’ has come to mean north, and ‘uphill’ is used to connote the south. Exclusive use of cardinal descriptors might also be due to the topographic features of Tenejapa. Tenejapa is a quite mountainous area, with many ridges and valleys and therefore offers the possibility to orient oneself by the natural landmarks.

If topographic features indeed play a role in the development of spatial concepts and spatial language, one could suggest that people grown up in the Netherlands would not show such a strong tendency towards cardinal spatial concepts. In contrast to Tenejapa, the Netherlands are known as a country with flat landscape and small differences in elevation and the country's name is derived from the Dutch word 'neder' meaning 'low'. Therefore, one would expect a less strong preference for the cardinal directions for spatial description for Dutch people. Indeed, it seems that Dutch people at least have a strong preference for the viewer-related reference frame. Asking Dutch participants to describe spatial relations during several games always resulted in the use of the viewer-related reference frame rather than using the cardinal reference system (Levinson, 1996a; Pederson, 1998).

Note that we are now dealing with (extreme) differences in spatial perception; differences *between* western and nonwestern societies. With regard to differences *within* western societies, most psychological research on wayfinding generally proceeds from the assumption that western societies do not differ in spatial perception (eg. Eysenck & Keane, 2005). However, differences in preference for spatial perspective and spatial descriptors have also been found between western societies. Developing an international wayfinding strategy scale to report preference for survey or route strategies, Lawton and Kallai (2002) could reveal individual differences in wayfinding strategies between participants from the United States and Hungary.

Linguistic differences may also guide us to differences in the use of spatial descriptors within western societies. Tenbrink (2007) mentions several linguistic differences in meaning and use of spatial descriptors between the German and the English language. For instance, in contrast to the English language, in the German language some spatial markers can also denotate a temporal relation. For instance, the term “vor”, has spatial (in front of) as well as temporal meaning (before). The German language parrales Dutch in several aspects (den Besten, 1985). Hence, the same is true for the equivalent Dutch expression “voor”, having spatial as well as temporal meaning. The equivalent English expression “in front of” can only used te denote spatial meaning. To give another example, to express that a car is “on the left”, English speakers use a noun in a prepositonal phrase, whereas German or Dutch speakers can make use of the adverb “links” (“Das Auto ist links”, “De auto is links”) . (Tenbrink, 2007; Grabowski & Miller, 2000)

Further, a study by Lawton (2001) demonstrated that someone's living environment can affect the frequency of using cardinal cues in direction giving. She examined regional differences in the use of cardinal descriptors provided by participants giving wayfinding directions in response to an internet survey. Participants living in Midwest/West of the United States and participants who reported living in areas where streets are arranged in grid-like pattern, aligned with the cardinal directions, referred more frequently to cardinal directions. This was in contrast to participants living in the Northeast/South of the United States. These findings were explicated by the use of different land portioning systems. The Northeast of the USA was surveyed by the metes-and-bounds method, using physical features of the local geography, to define and describe the boundaries of a parcel of land. The West/ Midwest were surveyed by a method, in which land was systematically partitioned into rectangular subsections adjusted to north–south and east–west reference lines (U.S. Public Land Survey). As roads in America often run parallel to property borders, roads in these areas tend to be arranged in a grid-like pattern, more in line with the cardinal directions than roads in the Northeast of the USA (Campbell, 2001; see also Figure 1). These findings suggest that the salience of cardinal directions is greater in areas where roads were arranged in a grid-like pattern.

In the Netherlands, the traditional method of land partitioning is the so called "traditionele blokverkaveling". Analogue to the metes and bounds method in the USA, this method also uses natural physical features to define property borders, creating relative small irregular pieces of land (Barends, Renes & Baas, 1991; see also Projectteam WatWasWaar.nl / Toutatis BV, 2008). The American highway system is organized and denoted in terms of cardinal directions. Contrastingly, in Europe road denotations are usually based on city names or numbers. Further, automobiles sold in America are often equipped with compasses, but in Europe compass use in navigation is quite uncommon. Altogether, these findings suggest that the cardinal system is more salient in the Netherlands than in (the Western parts of) America. It seems likely that Americans are generally more accustomed to cardinal concepts and generally make more use of cardinal descriptors than people living in the Netherlands.

This study

Interestingly, in the salience of cardinal points seem to vary for different living environments. The abovementioned study by Hund et al. (2008) tested exclusively participants from a Midwestern University. Therefore we proposed that results would differ, if conducting the same experiment with Dutch people living in an environment with less saliency of the cardinal directions. The main question examined in this study was whether abovementioned conclusions made by Hund et al. (2008) could be generalized to the Dutch population. In particular, we hypothesized that cardinal concepts are to a lesser extent present in native Dutch speakers. Therefore we proposed that Dutch participants use cardinal cues less frequently than American

native speakers when addressing wayfinding descriptions to people in survey vs. route situations.

The findings of the first experiment conducted by Hund et al. (2008) yielded that, during execution of their wayfinding description task, cardinal cues were provided relatively frequent. (see Figure 5). A direction giving study by Ward, Newcombe and Overton (1986) demonstrated that individuals massively increase the use of the cardinal directions when being alerted to the concept of cardinality. Similar effects for spatial descriptions were reported by Tversky (1996). In fact, in the aforementioned study by Hund et al. (2008) the cardinal directions were explicitly named and pointed to, prior to the start of the first experiment. This might have led to a slight bias towards the use of cardinal descriptors. This issue was adressed in our second experiment in which we asked Dutch participants to conduct an adjusted version of the wayfinding description task used by Hund et al. (2008). Having in mind the indications for less frequent use of cardinal descriptors of Dutch people, we hypothesized that not explicitly mentioning and pointing to the cardinal points prior to the experiment leads to even further reduced mention of the cardinal directions.

