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Going beyond the Spatial Agency Bias: Agentivity, prominence and the visuospatial depiction of transitive sentences

Elsi Kaiser*

Abstract. When a person reads or hears a sentence, what kind of visuospatial representation do they construct? Prior work has proposed a Spatial Agency Bias, according to which people conceptualize events with a left-to-right trajectory, with the left side associated with agency (at least in languages using left-to-right scripts). However, researchers disagree on the source and robustness of the Spatial Agency Bias. We suggest that a key obstacle stems from insufficient testing of how agentivity relates to other concepts. We report two experiments manipulating voice, thematic role and word order. Our results point to a general Prominence Bias: Factors that make entities more prominent/salient favor left-side placement.

Keywords. spatial agency bias, agentivity, clefts, spatial asymmetries, active vs. passive voice, thematic roles, word order, information structure, prominence

1. Introduction. A large body of psycholinguistic work investigates how people construct linguistic utterances when given visual depictions of events (e.g. Griffin & Bock 2000, Papafragou et al. 2006, Momma et al. 2018, Do & Kaiser 2022). However, what about when a person hears / reads a sentence describing an event? What kinds of visuospatial representations, if any, do we construct based linguistic input? There exist connections between linguistic and spatial representations (e.g. Boroditsky 2000, Van Dijk & Kintsch 1983, Zwaan & Radvansky 1998). In particular, it is claimed that agentivity is key in guiding our spatial conceptualization of transitive events. When asked to draw events (e.g. *the circle is chasing the square*), English speakers tend to visualize agents to the left of patients (e.g. Chatterjee et al. 1995, 1999), an effect called the Spatial Agency Bias (SAB). But researchers disagree about the source and robustness of SAB effects (e.g. Maass & Russo 2003, Boiteau et al. 2020). Furthermore, whether agentivity is the key driver is unclear. The limited systematic investigation of more nuanced syntactic and semantic properties of transitive sentences means that many questions remain open.

In our work, we use a drawing task to test how notions such as subjecthood, agentivity and order-of-mention influence the visuospatial event representations that comprehenders construct. As a whole, this work seeks to shed light on the general question of what properties of linguistic descriptions influence how prominently/saliently referents are represented in comprehenders' minds – a question that is relevant for many aspects of language processing, including reference resolution, discourse structure, morphosyntactic patterns, our understanding of argument structure, as well as many core issues in real-time language production and comprehension.

1.1 SPATIAL AGENCY BIAS. A diverse body of work suggests that humans have a Spatial Agency Bias (SAB): we tend to conceptualize events with a horizontal trajectory, with the left side associated with agentivity, at least in languages with left-to-right scripts (e.g. Suitner & Maaas 2016

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Author: Elsi Kaiser, University of Southern California (emkaiser@usc.edu).

for an overview). For example, using tasks where participants were asked to draw things like "the circle kicks the square", Chatterjee et al. (1999) found that English speakers tend to create drawings where the agent is on the left of the patient (see also Chatterjee et al. 1995).[1]

Similar results have been obtained with other kinds of tasks, including picture matching, reaction time measures, and aesthetic preference patterns. For example, in a sentence-picture matching task where people heard sentences and indicated whether a sentence matches an image where the agent is either on the left or the right, people were faster to respond when the agent was shown on the left side (Chatterjee et al. 1999). This association with agents and the left side has also been found in other languages with left-to-right scripts (e.g. Maass & Russo (2003) on Italian, Halicki et al. (2021) and Marklová & Delucchi Danhier (2023) on German, and Marklová & Delucchi Danhier (2023) on Czech and Spanish), as well as in images generated by AI image generators such as DALL-E (Marklová & Delucchi Danhier 2025).

