Path salience in motion events from verbal and visual languages

Neil Cohn (neilcohn@visuallanguagelab.com), Vivian Wong, Kaitlin Pederson & Ryan Taylor
Tilburg center for Cognition and Communication (TiCC)
P.O. Box 90153, 5000 LE Tilburg, The Netherlands

Abstract

Languages differ in the way they convey paths. S-languages conveying manner of motion directly in a main verb, while V-languages require a separate verb. This difference has been shown to influence the conceptualization and narration of motion events. We therefore asked: would this difference arise in the paths that people draw, particularly in visual narratives? We annotated the representations of path information (source, trajectory, goal) in a corpus of 35 comics from S- and V-languages. We found that panels from S-languages depicted the path of an action more often than those from V-languages, consistent with previous research on increased motion event salience for S-languages. These findings suggest that the conceptualization of paths from spoken language may influence the graphic depiction of paths.

Keywords: visual language; motion events; linguistic relativity; paths; attention

Introduction

Expressing information about the paths of actions is a challenge to communication systems. Spoken language expresses spatial relations with symbolic units. Languages break down actions as moving from a source (starting point) to a goal (endpoint) with some sort of manner (characteristic of the path, i.e., *bouncing*, *wiggling*, *sauntering*, etc.) (Talmy, 1985). This can be encoded in a sentence using a *satellite-framed* construction, which places both manner and motion into one verb (*go*, *run*), while a "satellite" expresses the path in a preposition (*out*, *in*), as in *She **ran out** of the room*. Alternatively, a *verb-framed* construction includes both motion and path in a verb (Spanish: *salir*–"exit", *entrar*–"enter"), and separating manner into an additional verb (*corriendo*–"running"), as in *She* **exited** *the room **running***. Corpus analysis has suggested that languages differ in which of these constructions they primarily use (see Slobin, 2003 for summary). Satellite-framed "S-languages" (English, German, Dutch, Mandarin) allow a main verb to contain information about manner of motion, while verb-framed "V-languages" (Spanish, French, Japanese, Hebrew) express this in a separate verb.

This difference in typology thus varies the salience of paths in motion events between languages. For example, in a sentence like *He ran **out of** house, **across** the street, **into** the bar,* an S-language can easily covey one main verb, and extend the manner of the path (running) across several event segments using prepositions. In contrast, V-languages would require a separate verb for each path (*He exited the house, crossed the street, entered the bar*) and would need to add a verb repeatedly to each clause to specify manner (*running*).

Because V-languages frame manner in a separate verb, they demand extra effort and attention in contrast to the increased salience of paths in motion events by S-languages (Slobin, 2000, 2003). This difference in salience has manifested in studies of mental imagery, translation, and narration—often elicited from reading wordless visual narratives. Narratives told by speakers of S-languages tend to create units of successive events and draw focus to the manner of motion, while those by speakers of V-language often frame the setting and environment where motion events happen, leaving both paths and their manner to inference (Slobin, 2000, 2003).

Given that much previous work examined participants' verbalized narration of wordless, drawn visual narratives, would path salience be reflected in the drawing systems that appear in visual narratives themselves? In drawings, motion needs to be converted from dynamic movement into a static depiction. Such information is implied by the postures of figures in actions, and further clarified by graphic devices, like motion lines, which overtly depict the path of an action by trailing a moving object (Cohn, 2013; McCloud, 1993). Motion lines differ in the "visual languages" used to draw visual narratives throughout the world (Cohn, 2013; McCloud, 1993) and their understanding is learned over time (Friedman & Stevenson, 1975) and conditioned by experience with comics (Cohn & Maher, 2015; Nakazawa, 2016). In addition, both behavioral and neurocognitive research suggests that actions are more easily understood when motion lines depict their paths than without motion lines (Cohn & Maher, 2015; Ito, Seno, & Yamanaka, 2010).

Given that S- or V-languages differ in how they encode properties of paths, might this salience of paths in visual depictions differ based on a drawer's spoken language? That is, might the conceptualizations from one domain (e.g., speaking) "permeate" those of another domain (e.g., drawing) as a reflection of shared conceptual resources (Cohn, 2016)?