On the one hand, it seems likely that people living in the Netherlands are less well accustomed to the cardinal concepts. On the other hand, research employing spatial descriptions indicates that survey descriptions can be understood properly by the Dutch population and seem to be well accepted (e.g. Noordzij & Postma, 2005). A second goal of this study was to investigate whether and how Dutch participants are able to adapt their wayfinding descriptions to the (survey) perspective of their recipient. At first, we aimed to replicate the findings of Hund et al. (2008) that descriptive features used in wayfinding directions are affected by perspective of the recipient. Secondly, we proposed that, although Dutch people naturally might use less cardinal descriptors, they are well able to adapt to the perspective of the recipients of their wayfinding description. We hypothesized that our Dutch participants use different spatial language and differing descriptional strategies for descriptions to recipients who are looking at a map, compared to recipients who are driving through the town.

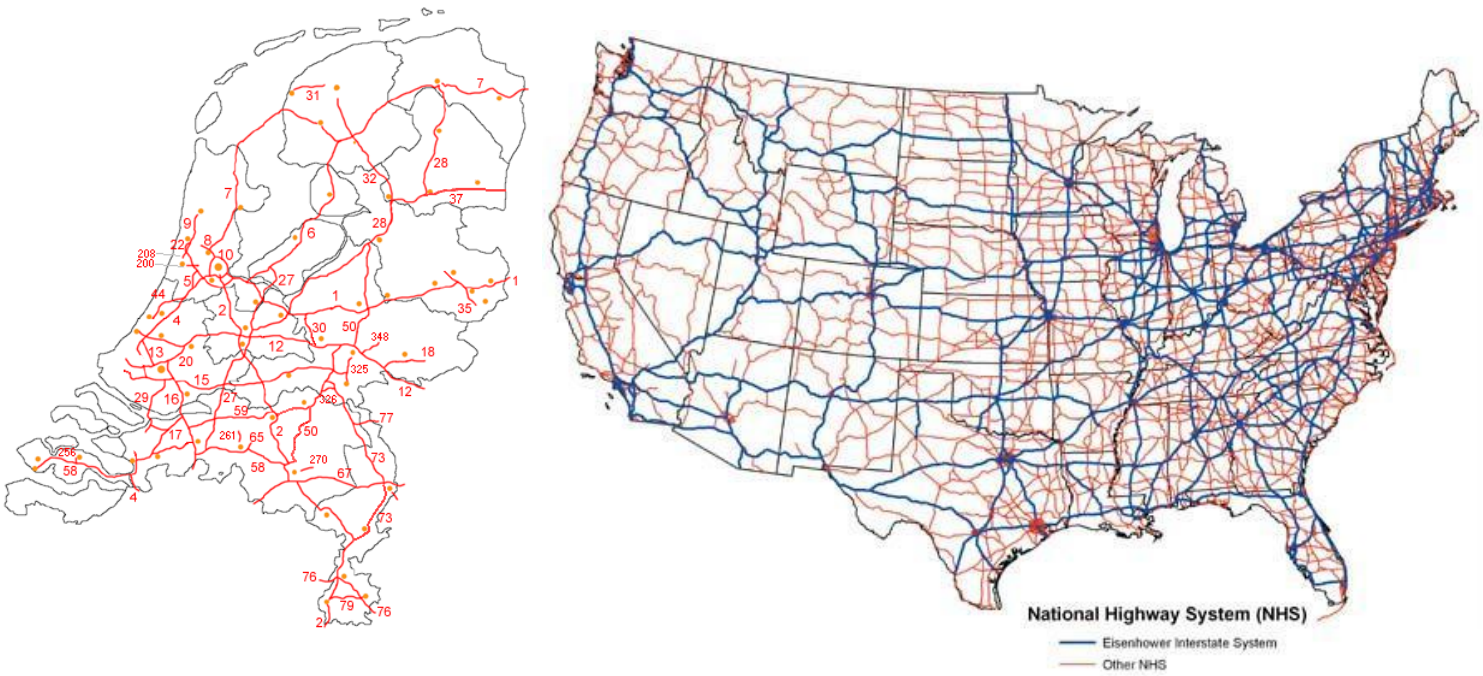

Figure 1. Overview of the Dutch (left) and the American (right) Highway system.

Method

The research study described in the present paper is the development of a previous study by Hund et al. (2008), exploring the effect of culture and recipient perspective on the frequency of providing several descriptive features in giving wayfinding directions. Experiment 1 was designed to test whether, compared to an American sample, native Dutch participants less frequently mention cardinal cues in a direction giving task.

In the study accomplished by Hund et al. (2008) participants conducted a wayfinding description task whereby cardinal points were explicitly verbally mentioned and indicated prior to the experiment. We proposed that this might have led to a bias for the cardinal system. A second experiment (Experiment 2) was conducted to assess whether cardinal descriptors are less frequently mentioned if the cardinal directions are not indicated and explicitly mentioned during introduction of the model town.

Participants

In *Experiment 1*, 30 native Dutch speaking students (14 male, 16 female) from the University of Twente ranging in age from 18 to 31 years (mean age 22) participated, as partial fulfillment of course requirements. In *Experiment 2* four male and four female native Dutch speaking participants took part, raging in age from 18 to 27 years (mean age 22,5). Four of them participated as partial fulfillment of course requirements. The other four participants participated without receiving any reward. All 38 participants gave informed consent and both experiments were approved by the local ethics committee.

Stimuli

A fictitious model town was built on a 1,20m x 2m piece of white cardboard. The town contained pictures of 17 landmarks (buildings and topographical features; e.g. hospital, park) and 29 streets, marked by purple tape and printed street names (see Figure 2). The landmarks were made using the same pictures as applied in the study of Hund et al. (2008), labeled with synonymous Dutch terms taped on top of matchboxes. The pictures were averagely sized 7,5 x 7,5 cm. Streets were labeled by Dutch street names, similar to the street names used in the American study. A red toy car was used to mark starting locations.