The privileged status of the left side appears to reverse in languages with right-to-left scripts. Although spatial agency effects in such languages are less studied, existing work suggests that the right side is privileged. For example, Arabic speakers tend to create drawings where the agent is to the right of the patient (e.g. Maass & Russo 2003, see also Maass et al. 2013, see also Esaulova et al. 2021 for a non-linguistic aesthetic judgment task), suggesting that languages with right-to-left scripts exhibit a SAB that privileges the right side, rather than the left (but see also Altmann et al. 2006 for divergent results). Related work has explored spatial directionality biases using aesthetic judgment tasks with images exhibiting left-to-right vs. right-to-left directionality, often without clear agents. For example, Chokron & De Agostini 2000 found that French and Hebrew speakers prefer images with left-to-right directionality and right-to-left directionality respectively, but Treiman & Allaith (2013) found no such differences between Arabic and English speakers. (For data on languages traditionally read vertically from right to left, see Ishii et al. 2011 and Liu et al. 2016 who tested Japanese and Taiwanese participants).

Thus, crosslinguistic work suggests that script directionality matters. In addition to script directionality, it is also claimed that universal functional properties of the brain may be at play (e.g. Chatterjee 2001). Recent work by Boiteau et al. (2020) also highlights the role of cerebral lateralization. Based on an analysis of art painted on rocks by the San in Southern Africa, who have no written language, Boiteau et al. (2020) find that the majority of the paintings suggest rightward motion, in line with the lateral direction of movement predicted by the Spatial Agency Bias. This suggests the SAB is not simply a consequence of writing directionality.

Ultimately, the origins of the SAB, including its relation to writing system directionality and brain lateralization, are still debated. It seems likely that multiple factors may be at play. More generally, it is worth noting that spatial asymmetries are also observed in non-linguistic domains, including how humans conceptualize the size of numbers (e.g. Dehaene, Bossini & Giraux 1993) and time lines (e.g. Bonato, Zorzi, & Umiltà 2012).

Crucially, for our aims in this paper, it does *not* matter whether the left or right side is privileged. Although this is an important question in its own right, whether the privileged position is the left or right is not relevant for our aims. Rather, what matters for us is simply that there exists one spatial location that is more 'privileged' (used for more prominent / 'important' entities) than another, whether it's the left or the right. Thus, the experiments reported here make use of the

[1] The fine-grained spatial meaning of the verb can also play a role. Although the subject is the agent with both *pull*-type and *push*-type verbs, prior work (eg. Chatterjee et al. 1999, Halicki et al. 2021) suggests that the left-side bias for agents is weaker with verbs like *pull* and *defend*. In the present paper, we do not test *pull*- or *defend*-type verbs.

fact that there exists a privileged location and seek to understand what influences whether an entity is realized in that location, regardless of whether it is left or right. As our studies focus on English speakers, the relevant privileged location is the left side.

1.2 CONSEQUENCES OF LINGUISTIC PACKAGING: PASSIVIZATION AND WORD ORDER. Traditionally, work on Spatial Agency effects focused on agentive sentences in the active voice, where the agent is both the syntactic subject and the first-mentioned argument (ex.1). However, in the passive voice, both word order and grammatical roles change. The agent is demoted to the by-phrase, and the patient is now realized in sentence-initial position and occupies the role of the syntactic subject. In this section, we review prior work on how passivization and word order influence Spatial Agency effects.

(1) a. The circle is chasing the square. b. The square is chased by the circle.

First, let's consider passivization. Given that passive voice is widely regarded as boosting the prominence of the entity 'promoted' to grammatical subject position (e.g. Keenan & Dryer 2007), the question becomes how passivization affects the Spatial Agency Bias. This question has been investigated since Chatterjee et al.'s (1995) ground-breaking work on English testing how people draw agent-patient sentences similar to (1a,b). Although the sample size and the number of items were small, Chatterjee et al. found that passivization eliminated the preference to position agents on the left. We regard these results as suggesting that when the patient is promoted to subject position and the agent demoted to a by-phrase (i.e., both word order and grammatical role 'boost' the patient), the patient competes with the agent for realization on the left. The finding that passivization weakens or eliminates the association between agentivity and left side placement also arises in lateralized button-pressing tasks (Boiteau & Almor 2017a,b).[2]

In a follow-up study, Halicki et al. (2021) compared actives to passives in Italian and German, using drawing tasks and picture selection tasks. They used clearly agentive sentences involving verbs like *kick* and *attack*. Both German and Italian have passives similar to English, where the patient is mentioned first and realized in the syntactic subject position, while the agent is mentioned later in the sentence in a by-phrase – in other words, both word order and grammatical role are at play. Halicki et al.'s results show that in German and Italian, the SAB effects seen in the active voice are either significantly weakened or entirely absent in the passive, echoing Chatterjee et al.'s results for English. Halicki et al. (2021) attribute this to "pragmatic relevance inferred by syntactic functions and word order" (p.167); they note that they do not seek to distinguish effects of subjecthood from effects of word order.

