

Narratives of Space, Time, and Life

BARBARA TVERSKY

Abstract: The mind constructs narratives from what would otherwise be chaos. Narratives viewed minimally—at least two temporally ordered events—are revealed in the way people talk about space and time. Narratives replete with a voice, causality, and emotion are reflected in the stories people tell about their own lives, stories that, as acknowledged by their tellers, distort the details around 60% of the time, but, according to their tellers, distort the ‘truth’ far less often.

Life is happening all at once, all the time; everywhere, noise, light, smells from all directions, stimuli from without and from within. Where am I, what is around me, where have I been, where am I going? What am I doing, what is happening around me? Our experience of coherence belies that chaos. Out of the stream of sensation, the mind carves objects in space and actions in time, and configures objects into scenes and actions into events. If narrative is taken in its minimalist sense as a representation of at least two events with a temporal ordering between them (Wilson, 2003), then maintaining awareness of space and time entails creating a minimalist narrative from the continuous ubiquitous multimodal barrage of sensation. Some regard the minimalist view of narrative as too inclusive, encompassing what might better be called description or explanation. They require narrative structure to have causal relations or narrative voice or demand narrative content to include character or emotion (e. g. Bruner, 1986; Oatley, M.S.). Here, drawing primarily on our own research, I first characterize the kinds of minimalist narratives that people create for space and time, and then turn to fuller narratives, the stories people tell others from their lives.

Space

Perspective

Space surrounds us, omnipresent. Yet narratives are linear: like attention, they take things one after another. How do we arrange the things in space into a coherent

Thanks are due Sam Guttenplan, Maria Black, and Greg Currie for guidance and suggestions on the manuscript. I am also indebted to my collaborators on the research reviewed, Holly Taylor, Jeff Zacks, Gowri Iyer, Bridgette Martin, Beth Marsh, Nicole Dudukovic, and Danny Oppenheimer. Portions of the work were supported by grants Office of Naval Research, Grants Number NOOO14-PP-1-O649, N000140110717, and N000140210534 to Stanford University

Address for correspondence: Psychology Department, Jordan Hall, 450 Serra Mall, Stanford University, Stanford, CA 94305, USA.

Email: bt@psych.stanford.edu

linear structure? It has been put forth that a natural way to impose a linear structure on parallel space is to use the perspective of experiencing space, that is, traveling through it (Levelt, 1989). Consistency of perspective is also presumed to be necessary for construction of a mental spatial framework in which to place each object or landmark. The inspiration for this analysis came from a study in which New Yorkers described their flats (Linde and Labov, 1975). Speakers took their listeners on mental tours or *routes* of their flats, describing each successive object or room from the traveler's changing viewpoint, in terms of the traveler's intrinsic reference system, left, right, front, and back. Here is an example from our corpus, a route description of a convention center: 'You walk through the entrance and there is a H₂O fountain on your left and a personal computer store to your right. Next to the H₂O fountain along the wall is a bulletin board. Across from the bulletin board are Movie Camera and 35 mm Camera Stores. After you pass the bulletin board (on your left) and Camera Stores (on your right) there is an office in the back of the building in the left hand corner' (Taylor and Tversky, 1992a). If they peruse tourist guidebooks, aspiring travelers will indeed find route descriptions of the places they are considering visiting.

But prevalent in tour guides is another kind of spatial description, another way of linearizing space, one we found frequently when we asked people to describe a variety of spaces, indoor and out, large and small, learned from exploration or from maps, namely, a *survey* perspective (Taylor and Tversky, 1992a; 1996). In a survey perspective, speakers describe an environment from a stationary viewpoint above the environment, locating landmarks with respect to one another in terms of an extrinsic reference system, typically north-south-east-west. Here's an example from our corpus: 'This is a map of a small town bordered on the north by the White Mountains and on the west by the White River. Two major roads intersect in this town. Mountain Road is the North-South road, and this is on the eastern side of the town. River Highway is the east-west road and it is on the southern side of town. The roads intersect at the southeastern corner of the town. At this intersection, there is a gas station and a restaurant. The gas station is on the northwest corner of the intersection. The restaurant is on the northeastern corner'. A survey perspective is in fact another natural way of experiencing an environment, from a height. There is a third description perspective, found infrequently, a *gaze* perspective (Ehrich and Koster, 1983) obtained from a single unchanging viewpoint looking onto an environment, notably from a doorway onto a room. This is also a natural way to perceive an environment. Gaze perspectives are a hybrid; like a route perspective, the spatial relations are relative to a viewer and like a survey perspective, the point of view is constant. In a gaze perspective, landmarks are described relative to each other from the viewer's stationary point of view in terms of the viewer's left, right, front, and back. So, to describe van Gogh's bedroom from the entrance, I would say that to the right is a bed. To the left of the bed is a small chair. To the left of the chair is a night table, and in front of the night table, farther to the left, is another chair. The 'rights' and 'left' are with respect to the viewer at the room's entrance. Gaze descriptions are used only when