Stimuli applied in the two experiments are the same, except that in *Experiment 2* a compass rose (9,5 x 9,5 cm), printed in black-and-white, was placed on the left lower side of the model town to clarify the cardinal directions in the model town.

Design and procedure

Experiment 1

Prior to the start of both experiments, the model town was placed on the floor in the middle of a 22m^2 room to facilitate walking around the model. A laptop computer was positioned on a table standing next to the lower side of the model town, defined as "south side ". Participants were welcomed and introduced to the study and their personal data (gender, birth date) were checked. To familiarize participants with the model town, the four cardinal directions were pointed and noted verbally while experimenter and participant were standing at the south side of the model. Further, participants were given 30 seconds to study the fictitious town after which they completed 12 navigation giving trials diverging in recipient perspective. During 50% of the trials participants were asked to imagine giving directions to a person looking at a map of a town (using a survey perspective). During the other 50% of the trials participants imagined giving directions to a person driving in the town (using a route perspective). After the car had been placed at the starting location, perspective and destination were given verbally, and participants were asked to write down the directions they would give to someone who has to find his way from the starting location to the destination. Subjects were encouraged to sit down in front of a table on which the laptop computer was positioned; in the manner that they could most comfortably alternate between typing and looking at the model. Responses were assessed by letting participants type their answers into the laptop computer. There were no time restrictions completing the task and participants were allowed to move around the outside of the model town. The order of routes (Route trials assessed first vs. Survey trials assessed first) was counterbalanced. The assignment of trials was counterbalanced in that the first three trials of each block randomly contained one of the six route trials used in the study of Hund et al. (2008). However, to increase the power of our design, we decided to double the number of trials for each participant. The fourth, fifth and sixth trials of each block randomly contained one of 10 other newly-selected routes.

Experiment 2

For the second experiment design and procedure for the most part were the same as in the first experiment. However, to avoid a bias towards the use of the cardinal directions, unlike experiment 1, we did not explicitly mention or indicate the four cardinal directions prior to the experiment.

Data analysis

For the data of both experiments for each perspective the frequency of mentioning specific navigational features were coded. These were cardinal directions (e.g. "ten zuiden van" (in the south of)), distances, left or right, landmarks and street names (unique names used in the experiment). As in the study of Hund et al. (2008), landmarks and street names were tallied

separately. Thus, if a particular landmark or street name was mentioned twice in succession it was actually counted twice. Distance was separately coded as "distance in number of streets", "distance in number of blocks" and "distance others". Left and Right mentions included any mention the words "left" and "right" (e.g. "links" (left) or "aan de linkerkant" (to the left)). Additionally, the total frequency of each descriptive feature was calculated for each perspective for data from both experiments. Frequencies of the six descriptive features were analyzed using separate 2x2x2 repeated measure Analysis of Variance (ANOVAs) with User Perspective (Survey vs. Route) as within-subjects variable and Order (Route-Survey vs. Survey-Route) and Gender as between-subject variables for each experiment.

We intended to compare data obtained from our Dutch sample to the data of the American study. Therefore, we computed means of mention of four descriptors for the data from both our experiments based on the data obtained during the first 3 trials of each block. Consequently, we compared only those trails containing the same routes used in the American study of Hund et al. (2008). We decided not to compare any mentions of distance. In the study of Hund et al. (2008), "distance in blocks" descriptors were coded. In contrast, we coded mentioning of "distance in number of streets", as using the equivalent Dutch term of "street blocks" in general is quite uncommon in the Dutch language. Likewise, mention of "distance other" in the American study was defined imprecisely by "included all other distance mentions, such as the end of the street, a long while, etc". Along these lines, we consider this category of descriptors as not directly comparable between both studies. Unfortunately, we were not able to not use statistical means for the cross-cultural comparison, as the data obtained from the American sample were not available to us.

Further, to answer the question to what extent Dutch participants are able to adapt to the perspective of their recipient we looked for additional differences in language use between both experimental conditions. Based on the definitions of prototypical survey and route descriptions and sample descriptions by Taylor and Tversky (1996), we tallied the total use of imperatives, stative verbs ("is" bevindt zich", "zit") vs. active verbs ("gaan", rijden", "afslaan") and the frequency of referring to the addressee ("je", "jij", "jouw", "u", "uw" , corresponding to the English terms "you" and "your") for each description for both perspectives. Additionally we focused on the amount of overview information provided at the beginning of a description. All descriptions beginning with information about where the addressee is situated in the environment ("u bevindt zich nu…", "je staat nu bij…" "u rijdt richting de stad") or descriptions beginning with the mention of the target ("de rechtbank bevindt zich", "bibliotheek ligt daar [wijs aan]") relative to the environment were counted for each perspective and defined as hierarchical. Frequencies of imperative use, active and stative verb use and hierachical descriptions were analyzed using separate 2x2x2 repeated measure Analysis of Variance

(ANOVAs) with User Perspective (Survey vs. Route) as within-subjects variable and Order (Route-Survey vs. Survey-Route) and Gender as between-subject variables.

To better capture the participations' choice of perspective each description was rated as route, survey or neutral. The rating was based on earlier mentioned definitions of prototypical route and survey descriptions (Taylor & Tversky, 1996). If a description did not include any survey features and was most likely to be given to someone in a route perspective it was coded as route descriptions. If a descriptions included any typical survey features and was likely to be provided to someone using a map it was coded as survey description. Descriptions which were difficult to classify (e.g. due to missing verbs) were coded as a neutral descriptions.

Figure 2. Model town from bird's eyes view as used in Experiment 1.