A study by Tversky and Chow (2009) sampled panels out of one comic each from Japan, Italy, America, and China. These books crossed distinctions of Western cultures (America and Italy) and Asian cultures (China and Japan), in addition to crossing linguistic typology of S-languages

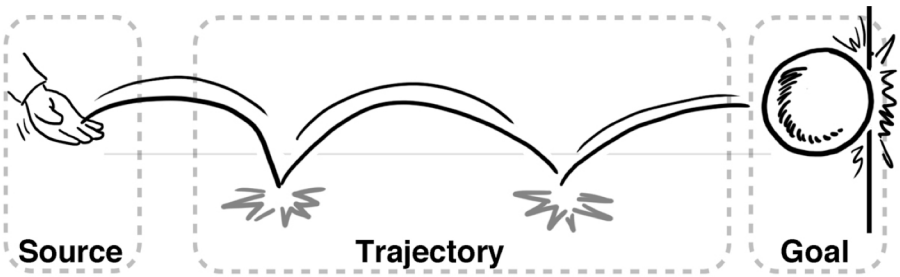

Figure 1. A path depicted by a motion line segmented into its component parts.

(Chinese and English) and V-languages (Japanese and Italian). Panels were then rated on a scale of "action" vs. "setting the scene" by American and Japanese participants. Participants rated panels from China and America (S-languages) as more "active" than those from Japan and Italy (V-languages), but within these contrasts panels from Asian countries (China, Japan) were rated as more active than those from Western countries (America, Italy). These results provide preliminary evidence that path information encoded differently in S- and V-languages could influence the drawings of speakers of those languages. Nevertheless, this work was limited in that it included panels from only single comics per group, and did not directly examine the depiction of paths within those works, instead using "action" as a proxy for paths.

We therefore further investigated this issue by coding the component parts of paths directly in panels from various comics from around the world. Paths were analyzed for their component segments: a source (the start of the path), the goal (the endpoint of the path), and the trajectory (the path traversed). The manner is typically encoded in the trajectory. In Figure 1, the ball is *bouncing,* but without that middle segment, the ball would appear to move in a straight path. As in Figure 1, an image could depict all three of these path segments at once, or a panel could frame isolated segments of a path (imagine each dotted box as images on their own, or combining them for Source-Trajectory or Trajectory-Goal segments).

We coded the properties of path information in 35 comics from around the world, drawn by speakers of S-languages (English, Mandarin, German) and V-languages (Japanese, Korean, French). However, we also considered the possibility that path information could vary as a function of the influence of comics traditions. For example, American and Japanese comics have been observed to use different types of motion lines to depict the paths of moving objects (Cohn, 2013; McCloud, 1993, 1996). Yet, motion lines were a highly borrowed element from the Japanese Visual Language into mainstream American comics during the influx of manga into America in the 1990s. In addition, Original English Language (OEL) manga are comics drawn in the "style" of Japanese manga, but are created by speakers of English (an S-language). This is contrasted by Korean "manhwa," which are also imitative of the visual language of Japan, but come from Asia and speakers of Korean—another V-language. Chinese manhua (including "wuxia" from Hong Kong) are also from Asia, but do not necessarily imitate the Japanese Visual Language.

Following previous work, we reasoned that representations from visual narratives produced by speakers of S-languages (and optimized for those readers) would depict more paths than those from V-languages. Specifically, they should depict more trajectories, since that path segment illustrates its manner.

Methods

Materials

We selected 35 books for analysis, with 5 from each of our primary groups which varied in their continent of origin

Table 1. Characteristics of comics included in our corpus study.

Comic type	Continent	Original Language	Language path type	Total pages	Total panels	Average panels/page
American Mainstream	America	English	S-language	106	541	5.16
OEL Manga	America	English	S-language	137	768	5.62
Chinese manhua	Asia	Mandarin	S-language	131	772	5.92
German comics	Europe	German	S-language	136	772	5.78
French bande desinée	Europe	French	V-language	100	769	7.73
Japanese manga	Asia	Japanese	V-language	106	563	5.62
Korean manhwa	Asia	Korean	V-language	118	579	5.2
TOTAL				**834**	**4,763**	**5.86**

(America, Europe, Asia) and path language type (S-language, V-language), as listed in Table 1. A full listing of works analyzed appears in the Appendix. We attempted to retain the same general genre (action, adventure, superhero, fantasy, sci-fi) throughout all the books as best as possible. Coders analyzed either a single issue, chapter, or episode in each book, 25 pages, or 150 panels, whichever came first. This amounted to an average of 23.8 pages and 136.1 panels per book, across a total of 4,763 panels in 834 pages (see Table 1). All annotations were incorporated into the Visual Language Research Corpus (VLRC: http://www.visuallanguagelab.com/vlrc/index.html).