an entire scene can be viewed from one position. Larger environments, ones that cannot be viewed from a single viewpoint, are described with route or survey perspectives.

It is curious that a route perspective conforms to the broad sense of narrative as a representation of at least two events linked in time, but that a survey perspective may not. In a survey perspective, there are declarations but not events, and the links are spatial, not temporal. Yet, it is notable that although space is static, it is so frequently described dynamically, as if the listener were traveling through it, imposing a temporal order on relations that are stationary. Turning space into time, adopting a route rather than a survey perspective, is all the more noteworthy as the tours are imaginary and constructed and most of the environments described were learned from maps. Levelt's intuition that spaces would be described from a perspective of experiencing space was correct in general, but spatial experience has more possibilities than the route perspective he considered. Nevertheless, it does not seem to be perspective that confers coherence to spatial descriptions. A second finding, described below, revealed that conceptual organization of environments prior to assigning perspective provides coherence to spatial descriptions and linearizes them as well.

Organization of Spatial Mental Models

The first surprise in the data was that descriptions took survey as well as route perspectives. A second surprise was that more than half the descriptions switched perspectives, often mid-sentence, usually without signaling. Here is an example from our corpus: 'As you enter the amusement park, you come from the west. . . . As you enter straight in, there is a central area which has restrooms, a ticket booth, and first aid. From this central area, 3 main "roads" extend, one to the north, one to the southeast, and one south and west. The north road takes you to the Arctic North. The road makes a loop around a center area in the Arctic North which has a popsicle stand (on the SW corner of the center), a Bob's Burger Stand, on the east side, and restrooms on the NW (I think) of the center. Following the loop around westwardly, you will arrive at the blizzard roller coaster, extending north as you enter the Blizzard area, first you will find a ticket stand, then the area where you wait in line, then furthest north, the actual coaster. . . . The lobby is to the right, the round arena is to the left'. Despite inconsistency of perspective, the descriptions that mixed perspective were as comprehensible to another group of participants as those that did not. A consistent perspective, then, is not needed to establish a coherent mental spatial framework.

How is it that descriptions that mix perspective are easily comprehended? Scrutiny of the descriptions revealed consistency from a different source. Irrespective of description perspective, for each environment, the landmarks were ordered in the same way. This suggests that order of mentioning landmarks is determined prior to selecting a perspective. The similarity of order across participants indicates systematicity in selecting order of mentioning landmarks. In fact, the order of

describing was hierarchical, that is, certain landmarks, the more prominent ones, of each environment were described before others. The nature of the hierarchy depended on characteristics of the environments. When an environment had an entrance or natural boundaries, those served as starting points. When an environment had clusters of landmarks related spatially or functionally, these were described together. A default organization was reading order, starting northwest and ending southeast. For describing environments, then, a linear path does serve as an organizer; however, the path need not be a route through the environment, and the path can be conveyed by either survey or route perspectives. The organization of an environment, spatially or functionally or both, forms the structure underlying the spatial narrative, and precedes selection of perspective. Perspective serves to communicate the spatial links among the landmarks. In that way, spatial perspective provides a rudimentary narrative voice.

The fact that order precedes perspective also suggests that mental representations of the environments are perspective-free. There is evidence for perspective-free representations of at least small, well-learned environments from memory and reaction time as well (Taylor and Tversky, 1992b). In those experiments, participants learned environments from descriptions with survey or route perspectives. Participants were then tested on questions from both route and survey perspectives. Some of the questions were drawn verbatim from the text; others required inferences from information in the text. Participants were faster and more accurate at verbatim questions than inference questions, suggesting that these can be verified from memory for the wording of the text. For inference questions, participants were as fast and accurate for the perspective they didn't study as for the perspective they did study, indicating that inference questions were verified from a mental model of the environment, and that the mental models were perspective-free. Analogous to an architect's model, or an actual scene, the mental models have no inherent perspective, but can be described from several. One might say the same for narratives in the more focal sense, that the events are first organized, not necessarily in strict temporal order, and then related from one or more perspectives, or narrative voices. Let us turn now to examine how actions in time are structured into narratives.