Results

Experiment 1

The analysis of ***cardinal direction*** frequency yielded a significant main effect of Perspective ($F(1, 26) = 10{,}99$, $p = .003$) but no other significant effects (all Fs < 3.04, ps > .093). Participants included cardinal descriptors significantly more often when addressing a person looking at a map compared to addressing someone driving in a car. The mean frequencies of mention of the descriptional features for each condition are depicted in Table 1. Participants mentioned ***landmarks*** significantly more frequently in the survey condition than in the route condition ($F(1, 26) = 6.386$, $p = .018$). For another, a significant interaction effect of Perspective x Order ($F(1, 26) = 5{,}73$, $p = .024$) was obtained. When route descriptions were obtained first (Route-Survey), landmarks were more frequently mentioned in the survey condition compared to the route condition, while this difference was comparatively small when survey trials were obtained first (see Figure 3). The Analysis of frequency of mentioning ***street names*** revealed a significant main effect of Perspective ($F(1, 26) = 7.48$, $p = .011$). Participants included streets names significantly more frequently when addressing to someone looking at a map compared to addressing someone driving in a car. We also yielded a significant interaction effects of Order x Gender ($F(1,26) = 5.43$, $p = .028$). When route descriptions were assessed first (Route-Survey), males mentioned street names significantly more often (M = 16.93, SE= 3.32) than females (M = 8.19, SE = 3.11). In contrast, when descriptions provided to recipients in survey situation were assessed first (Survey-Route), streets names were more frequently mentioned by women (M = 14.19, males: M = 7.93). With regard to the use of ***left and right*** cues, there was a significant main effect of Perspective ($F(1,26) = 4.70$,$p < .05$). Giving directions to a recipient in the route condition, participants mentioned left/right descriptors more frequently compared to the survey condition. The effect of Order on naming of left /right descriptors was marginally significant, ($F(1, 26) = 4.05$, $p = .055$). ***Distance mentions in number of streets*** were relatively frequent. Perspective had a significant effect on the frequency of mentioning descriptors of distance in no of streets ($F(1,26) = 6.27$, $p = .039$). Distances in number of streets were more often mentioned to addressees in route situations than in survey situations. Comparison of ***distance other*** descriptors did not yield any significant effects (all Fs < 2.74, ps > .11).

Experiment 2

In the second experiment, cardinal descriptors were not mentioned at all; neither for survey, nor for route perspective (see Table 1). Probably due to lack of statistical power, results of the repeated measures ANOVA did not yield any significant main effects of Perspective (all Fs < .329, ps >0.59). Significant interaction effects of Perspective x Order ($F(1,4) = 17.02$, $p = .15$) and Perspective x Gender ($F(1,4) = 12.30$, $p = .025$. We only discussed results if these were meaningful to answering our hypothesis.

Table 1

Mean frequency of mention of six descriptive features during six experimental trials for each recipient perspective. Standard error is listed in parenthesis

Descriptive Feature	Experiment 1 Perspective		Experiment 2 Perspective	
	Route	**Survey**	**Route**	**Survey**
Cardinal	0.19 (.20)	3.75 (1.12)	0.00 (.00)	0.00 (.00)
Distance (No of streets)	11.84 (.69)	9.40 (1.01)	8.50 (2.03)	8.38 (2.27)
Distance (Other)	6.33 (.74)	5.49 (.58)	6.88 (.93)	6.88 (.84)
Left / Right	23.81 (.65)	20.79 (1.15)	24.25 (.85)	22.75 (1.96)
Landmark	6.09 (.62)	7.45 (.82)	7.50 (.75)	8.13 (.91)
Street names	10.57 (1.58)	13.05 (1.05)	12.00 (4.60)	12.50 (5.02)

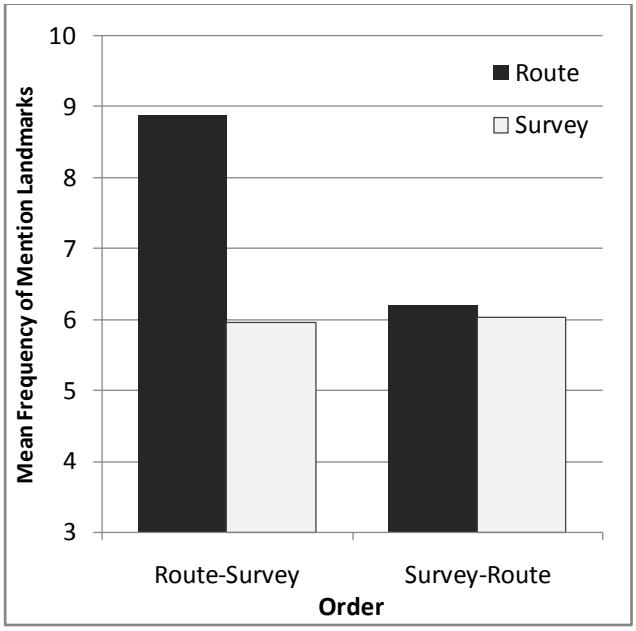

Figure 3. Mean frequency of mention of landmarks in the first experiment for the route and survey condition for different orders of condtion.

Qualitative Cross-cultural Comparison

To bring the data obtained from our Dutch sample together with the data of the American study, we included only the data obtained during the first 3 trials of each block. Consequently, we compared only those trails containing the same routes as had been used in the American study of Hund et al. (2008). Results can be seen in Figures 4 and 5.

In contrast to the American sample, Dutch participants mentioned less cardinal descriptors in both perspectives and more left-right cues in the survey perspective. Compared to the data of Hund et al. (2008) we obtained less overall mention of street names, whereas landmarks were mentioned more often. Further, in contrast to the American sample, we yielded a significant effect of Perspective on mention of street names and the direction of main effect Perspective on landmark use reversed.