Data Analysis

Trained coders independently analyzed each book panel-by-panel across the areas of analysis with 60% of books were annotated by two coders. Coders were trained through an extensive course on visual language linguistics and prior to coding scored above an 85% agreement on assessments of their coding ability.

Coders identified whether a represented path depicted its ***source*** (starting point), ***trajectory*** (midpoint and the path itself), and/or ***goal*** (endpoint). Panels could involve an isolated path segment (just source, trajectory, or goal) or multiple segments together (ex. source-trajectory, trajectory-goal). We also annotated the cues used to signal these paths, be they graphic devices like motion lines, or the postural cues of figures in motion. We recorded the total number of path segments in a given panel, and calculated the mean number of instances by dividing the sum of path segments divided by the total number of panels per book. Final analyses averaged the means for each book between coders' scores.

Our analyses looked at panels which included any path segments (e.g., a panel with a trajectory, and/or both a trajectory *and* goal), and those that panels depicting only an isolated path segment (source, trajectory, *or* goal). Path segments were analyzed using repeated-measures ANOVAs that set path segment (i.e., source, trajectory, goal) as the within-groups factor and comic type (Table 1), continent of origin (America, Asia, Europe) or language type (S- vs. V-language) as the between-groups factor. Follow up analyses examined the differences of each area of analysis within and between groups.

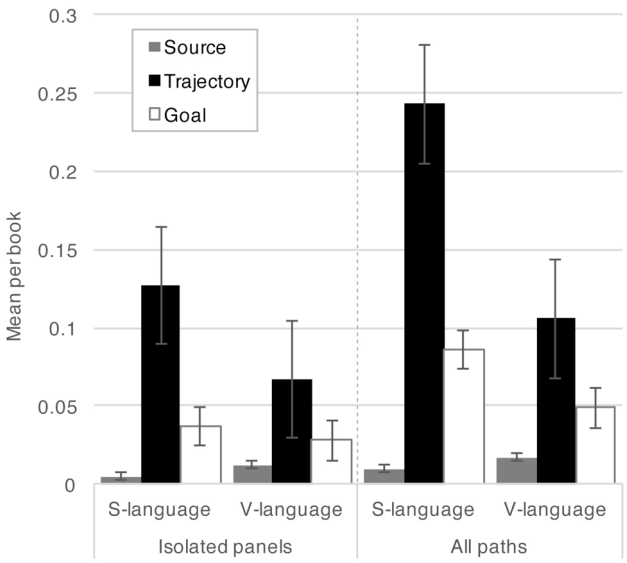

Figure 2: Path segments isolated to individual panels averaged across language types. Standard error is depicted.

Table 2. Results of ANOVAs for comparisons of path segments between language types, continents, and comic types.

		All path segments		Isolated path segments	
	df	F-value	η^2	F-value	η^2
Language Types					
Path Segment (PS)	2,66	33.0***	0.5	47.2***	0.59
Language Type (LT)	1,33	5.9*	0.15	5.3*	0.14
PS*LT	2,66	6.8**	0.17	7.0**	0.18
Continents					
Path Segment (PS)	2,64	30.7***	0.49	47.9***	0.60
Continents (C)	1,32	0.59	0.04	1.95	0.11
PS*C	4,64	0.60	0.04	1.76	0.10
Comic Types					
Path Segment (PS)	2,56	92.8***	0.77	60.7***	0.68
Comic Type (CT)	1,28	6.5***	0.58	6.4***	0.58
PS*CT	12,56	6.9***	0.60	5.8***	0.56

Results

Our initial 2 x 3 repeated-measures ANOVA examined the difference between path segments (source, trajectory, goal) between different language types (S- vs. V-). We found main effects of path segments and language type, as well as an interaction between them (see Table 2). These analyses were carried out both for panels with any path segment, and those with isolated path segments. The main effect of path segment arose because, across language types, trajectories were used more than goals, which were used more than sources (all $ps<.05$; see Figure 2). However, across both analyses comics originally produced by speakers of S-languages used significantly more trajectories than those by V-languages (all $Fs > 7.3$, all $ps < .01$), but neither sources nor goals differed on the basis of language types (all $ps > .134$).