Events

If description often imposes a temporal order on static space, might the converse occur for time? Might description freeze time as a sequence of static scenes? Some suggestion of this comes from nouns derived from verbs, states from processes; certain noun constructions are designed just for that—addition, submission, coronation, exoneration. To uncover the determinants of event segmentation, we filmed a set of ordinary events rated as familiar (making a bed, doing the dishes) or unfamiliar (fertilizing a plant, assembling a saxophone) (Zacks, Tversky, and Iyer, 2001). Participants watched these films, pressing a button every time, in their

judgment, one event segment ended and another began. They did this twice, once at the coarsest level that made sense, and once at the finest level that made sense, in counterbalanced order. Some participants described what happened in each segment after they pressed the button.

Hierarchical Structure

One question of interest is whether event segmentation was hierarchical, that is, whether the coarse unit boundaries coincided with fine unit boundaries more often than expected by chance. It could be that coarse units were segmented top-down, conceptually, by goals, and fine units segmented bottom-up, perceptually, by large changes in perceived activity, and that changes in goals and changes in activity might not coincide. In fact, segmentation was hierarchical both within participants and across participants. This indicates that, as for objects, large perceptual changes correlate with and serve as cues for changes in function, goals and subgoals in the case of events. A second question of interest is the effect of describing on hierarchical structure. Describing while segmenting imposes two tasks on participants; two tasks might overload participants, yielding sloppier segmentation, lowering hierarchical alignment. However, the effect of describing was to increase hierarchical alignment considerably, a larger effect than familiarity. Describing appeared to call attention to goals, providing a more meaningful basis of segmentation than large changes in activity.

Foundations of Segmentation

The content of the descriptions gave insight into the foundations of event segmentation at both coarse and fine levels. Ninety-six percent of the descriptions were actions on objects. The remaining 4% described the actor entering or exiting the scene. At the coarse level, each segment tended to involve a different object or object part; the verbs used tended to be general, and the nouns specific. Here is part of one person's descriptions of making the bed: 'walking in; taking apart the bed; putting on the sheet; putting on the other sheet; putting on the blanket . . .'. At the fine level, each segment tended to entail a different action on the same object or object part; the verbs tended to be specific and the nouns general. Here is the same participant's description of putting on the bottom sheet: 'unfolding the sheet, laying it down, putting on the top end of the sheet, putting on the bottom, straightening it out'. Coarse and fine units differed qualitatively. Yet another group of participants who described the events of the film after viewing the film, from memory, described them in much the same way as those who described them while watching, a sequence of actions on objects. In both observation and in memory, the events are described as a series of causally related actions, subgoals that together achieve a larger goal.

At first it may seem odd that objects segment events. Many are artifacts. Yet it is hard to think of events that don't involve interacting with objects. Interestingly, objects segment events for primates (Byrne, 1999) and for infants (Woodward,

1998) as well. Together, these findings suggest that actions on objects organize event segmentation because each subsequent object or object part is accompanied by changes in goals and subgoals that in turn, entail changes in physical activity. The changes in physical activity accompanying actions on objects mark serve as clues for changes in goals. More insight comes from research on segmentation of unfamiliar, ambiguous events, activities of geometric figures in rudimentary scenes (Martin and Tversky, 2003). The films were constructed according to a script, either a confrontation between two triangles and a square or else a game of hide-and-seek. When first viewing films of these events, participants form a greater number of smaller segments, and describe changes in motion rather than intentional actions. After viewing the films 5 times and writing a narrative of the events, participants segment at the same places forming the same units, but fewer of them. Although the same units are discerned with experience, they are interpreted differently, as intentional actions on objects, not simply actions. With experience, then, viewers come to describe (and probably see) the films not as a sequence of actions, but rather as a series of causally related intentional events.

The simple, mundane events that fill our lives can be reliably segmented. At a coarse level, the segments are punctuated by objects or object parts; each new segment corresponds to interaction with a new object or object part. At the fine level, segments are punctuated by articulated actions on the same object or object. In both cases, the actions are described as actions on objects, goals or subgoals completed. A stronger sense of narrative, then, accompanies experience with events, one based on causal sequence rather than temporal sequence. Now we turn to research on narratives in the full sense, narratives with voice, with character, with emotion, the stories that people tell others about their own lives.