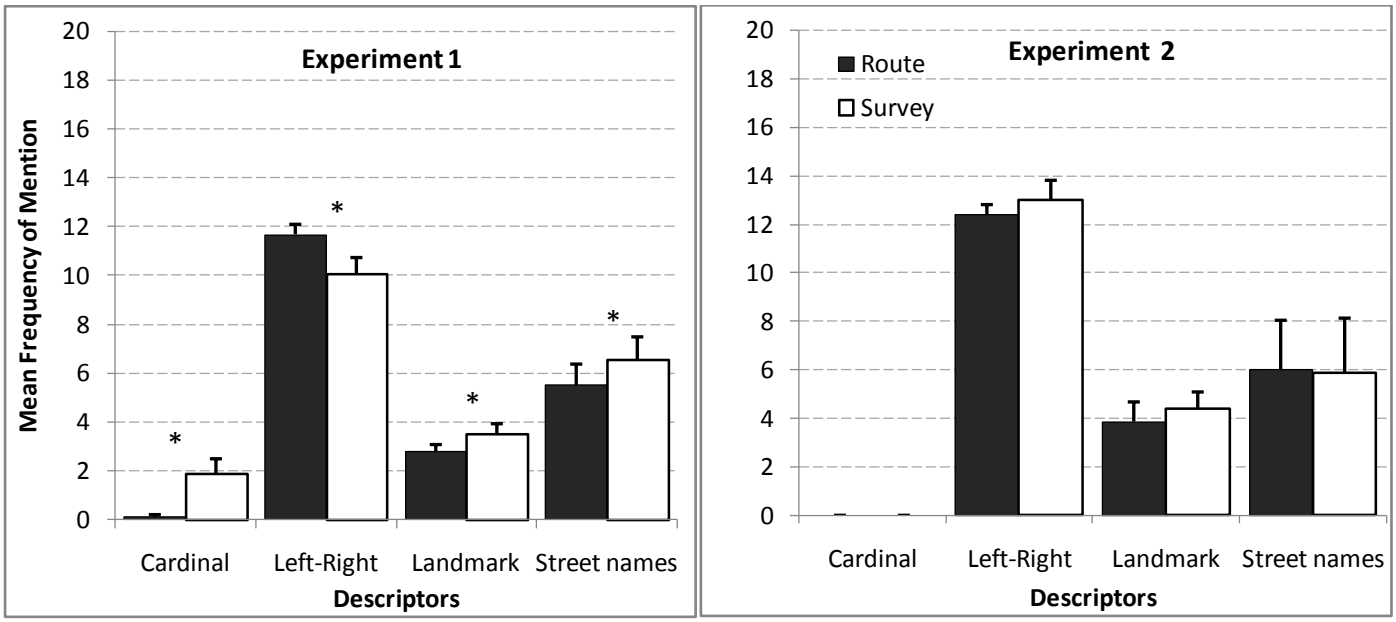

Figure 4. Mean frequency of mention of four descriptive features in the first three trials of Experiment 1 (left) after explicit mentioning of cardinal directions during instruction phase and Experiment 2 (right) where cardinal directions had not explicitly been mentioned beforehand. Based on a model town, Dutch participants provided wayfinding directions to recipients either adopting a route or survey perspective. Asterisks denote significant effects across Perspective ($p < .05$) from repeated measures ANOVA.