In line with Tversky and Chow's (2009) contrasts between cultures, we also analyzed path segments collapsed across continents (America, Europe, Asia) with a 3 x 3 repeated-measures ANOVA. Consistent with our other analyses, we again found main effects of path segments, but found no significant main effects of continent or interaction between path segments and continents. This held for analyses of all path segments and isolated path segments (Table 2).

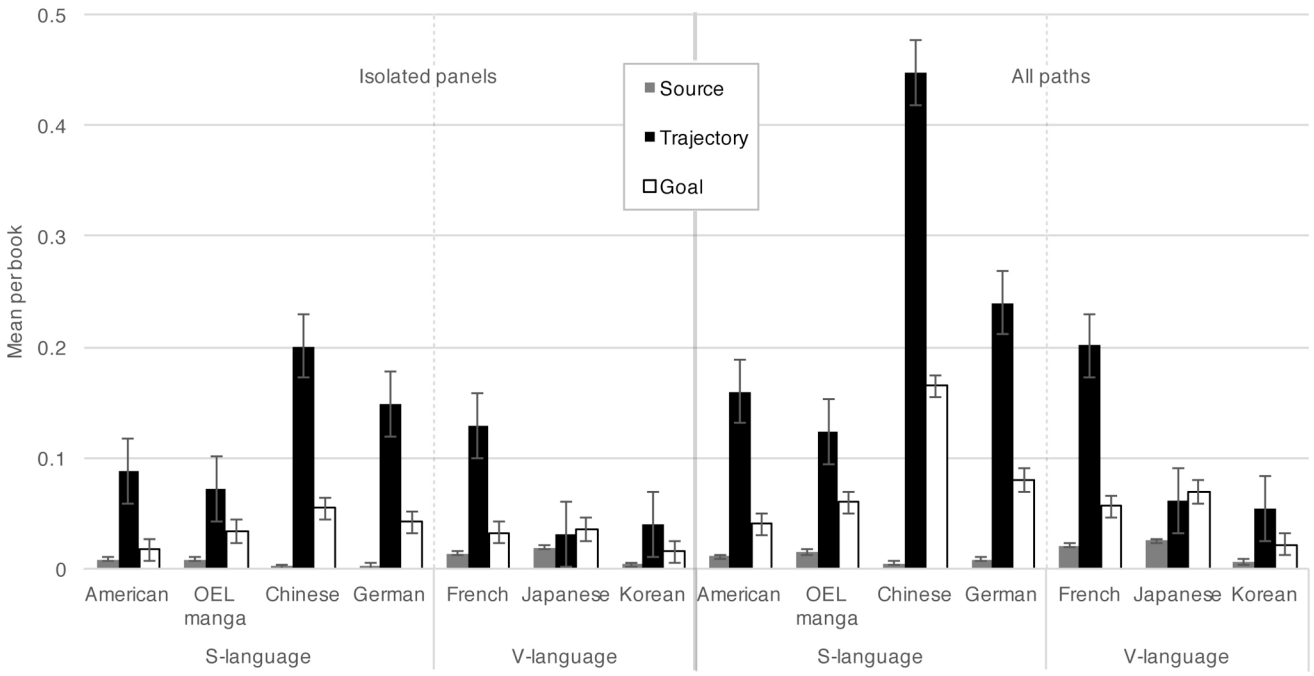

Figure 3: Path segments isolated to individual panels from various comics. Standard error is depicted.