Retelling our Lives

Teller of Stories

People talk. One of the things people like to talk about is what happens to themselves and others. To characterize the stories people spontaneously tell others about their own lives, we asked undergraduates to keep track of the stories they told others over several weeks (Marsh and Tversky, in press). For each story, students recorded the gist of the story, the audience for the story, their purpose in retelling the story, the intensity of the event, and the valence, positive or negative, of the event. They also recorded whether they had distorted the story in any way, by adding information, exaggerating information, minimizing information, or omitting any important detail. Finally, they were asked if they had misrepresented the events. Although most of the stories were told to friends, a few were told to family, teachers, or employers. Most of the stories were told to inform (58%) or to entertain (38%). Most of the stories were of recent events, things that had occurred within the previous week, primarily social events (33%) followed by academic events (17%), the rest miscellaneous. Most events were rated

as emotional, intense or very intense, half positive, half negative. Stories were retold 2.7 times on average. None of this is surprising, nor that the content was typically banal, though some stories were powerful—successes, failures, embarrassments, humiliations, triumphs, arguments, intrigues, romantic adventures.

The surprising findings concerned the distortions. By their own admission, students added, omitted, exaggerated, or minimized information in at least 61% of the stories they retold, sometimes altering a story in more than one way. Distorting seems to be the norm, not an aberration. In spite of this (or perhaps because of it), students acknowledged misrepresenting the information only 42% of the time. Story-tellers (that's us) allow themselves some license to embellish what they acknowledge to be true; nearly half the stories they tell are distorted according to the story-tellers. The most common alteration was omitting important details; omissions were reported for 36% of the stories. Exaggerations were reported for 26% and minimization for 25%. Only 13% of the stories were reported to contain information that was not part of the original event.

The purpose of telling the story had impressive effects on the pattern of distortions. Stories told to convey information tended not to exaggerate, but did tend to minimize and to omit important details. Stories told to entertain had a mirror-image pattern; they tended to exaggerate and add details but not to minimize or omit important details. Stories regarded as intense tended to minimize and omit important details, but not to exaggerate. Similarly, stories with either social or academic content tended to minimize and omit important details. Roughly speaking, the types of alterations fell into two patterns: exaggerations, perhaps with additions, or minimizations with omissions. Put differently, they are either caricatures or normalizations. Stories told to entertain were caricatures; stories told to convey information were normalizations. Story-tellers know something about their audiences; after all, story-tellers are audiences for the stories of others. Listeners in fact find caricatured stories more entertaining (Dudukovic, Marsh, and Tversky, in press) and exaggerated stories less believable (Oppenheimer and Tversky, in preparation).

Listeners to Stories

If fully 61% of the stories told are altered by admission of their tellers, are listeners aware of the alterations? Addressing this problem is tricky because asking listeners if they detect alterations in the stories they hear alters the way they listen, making them vigilant and suspicious. The procedures for assessing veridicality of stories from the listeners' viewpoints are biased opposite to the procedures for assessing veridicality from the tellers' viewpoints. Story-tellers are likely to underestimate the alterations they make and alerted listeners are likely to overestimate the alterations tellers make. Nevertheless, we asked another group of students to record the stories they heard from others an hour a day for several weeks (Oppenheimer and Tversky, in preparation). As for the tellers, the listeners recorded the gist, the audience, and the goals of each story. They also recorded whether they thought the

story had been altered in any way, by adding, omitting, exaggerating, or minimizing information. If so, they recorded what made them think so. As noted, asking listeners to record alterations makes them suspicious listeners; more than likely leading them to 'detect' more alterations than they would spontaneously, with a natural listening attitude.

The overall rate of detecting alterations in fact matched the rate of producing them. Despite this fortuitous, almost magical, correspondence of numbers, it seems unlikely that listeners are calibrated in detecting alterations. For one thing, speakers report a different pattern of alterations than that reported by listeners, suggesting that listeners miss some distortions, and most likely catch some that weren't there. Specifically, listeners reported exaggerations at a far higher rate than tellers admitted to. There were also surprising findings. Listeners detected more distortions in the stories they heard from instructors than in those they heard from friends and acquaintances. Men reported far more distortions than women (77% for men, 52% for women), a provocative finding attributable to gender of listener, not to gender of speaker. So men overshot the base rate of self-reported alterations, and women underestimated it.