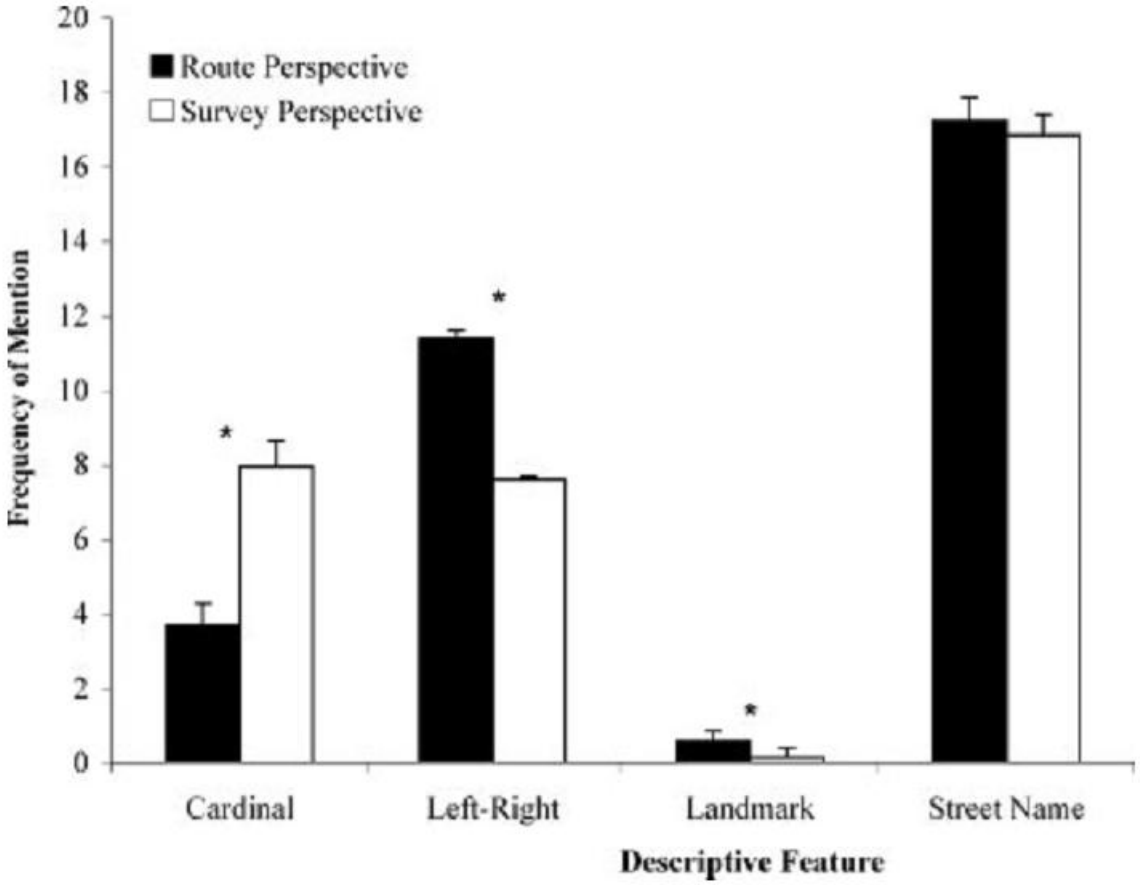

Figure 5. Mean frequency of four descriptive features in wayfinding directions through a model town. 64 American participants were tested, adopting each of two recipient perspectives (study Hund et al. 2008)

Perspective Taking

We found a significant difference in the amount of overview information provided at the beginning of the description for Perspective ($F(1,34) = 8.49$, $p = .006$). Giving information to a referent in the survey perspective, participants made more use of hierarchical information in the survey perspective ($M = 1.24$, $SE = 0.36$) compared to the route perspective ($M = 0.38$, $SE = 0.23$).

Statistical comparison of the use of imperatives did not yield any significant results (all Fs < 3.24, ps > .084), neither did the analysis of frequency of mention "you"/"your" (all Fs < .49, ps > .489). Regarding the verb use, we did not find any effects for the analysis of frequency of active verb use (all Fs < 2.12, ps > .157). In contrast, we did find a significant main effect of Perspective on the frequency of stative verb use ($F(1,34) = 5.42$, $p = .026$). Participants mentioned stative verbs more frequently in the survey condition ($M = 5.35$, $SE = 0.61$), compared to the route condition ($M = 3.82$, $SE = 0.54$), whereas a significant interaction effect of Perspective x Order ($F(1,34) = 5.07$, $p = .031$) indicates that stative verb use does only differ between both perspectives when route trials were obtained first (see Figure 6).

Results of the coding yielded that descriptions provided to participants in the Survey condition were more likely to be coded as survey descriptions. Results can be seen in Table 2.

Examples of descriptions, each rated as route, survey or mixed can be seen in Table 3.

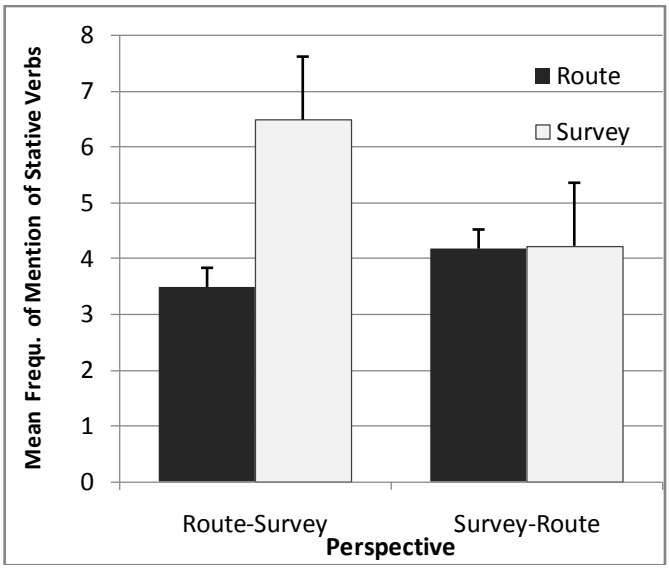

Figure 6. Frequency of mention of stative verbs in both experiments for both different recipients` perspectives.

Table 2. Ratings of descriptions provided for two different recipient perspectives

	Rating		
Perspective	Route	Survey	Neutral
Route	177 (78%)	8 (3%)	43 (19%)
Survey	154 (62%)	40 (16%)	53 (22%)

Table 3. Example descriptions for each recipient perspective

Route Perspective	"Rij net zo lang rechtdoor tot je niet meer verder kunt, vervolgens ga je daar met de weg mee naar links, rechts en daarna weer links. Rij deze weg helemaal uit en sla aan het eind linksaf en dan meteen weer rechtsaf. Ga nu bij de tweede afslag links en dan ziet u de bank aan uw linkerkant."
	"Neem de eerste straat links en de tweede straat rechts. Vervolgens weer de eerste links en daarna de derde rechts. Op een gegeven moment zie je aan de rechterkant het postkantoor."
	"Deze straat uitrijden en aan het einde van de straat rechts, Hier alsmaar rechtdoor rijden en dan neemt u de derde straat rechts en dan vindt u aan het einde van de straat de fitneszaal aan uw linkerkant."
Survey Perspective	"U bevindt zich nu hier op de Klerkstraat, de fitnesszaal bevindt zich daar niet al te ver in oostelijke richting. Ga meteen links en vervolgens weer rechts via de Wilsenweg."
	"De bibliotheek ligt daar (wijs aan). Je kunt het beste rijden: eerste straat rechts. einde van de straat naar links. meteen weer naar rechts. meteen weer naar links. eerste straat weer links. einde van de straat naar rechts. en weer naar rechts."
	"Rechtdoor tot aan het eind vd straat, Penninglaan rechtsaf, rij omhoog en links de Divisiestraat op, dan rechts de Wilsenweg volgen en weer rechts de Eikstraat op."

Discussion

This study demonstrated differences in the manner of giving wayfinding descriptions between western cultures. Testing American participants providing wayfinding descriptions to addressees in route and survey situations, Hund et al. (2008) found a significant effect of referent perspective on the mention of several wayfinding descriptors. We replicated these findings with native Dutch speakers.