Finally, to assess the differences between each comic type, we used a 3 x 7 repeated-measures ANOVA to compare path segments across all comic types. We found main effects of path segments and comic type, and an interaction between them (Table 2). As in Figure 3, in almost all types of comics, trajectories appeared more than goals, which appeared more than sources (all *p*s < .05). The exception to this was Japanese manga, which depicted near equal amounts of trajectories and goals. Follow up analyses showed comic types did not differ in their depiction of isolated sources or goals when isolated in panels (all *p*s > .364), but did differ for trajectories in both analyses (all *F*s > 7.3, all *p*s <.001) and between goals in panels depicting any paths, $F(6,28)=2.6$, $p<.05$. Specifically, the difference in isolated trajectories seemed to be motivated by Chinese manhua, which used more trajectories than all other comics (all *t*s > 4.1, all *p*s <.01) except French and German comics (all *p*s > .16), while panels with any paths including trajectories were higher in Chinese manhua than all other comics (all *t*s > 3.5, all *p*s < .05), except trended higher than German comics (p = .076). In addition, isolated trajectories in Japanese manga and Korean manhwa were fewer than in French and German comics (all *t*s > 3.1, all *p*s <.05).

Discussion

This corpus analysis examined comics from seven different types of comics from around the world to investigate whether the depiction of path information varied on the basis of culture and/or spoken language typology. Though we found that path segments differed between comics, such variation did not vary based on the comics' continent of origin. However, they did vary based on a comics' original language type.

On the whole, the trajectories of paths—i.e., the path itself—were depicted more than the goals (endpoint) of the paths, which in turn appeared more than the sources (starting point). The prominence of goals over sources aligns with findings that the endpoints of paths are more salient than starting points in verbal language, and in perception and attention (Lakusta & Landau, 2005; Regier, 1996, 1997). However, the fairly consistent depiction of trajectories beyond sources and goals suggests an importance for the visual depiction of paths themselves in motion events, more than their start or endpoint. This is consistent with the idea that motion lines disambiguate actions by depicting their paths (Cohn & Maher, 2015).

In addition, we found that trajectories isolated to their own panels appeared more in the depictions of paths from visual narratives from S-languages than V-languages. These findings are also consistent with findings that the conceptualization and narration of motion events are more salient for speakers of S-languages than those of V-languages (Slobin, 2000, 2003), and with previous work (Tversky & Chow, 2009) showing panels from S-languages (English, Chinese) are as rated more action-oriented than those from V-languages (Japan, Italy). These findings support the idea that the framing of path information in a spoken language may influence its depiction in a drawn visual language.

Despite our finding of differences between comic panels on the basis of spoken language typology, we found no significant differences based on the comics' continent of origin. This differed from Tversky and Chow's (2009) finding of a split between how "active" panels were rated in

Western and Asian comics. However, inspection of Tversky and Chow's reported data suggests that Chinese panels may have driven the effect of higher ratings of "action" compared to all others type. We too found that manhua exceeded the depiction of paths of all other types of comics, though here it may have offset differences between continents given the relational similarities otherwise between pairs of books from Asia (Korean, Japanese), America (US mainstream, OEL manga) and Europe (French, German). The difference between manhua and other types of comics—including those from other S-languages—may support the classification of Mandarin as variant from the binary split of S- and V-language types (Chen & Guo, 2009).

The absence of variation between depictions of paths on the basis of culture contrasts from findings across other aspects of structure from the visual languages used in comics. For example, previous corpus analyses have suggested differences between cultures on the basis of comic panels' attentional framing structure (Cohn, Taylor-Weiner, & Grossman, 2012), narrative patterns across panels (Cohn, In press), semantic transitions between panels (McCloud, 1993), and visual morphology like speech balloons (Forceville, Veale, & Feyaerts, 2010). Combined with prior findings, our results suggest that cross-cultural variation in visual narrative systems may involve a diverse number of factors including cultural specificity, visual language patterns, and possibly influence from spoken languages.