What tipped listeners off to possible distortions? Listeners reported several reasons. A frequent reason was the source of the story; they believed the story-teller to be unreliable. In the words of one respondent, 'She's a drama queen'. A second common reason was the manner in which the story was told; another respondent said, 'He was waving his arms too much'. Yet another cause for doubting the veracity of a story was plausibility of the story; 'Nobody can eat that much, he must have been exaggerating'. Some listeners prided themselves as effective detectors; one said, 'I'm always catching people at embellishment'. Finally, circumstances, something about the situation of retelling, also played a role in arousing suspicions; as one respondent put it, 'He wouldn't tell me about the drugs with his parents in the room'.

Remarkably, listeners did not use the goals of retellings as clues to alterations even though goal is an important factor: stories told to entertain caricature and stories told to convey information normalize. This failure of attribution arises in spite of the fact that listeners are also story-tellers and when they themselves tell stories, they undoubtedly caricature to entertain and normalize to inform. Story-tellers apparently use these effects to craft stories to serve their purposes, but do not work backwards from the effects to the goals. Why? One can only speculate. All of the reasons for suspicion that listeners give are specific, particular to the circumstances of this story-teller, this story, this situation, this listener. Goals, however, are general. Like base rates (Kahneman and Tversky, 1973), they are remote, too many steps removed from a particular case, here, a retelling, to be seen as causal.

If fully 60% of the stories people tell each other are altered, then how do people discount what they hear? Some exaggerations may be discounted, by the way that participants reported detecting them, on the grounds of plausibility, by general knowledge of the world or specific knowledge of the teller or the situation. Irrespective of suspicions, listeners may interpret the details of the stories they

hear as expressive rather than literal. If story-tellers say that they only slept four hours in two nights or that their parents screamed at them for an hour, listeners take that to mean that the story-tellers were tired or that their parents were angry. Exaggerations are easy to see that way. Other distortions may not be as easy to detect or interpret. If plausible details are added or omitted, such as can happen when people tell their side of a dispute, then listeners may have no way of detecting what has been changed or, if by chance suspected, of surmising what must have been the case.

Distorting One's Own Memory

Putting a spin on events to relate them to others has consequences not only for listeners of stories but also for tellers of the stories: the alterations that are introduced into retellings of events may become incorporated into memories for the events. To check if retellers distort their own memories by the narrative they impose on retellings, we developed a laboratory task rather than relying on natural reports of retellings (Tversky and Marsh, 2000). The situation we constructed also illustrates the fact that we use information from our lives not just in telling the stories of lives, but for many other ends as well. Participants studied a story that related a series of hypothetical events that occurred their first week of the semester getting acquainted with two new roommates. In the story, each of the roommates did some annoying things, like spilling red wine on their new carpet or borrowing a new leather jacket without asking and not returning it. Each roommate also did some socially attractive things, like telling funny jokes or playing volleyball well. Finally, each new roommate did some neutral things, like going to the library. After studying the story, participants completed an unrelated task to fill time.

So much for the learning phase. Now for using the information acquired in a natural way. After the unrelated task, participants were asked to write a letter about one of the new roommates from one of two perspectives. One perspective was aimed at the socially attractive behaviors, the other perspective was aimed at the annoying behaviors. A third of the participants wrote a letter recommending the target roommate to a fraternity or sorority for which the criteria were sociability and athletics. Another third of the participants wrote a letter to the housing office requesting to get out of rooming with the target roommate because of inconsideration on the part of the roommate. The remaining participants served as a control; they wrote as much as they could remember about one of the roommates. On the whole, the letters were coherent and convincing arguments either promoting or criticizing the target roommate. The letters contained more perspective-relevant information for the target roommate as well as more perspective-related embellishments. Importantly, the letters did not contain intrusions, that is, perspective-related actions committed by the non-target roommate. The control participants wrote dry, unbiased summaries of the targeted roommates acts.

Now for the key results, the effects of the retelling perspective on later recall. After completing yet another unrelated task, participants recalled the original story in as much detail as possible. In contrast to the lively letters, the recall of the story was in the prosaic, factual style of the original. However, the recall contained two types of distortions: it contained more perspective-relevant information for the target roommate than for the other roommate, and it contained more intrusions of perspective-relevant information for the target roommate than for the other roommate. For example, some participants who wrote a letter to the housing office about Michael, recalled that Michael spilled the wine on the carpet even though it was David who did that annoying act. There were no biases in the recall of control participants. Further studies varying the task and story were done. The same two types of memory distortion were found in recognition memory as well as free recall, in an entirely different story, and in a variation in which participants' letters referred to generalities but not to specific incidents, altogether four independent replications.