Main research questions

Results of both of our experiments confirmed that while providing wayfinding descriptions, native Dutch speakers less frequently use cardinal descriptors than American native speakers do. Conducting the second experiment, one participant was thinking out loud about how to adapt descriptions to a recipient in the survey condition. After thinking a while, it did not come to his mind to make use of the cardinal directions. This provides anecdotal support for the notion that *for Dutch people cardinal concepts are to a lesser extent present than for Americans* (see the text below for further discussion). Additional support for this claim was provided by the results of Experiment 2. Not explicitly mentioning and pointing to the cardinal points prior to the experiment resulted in no mention of the cardinal directions at all as. Altogether these facts indicate cross-cultural differences between western countries in the salience of cardinal concepts. Unfortunately, we did not have the corresponding data available to test this claim by statistical means.

Further, results of Experiment 2 strengthen our assumption, that being alerted to the concept of cardinality increases the frequency of mention of cardinal descriptors. Inquiring participants after finishing the experiment about whether and how they made differences between both experimental conditions most of them could not explicitly name any differences in their descriptions. This suggests that adaptations were not the result of deliberate strategies. However, during the first experiment some participants explicitly asked whether they were supposed to use cardinal descriptors in the survey condition. These incidents provide additional support for the findings that *alerting participants to the cardinal system can lead to a bias towards the use of cardinal descriptors.* Further studies on direction giving should take this into account.

Thirdly, we asked whether Dutch participants, although not using the cardinal direction as frequently as Americans do, nevertheless are able to adapt their wayfinding descriptions to the perspective of their addressee. Ratings of descriptions, significant differences in verb use and differences in the amount of hierarchical information provided for both experimental conditions provided evidence for this proposition. Main effects of the referent's perspective on the frequency of mention of several descriptors provided additional support for the notion that

individuals are able to flexibly adapt to the situation of their recipients and thereby contributing to successful wayfinding. These findings match with earlier findings of Hund et al. (2008). In consistence with their results we were able to confirm that cardinal descriptors are more likely to be provided to people in survey situations (e.g. when looking at a map or standing at a high point in space) whereas left and right is more often mentioned to people in route situations (e.g. moving through the environment). Although there is evidence for differences between written and oral conversations (Chafe & Danielewicz, 1987; Ellis & Beattie, 1986) more applied wayfinding research of Hund et al. (2008) confirmed that these findings can be generalized to verbal direction giving in everyday settings with familiar, large-scale environments.

It seems that Dutch people yet are able to adapt to their descriptions to the referent's survey perspective without the use of cardinal descriptors. For instance, one participant used "rij naar boven" ("go up") instead of "go north". Here an intrinsic frame of reference is used, as the direction is given related to the referent's body, typical for the route perspective. Nonetheless the describing person could have imagined the scene from above, taking a bird's eyes view (which is typical for the survey perspective). These notions weaken the idea of a distinction between prototypical route and survey descriptions. Portraying the "overwhelming evidence for mixed perspectives" Tversky, Lee and Mainwaring (1999) propose that reference frames could be adopted as fragments, rather than as a whole and that it might be necessary to deconstruct the notion of reference frames for speakers as well as for perceivers. Our results are in line with this proposal, as we noticed that participants also mixed elements of route and survey descriptions in their wayfinding directions (e.g. by first describing the position of their addressee in the model town and continuing the description with a mental tour).
The fact that participants were able to manage adaptation to the survey perspective of their addressees, although the task of providing route descriptions strongly implies the concept of a mental tour, supports the idea of the flexible adaptation of reference frame as "fragments".

Other effects

Surprisingly, in our study Dutch participants mentioned landmarks significantly more frequently in survey situations than in route situations. Quite the reverse had been found in the comparable American study (Hund et al., 2008). Our results are in consistence with previous findings from America that in spatial description giving, the presence of landmarks reduces the likelihood of taking a personal viewer-centered frame of reference (associated with the route perspective; Tversky, 1996). Findings of Taylor and Tversky (1996) yielded that in spatial descriptions, landmarks are more likely being used as reference objects in survey decriptions rather than in route decriptions, but the percentage of landmark-relational terms did not differ between typical route and survey descriptions (both about 12%). In wayfindings descriptions, landmarks could either be used as external reference objects in line with the survey perspective

or as orientation points in a mental tour in line with the adaptation of a route perspective (e.g. Taylor & Tversky, 1996; Pederson, 2003). Regarding our study, it was noticeable that Dutch participants predominantly used landmarks at the beginning or at the end of their descriptions, possibly to provide information to their referents about their position in the model town (by adapting a bird's eyes view) and at the end of their descriptions to inform referents about having reached their destination (more in line with a mental tour). This is in consistence with a previous study on landmark use in direction giving, indicating that landmarks are more frequently used at specific reorientation points of a route (Michon & Denis, 2001). Taking into account the inconsistent findings, we speculate that landmark use might not necessarily be associated with the preference of one specific perspective.

Compared to Americans, for Dutch people the overall use of landmark descriptors was higher and the overall use of street names was lower. There is evidence that people are more likely to mention landmarks in route descriptions rather than route directions (Klein, 1983). This raises the question whether slight differences in interpretation of the task due to lexical differences in instructions might be a possible explanation for differences in overall use of landmarks between the two samples. Further, for this study American street names in the model town were translated into Dutch with the aim of providing names of similar length, meaning and similar spelling. Probably some of these translations were unfamiliar and inconvenient to write down. Therefore we propose that the lesser extent of street name use in our Dutch study, compared to the American study, might be due to methodological limitations. Further wayfinding studies with Dutch participants should take this into account by providing common Dutch street names.