Finally, given the differences between depictions of paths on the basis of S- versus V-languages, this work hints at "permeability" between the conceptualization made in expressive domains, here between spoken languages and drawings. This initial work could thus be followed by more extensive corpus research, in addition to experimental methods further examining these preferences. For example, both behavioral and neurocognitive work has shown that comic panels containing motion lines are easier to process than those omitting such visualized paths (Cohn & Maher, 2015; Ito et al., 2010). While comic reading expertise modulated these costs (Cohn & Maher, 2015), our findings here might suggest cross-cultural variation in such processing. Given the greater salience of paths for S-languages, would speakers of these languages be more sensitive to the absence of motion lines than speakers of V-languages, for whom depicted paths may be less salient? Might path information thus be a factor in translations or interpretations of comics across languages? This work can hopefully sponsor further research into the potential permeability between the conceptualizations in spoken and visual languages.

Works Analyzed

American Mainstream

Jenkins, Paul, Dale Keowen, & Matt Milla. 2004. *Darkness Resurrection*. Vol 4. Top Cow Comics.

Larsen, Erik. 2013. *Savage Dragon: The End*. Image Comics.

Love, Jeremy & Robert Love. 2004. *Fierce*. Vol. 1. Dark Horse Comics

Mignola, Mike & Guy Davis. 2005. *B.P.R.D.: The Black Flame*. Dark Horse Comics.

Morris, Steve. 2006. *Blessed Thistle*. Dark Horse Comics.

OEL manga

Bair, Katie & Robby Bevard. 2006. *Ninja High School Hawai'i*. Vol 1. Antarctica Press.

Clugston, Chynna. 2005. *Blue Monday*. Vol. 4. Oni Press.

Espinosa, Rod. 2001. *Chronicles of the Universe*. Vol. 1. Antarctica Press.

Gunstone, Kevin & Benn Dunn. 2003. *The Agents*. Antarctica Press.

Reid, Christopher & John Kantz. 2003. *Legends from Darkwood*. Vol. 1. Antarctica Press.

Japanese

Kazue, Kato. 2010. *Ao no Exorcist*. Vol. 4, Chapter 28. Kazé.

Mashima, Hiro. 2007. *Fairy Tail*. Vol. 4, Chapter 26. Del Rey.

Naoshi, Komi. 2012. *Nisekoi*. Vol 4, Chapter 32. Jump Comics.

Otaka, Shinobu. 2012. *Magi: The labyrinth of magic*. Viz Media.

Saito, Kenji & Nao Akinari. 2013. *Trinity Seven*. Vol. 7. Chapter 34.

Korean

Geuk-Jin, Jeon & Jin-Hwan Park. 2010. *The Breaker New Waves*. Chapter 36.

Han Yu-Rang. 2007. *Boy of the Female Wolf*. Vol 11, Chapter 69. Samyang Publisher.

Hwa, Kim Dong. 2009. *The Color of Earth*. Vol 1, Chapter 1. First Second.

Jung, Jee-Yun. 2004. *Kwaidan*. Dark Horse Comics.

Wann. 2006. *9 Faces of love*. Vol 1. Netcomics.

Chinese

Cha, Louis & Wing Shing Ma. 2002. *Heaven Sword and Dragon Sabre*. Vol. 1. Comics One.

Ma, Wing Shing. 2002. *Storm Riders*. Vol. 1. Comics One

Wong, Tony. 2002. *Mega Dragon & Tiger Future Kung Fu Action*. Vol. 5. Comics One.

Seto, Tony & Ying-Hsiang Lin. 2002. *Saint Legend: The Prelude*. Comics One.

Yan, Win, King Tung, Bryce Gunkel, & Calvin Chai. 2004. *The King of Fighters*. Vol. 3. DGN Productions.

French

Dieter, Viviane Nicaise, & Dina Kathelyn. 2004. *La Vie En Rose*. Glénat.

Galandron, Laurent & Viviane Nicaise. 2010. *Le Cahier à Fleurs*. Cycle I.

Godard, Christian & Various. 2003. *Une Folie Très Ordinaire*. Glénat.

Lapière, Denis, Pierre-Paul Render, & Mathieu Reynès. 2011. *Alter Ego: Fouad*. Dupuis.
Recht, Robin & Jean Bastide. 2012. *Notre Dame*. Glénat.

German

Fil, Bei. 2001. *Larry Potter*.
Greulich, Jonas. *Moga Mobo*. Vol. 2. Kostenlos.
Gronle, Thomas. *Moga Mobo*. Vol. 3. Kostenlos.
Mawil, Markus. 2004. *Die Band*. Reporduk t.
Sobottke, Bela. 2009. *König Kobra*. Gringo Comics.