How do people unintentionally, indeed, innocently, deceive themselves into remembering things that did not happen? When people retell events, they do so from a particular perspective, for a certain purpose. Their stories are connected by a theme or schema or narrative if you will—here are all the ridiculous things that happened to me today or here is how Michael is a perfect fit for your fraternity or an intolerable roommate. When recalling the events again, the schema imposed on the retelling serves as an organizer and retrieval cue. That schema-related information is better recalled and likely to be incorrectly intruded is a robust phenomenon. What is new here is that story-tellers impose the schemas themselves, thereby altering their own memories. Since the stories people spontaneously tell each other are similarly organized, it is inevitable that self-driven distortions of memory occur in the wild.

What can be concluded from the narratives people tell of their lives, narratives of the replete variety? First we saw that when people tell the stories of their lives, they do so for reasons, predominantly to entertain or to inform, and that the reasons lead tellers to impose a narrative, a spin, on the events. Only the most indulgent of parents would cheerfully listen to a list of unrelated happenings, and only from young children. The spins tellers put on the stories they tell have consequences for their listeners and for themselves. By their own admissions, story-tellers distort events in one of two patterns: caricaturing the information by exaggerating it or adding plausible details that did not happen or normalizing the information by minimizing it or omitting relevant details that did happen. Story-tellers acknowledge that they alter stories, and they acknowledge that many—but not all—of the alterations misrepresent the events. Replete narratives, then, distort. Listeners cannot always discount the alterations. Does that mean that we, as listeners and tellers, create and live in a distorted world, surrounded by exaggerations, minimizations, inventive additions, selective omissions? There is reason to think otherwise, that listeners don't take the details of the stories they hear as facts, but rather as expressive, that listeners take away the gist of the stories they hear and that the

gist may not be as far from the facts as the story. This line of reasoning, however, is still hypothetical at this point; it needs substantiation (stay tuned). The literary license story-tellers allow themselves, however, has demonstrated effects on their own memories, distorting them in the direction of the spin.

From Minimal to Replete Narratives

Narrative construction begins with making sense of the world, organizing the space in which we exist, comprehending the events that unfold around us. These are minimal narratives, stories we tell ourselves about where we are and what is happening around us, connecting representations of segments, temporally in the case of space, causally in the case of events. How they are constructed reveals and affects how people think about scenes in space and events in time. Although space and time are continuous, the mind discretizes them by the objects in space and the events in time. The framework of spatial narratives is landmarks and the spatial relations between them; they are united by perspective, typically the route perspective of a traveler in the space or the survey perspective of an overviewer of the space. The framework for temporal narratives is objects and the actions taken on them. Space and time form the background on which life is conducted, the basis for replete narratives, narratives with voice and character, with perspective and motivation, narratives we tell each other on a daily basis. Imposing voice, character, perspective, and motivation on the events of life does not just structure them, it also frequently alters the teller's own interpretation of the events. The alterations that narrative themes impose on events—exaggerations, minimizations, fabrications, and omissions—can not only mislead the audiences of the stories, but can also mislead the tellers of the stories.

*Psychology Department
Stanford University*

References

- Byrne, R.W. 1999: Imitation without intentionality: Using string parsing to copy the organization of behavior. *Animal Cognition*, 2, 63–72.
- Buhler, K. 1982: The deictic field of language and deictic words. In R.J. Jarvella and W. Klein (eds.), *Speech, Place and Action*. New York: Wiley. (Translation of part of 1934 book in German.)
- Bruner, J. 1986: *Actual Minds, Possible Worlds*. Cambridge, MA: Harvard University Press.
- Dudokovic, N., Marsh, E., and Tversky, B. 2004: Telling a story or telling it straight: The effects of entertaining versus accurate retellings on memory. *Applied Cognitive Psychology*, 18, 125–143.