In this study in all trials and conditions a car was used to mark starting locations. Two of our participants, doing the survey condition first, asked whether the fictitious person looking at a map was sitting in the car as well. Perhaps the recipient's situation in the survey condition was less clear when survey trials were obtained first, prior to the route trials. This might be a possible explanation for interaction effects with the order of conditions (route vs. survey perspective) obtained in this study. After having conducted our experiment, one participant mentioned that he did not immediately notice the change in instruction. Schober (1993) found that speakers were less likely to adopt their addressees' perspectives in an interactive situation than when their addressees were absent. Perhaps in further research using the same task one should consider the use of short video sequences to introduce changes in perspective of referents.

Cultural diversity and spatial cognition

How can the apparent differences in salience of cardinal concepts between the Americans and the Dutch people be explained? Two opposing views provide several explanations. On the one hand the Whorfian Hypothesis (Whorf, 1954), applied to the domain of spatial cognition, states

that differences in spatial language between cultures affect their non-linguistic concepts of space. Earlier mentioned findings by Levinson (1996b) and Pederson et al. (1998) support this view, by emphasizing that the lack of certain terms of references restricts the use of the corresponding frame of reference. Accordingly, compared to the Americans, the Dutch would make less frequent use of absolute frames of reference, and in particular of the cardinal concepts, because these words are less available in their language. In line with this, Majid (2002) supposes that habitual language use does influence spatial cognition by changing people's mental representations of the environment (Majid, 2002; Majid, Bowerman, Kita, Haun, & Levinson, 2004). Language experience can determine whether more or less attention is directed to particular features in the environment and this "perceptual tuning" (Goldstone, 1998) can influence the formation of categories and concepts about the environment (Majid et al., 2004). So, do Dutch people less frequently use cardinal concepts and descriptors because they are less sensitive to cardinal words and their attention is less focused on corresponding features? In the introductional part we already mentioned that Dutch and English spatial terms differ. Thus Dutch people, compared to the Americans, probably have developed differing representations of space and therefore provided less cardinal descriptors.

On the other hand, in line with earlier discussed findings of Lawton (2001), several authors argue against the Whorfian hypothesis. Gallistel (2002a) argues that because humans share common sensory and perceptual features, all brains should encode spatial relations in the same way. Steven Pinker claims that distinctions in cognition arise prior to the evolution of language and that language is an inborn instinct. He believes that language is a skill evolved through natural selection for biological adaptation to complex living environments (Pinker, 1994; Pinker & Bloom, 1990). Evidence is presented that the linguistic influences on spatial perception reported by Pederson et al. (1998) were confounded by environmental and cultural factors (Li & Gleitman, 2002; Bloom & Keil, 2001). Environment might shape both language and cognition and can differ in several aspects. For instance, there are urban vs. rural environments, open terrains vs. dense forests and these environments more or less facilitate mobility (Brown, 1983; Li & Gleitman, 2002). Further, differences in habitual actions between societies might (Gallistel, 2002a, 2002b). intervene the relation between language and cognition. Other mediating effects between language and cognition might be cognitive styles as individualism and cognitivism (Greenfield, Keller, Fuligni & Maynard, 2003).

So, do Americans so often orient objects with respect to the cardinal directions because they so often refer to the cardinal descriptors in their everyday speech (e.g. "south bedroom", "south avenue")? Or are cardinal descriptors more salient because the cardinal system is so often the relevant frame for their actions (e.g. to orient oneself towards the Rocky Mountains)? We propose that in this study, both factors, linguistic as well as environmental aspects contributed to the results. Much of the research on this issue focuses on differences in linguistic and

environmental factors between western and non-western societies. Thus clearly further research has to be done to clarify differences in spatial cognition *within* western societies.

Further Research

Further research has to be done, directly comparing direction giving behavior from a Dutch and an American sample, to confirm cross-cultural differences in direction giving by statistical means. It would be interesting to directly compare whether and how American and Dutch people, adapting to listeners in route and survey situations, differ in further several aspects of language use typical for route and survey perspective.

It would be interesting to further examine the relation between the presence of cardinal concepts on the one hand and the likelihood of adapting specific reference frames (or "fragments") on the other hand. In particular, one interesting research question would be whether Dutch people and Americans differ in their preference for environment vs. body related frames of reference. These questions should be examined using nonverbal assessment methods, for example in virtual reality (see e.g. Mou, Biocca, Owen, Tang, Xiao & Lim, 2004).

To asses the question to which amount environmental aspects influence the saliency of cardinal concepts in Western societies, one could compare the performance of American and British people in several spatial tasks. Another possibility would be to further investigate factors contributing to differences in spatial cognition between Americans in several parts of America (e.g. urban and rural regions). To account for the linguistic influences on cardinal concept use, one could compare spatial performance between Americans living in the Eastern parts of America in regions with less gridlike street patters with performance of Dutch people.

Our findings put a new complexion on the vast majority of results of the present psychological and linguistic research on wayfinding and spatial description giving which bases on the assumption of alikeness within western society. Based on our findings one could go one step further and test whether Americans not only make more use of cardinal descriptors but also are generally more accustomed to handle with survey-like concepts and corresponding instructions than people living in the Netherlands. Confirmation of this claim would have strong implications for research on spatial cognition in psychology, as this generally proceeds from the assumptions of equal spatial functioning between cultures of western societies (e.g. Herskovits, 1986; Freksa, Habel & Wender, 1998). Further, the ergonomic question can be raised whether products involved in navigational task should be adapted to people less used to cardinal concepts. This could have practical implications for the design of navigation systems, travel guides or emergency aids.

To sum up the findings of the present study, although Dutch people are able to perceive and process cardinal information, the cardinal concept seems to be less present for Dutch people than for Americans. Which role linguistic and environmental aspects play still has to be clarified.

Dutch people are nonetheless able to flexibly adapt to the needs of their addressees during direction giving underlining the evidence for flexible reference frame adaptation.

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