References

Chen, L., & Guo, J. (2009). Motion events in Chinese novels: Evidence for an equipollently-framed language. *Journal of Pragmatics, 41*(9), 1749-1766. doi:http://dx.doi.org/10.1016/j.pragma.2008.10.015

Cohn, N. (2013). *The visual language of comics: Introduction to the structure and cognition of sequential images*. London, UK: Bloomsbury.

Cohn, N. (2016). Linguistic Relativity and Conceptual Permeability in Visual Narratives: New Distinctions in the Relationship between Language(s) and Thought. In N. Cohn (Ed.), *The Visual Narrative Reader* (pp. 315-340). London: Bloomsbury.

Cohn, N. (In press). Structural complexity in visual narratives: Theory, brains, and cross-cultural diversity. In M. Grishakova & M. Poulaki (Eds.), *Narrative Complexity and Media: Experiential and Cognitive Interfaces*. Lincoln: University of Nebraska Press.

Cohn, N., & Maher, S. (2015). The notion of the motion: The neurocognition of motion lines in visual narratives. *Brain Research, 1601*, 73-84. doi:10.1016/j.brainres.2015.01.018

Cohn, N., Taylor-Weiner, A., & Grossman, S. (2012). Framing Attention in Japanese and American Comics: Cross-cultural Differences in Attentional Structure. *Frontiers in Psychology - Cultural Psychology, 3*, 1-12. doi:10.3389/fpsyg.2012.00349

Forceville, C., Veale, T., & Feyaerts, K. (2010). Balloonics: The Visuals of Balloons in Comics. In J. Goggin & D. Hassler-Forest (Eds.), *The Rise and Reason of Comics and Graphic Literature: Critical Essays on the Form* (pp. 56-73). Jefferson: McFarland & Company, Inc.

Friedman, S. L., & Stevenson, M. B. (1975). Developmental Changes in the Understanding of Implied Motion in Two-dimensional Pictures. *Child Development, 46*, 773-778.

Ito, H., Seno, T., & Yamanaka, M. (2010). Motion impressions enhanced by converging motion lines. *Perception, 39*(11), 1555-1561.

Lakusta, L., & Landau, B. (2005). Starting at the end: the importance of goals in spatial language. *Cognition, 96*, 1-33.

McCloud, S. (1993). *Understanding Comics: The Invisible Art*. New York, NY: Harper Collins.

McCloud, S. (1996). Understanding Manga. *Wizard Magazine, 56*, 44-48.

Nakazawa, J. (2016). Manga literacy and manga comprehension in Japanese children. In N. Cohn (Ed.), *The Visual Narrative Reader* (pp. 157-184). London: Bloomsbury.

Regier, T. (1996). *The human semantic potential: Spatial language and constrained connectionism*. Cambridge, MA: MIT Press.

Regier, T. (1997). Constraints on the learning of spatial terms: A computational investigation. In R. Goldstone, P. Schyns, & D. Medin (Eds.), *Psychology of learning and motivation: Mechanisms of perceptual learning* (Vol. 36, pp. 171-217). San Diego, CA: Academic Press.

Slobin, D. I. (2000). Verbalized events: A dynamic approach to linguistic relativity and determinism. In S. Niemeier & R. Dirven (Eds.), *Evidence for linguistic relativity* (pp. 107-138). Amsterdam: John Benjamins.

Slobin, D. I. (2003). Language and thought online: Cognitive consequences of linguistic relativity. In D. Gentner & S. Goldin-Meadow (Eds.), *Language in mind: Advances in the study of language and thought* (pp. 157-192). Cambridge, MA: MIT Press.

Talmy, L. (1985). Lexicalization patterns: Semantic structure in lexical forms. In T. Shopen (Ed.), *Language Typology and Syntactic Description: Vol. 3. Grammatical categories and the lexicon* (pp. 36-149). Cambridge: Cambridge University Press.

Tversky, B., & Chow, T. (2009, 11/21/09). *Comics: Language and Culture Affect Action in Depictions.* Paper presented at the Psychonomics, Boston, MA.