- Ehrich, V. and Koster, C. 1983: Discourse organization and sentence form: The structure of room descriptions in Dutch. *Discourse Processes*, 6, 169–195.
- Fillmore, C. 1975: *Santa Cruz Lectures on Deixis*. Bloomington, IN: Indiana University Linguistics Club.
- Fillmore, C. 1982: Toward a descriptive framework for spatial deixis. In R.J. Jarvella and W. Klein (eds.), *Speech, Place and Action*. London: Wiley.
- Kahneman, D. and Tversky, A. 1973: On the psychology of predictions. *Psychological Review*, 80, 237–251.
- Levelt, W.J.M. 1984: Some perceptual limitations on talking about space. In A.J. van Doorn, W.A. van der Grind and J.J. Koenderink (eds.), *Limits on Perception*. Utrecht, The Netherlands: VNU Science Press.
- Levelt, W.J.M. 1989: *Speaking: From Intention to Articulation*. Cambridge, MA: MIT Press.
- Levelt, W.J.M. 1996: Perspective taking and ellipsis in spatial descriptions. In P. Bloom, M.A. Peterson, L. Nadel and M. Garrett (eds.), *Space and Language*. Cambridge, MA: MIT Press.
- Levinson, S. 1996: Frames of reference and Molyneux's question: Cross-linguistic evidence. In P. Bloom, M.A. Peterson, L. Nadel, and M. Garrett, *Space and Language*. Cambridge, MA: MIT Press.
- Linde, C. and Labov, W. 1975: Spatial structures as a site for the study of language and thought. *Language*, 51, 924–939.
- Mainwaring, S.D. Tversky, B., Ohgishi, M. and Schiano, D.J. 2003: Descriptions of simple spatial scenes in English and Japanese. *Spatial Cognition and Computation*, 3, 3–42.
- Marsh, E. and Tversky, B. (In press): Spinning the stories of our lives. *Applied Cognitive Psychology*.
- Martin, B. and Tversky, B. 2003: Segmenting ambiguous events. In *Proceedings of the Cognitive Science Society Meetings*.
- Oatley, K. (M.S.): Fiction's sources: Conversation and imagination. Fiction's principal accomplishment: The idea of character.
- Oppenheimer, D. and Tversky, B. (In preparation): Discounting distortions in retellings.
- Schober, M.F. 1993: Spatial perspective-taking in conversation. *Cognition*, 47, 1–24.
- Schober, M.F. 1995: Speakers, addressees, and frames of reference: Whose effort is minimized in conversations about locations? *Discourse Processes*, 20, 219–247.
- Talmy, L. 1983: How language structures space. In H.L. Pick, Jr. and L.P. Acredolo (eds.), *Spatial Orientation: Theory, Research and Application*. New York: Plenum Press.
- Taylor, H.A. and Tversky, B. 1992a: Descriptions and depictions of environments. *Memory and Cognition*, 20, 483–496.
- Taylor, H.A. and Tversky, B. 1992b: Spatial mental models derived from survey and route descriptions. *Journal of Memory and Language*, 31, 261–282.
- Taylor, H.A. and Tversky, B. 1996: Perspective in spatial descriptions. *Journal of Memory and Language*, 35, 371–391.

- Tversky, B. 1991: Spatial mental models. In G.H. Bower (ed.), *The Psychology of Learning and Motivation: Advances in Research and Theory*. Vol. 27, 109–145. N. Y.: Academic Press
- Tversky, B. 1992: Distortions in cognitive maps. *Geoforum*, 23, 131–138.
- Tversky, B. 1996: Spatial perspective in descriptions. In P. Bloom, M.A. Peterson, L. Nadel and M. Garrett (eds.), *Space and Language*. Cambridge, MA: MIT Press.
- Tversky, B. Lee, P.U. and Mainwaring, S. 1999: Why speakers mix perspectives. *Journal of Spatial Cognition and Computation*, 1, 399–412.
- Tversky, B. and Marsh, E. 2000: Biased retellings of events yield biased memories. *Cognitive Psychology*, 40, 1–38.
- Wilson, G.M. 2003: Narrative. In J. Levinson (ed.), *Oxford Handbook of Aesthetics*. Oxford: Oxford University Press.
- Woodward, A.L. 1998: Infants selectively encode the goal object of an actor's reach. *Cognition*, 69, 1–34.
- Zacks, J., Tversky, B. and Iyer, G. 2001: Perceiving, remembering and communicating structure in events. *Journal of Experimental Psychology: General*, 136, 29–58.
- Zacks, J. and Tversky, B. 2001: Event structure in perception and conception. *Psychological Bulletin*, 127, 3–21.