Further evidence for this idea that linguistic form can modulate the SAB comes from recent work by Marklová & Delucchi Danhier (2023). They asked native speakers of German, Spanish and Czech to draw agentive sentences (e.g. *An octopus pushes a fish, a prince is waving to a princess, a farmer is chased by a wolf*), and tested whether word order and passivization play a role. They compared (i) sentences with agent-patient order (in active voice) to (ii) patient-agent order sentences that were a mix of passive voice and active voice in noncanonical OVS order). They again replicate the left-side SAB effect for the active sentences with canonical agent-before-patient order. Furthermore, the bias to put the agent on the left is weaker or absent in sentences with agent-patient word order – i.e., passives and topicalized OVS sentences. However,

[2] Boiteau et al. (2017a,b) further show that these effects arise in the button-pressing task when participants use their left hand but not their feet, which they take as evidence of effector-specific motor processes playing a role.

because Marklová and Delucchi Danhier do not look separately at passive voice vs. OVS order, their work leaves open the question of how order-of-mention and grammatical role (e.g. syntactic subjecthood) contribute to SAB effects.

As regards word order in the absence of passivization, Maass et al.'s (2014) work on Italian, Arabic and Malagasy reveals intriguing patterns.[3] Malagasy is written left-to-right but has VOS word order, so the patient is canonically mentioned before the agent. Thus, Malagasy offers an opportunity to test for effects of word order. Maass et al. found that while Arabic and English participants exhibited consistent agent-right and agent-left biases respectively, Malagasy participants' patterns varied: When asked to draw events (e.g. "the exchange of a gift between two people"), Malagasy speakers exhibit an agent=left bias, but in a picture selection task, they exhibit an agent=right bias. While these results suggest that order-of-mention can influence the SAB, Suitner et al. (2021) emphasize that the mixed results highlight the need for more research. Furthermore, we note that effects of object-before-subject order may be different when that is the canonical order in a language (as in Malagasy) vs. when it is a non-canonical order (e.g. generated via scrambling/topicalization in German or Czech), because in the latter case it signals that he object has a special discourse status. We return to this point later in the paper.

In sum, earlier work provides evidence of linguistic form modulating SAB effects. Specifically, passivization of agent-patient verbs and the associated promotion of the patient to the first-mentioned subject position can weaken or eliminate the bias to position the agent on the left. Crucially, it remains unclear how the change in grammatical roles and word order interact to contribute to the weakening of SAB effects. For example, how do changes in word order alone – when grammatical roles are kept constant – influence SAB effects? If the agent is still the syntactic subject but mentioned after the object, does this affect the likelihood of the agent being depicted on the left? If yes, this would indicate that our visuospatial conceptualization of events is influenced not only by referents' syntactic role (subject vs object) and semantic role (agent vs patient), but also by information typically regarded as more removed from core grammar, namely word order. This is one of the key questions we explore in this paper.

1.3 EFFECTS OF THEMATIC ROLE. The second key question we explore concerns non-agentive thematic roles. Prior work on the Spatial Agency Bias has largely focused on the question of how agent arguments are conceptualized and represented. For example, Suitner & Maass (2016) define SAB as "a specific use of space to convey dynamism, activity, and agency" (p.258). With this in mind, prior experiments have mostly focused on actions that have clear intentional agents (doers) and patients (undergoers) (e.g. *kicking, chasing*).

However, many events in the world and their linguistic descriptions do not contain arguments that are unambiguous agents. Consider example (2). In terms of the arguments' thematic roles, the verb *to chase* (2a) is typically regarded as involving an agent and a patient, while verbs like *to fear* and *to frighten* (2b,c) are typically analyzed as involving an experiencer argument and a stimulus argument. Due to a wide range of difference in their linguistic behavior, agent-patient verbs are standardly distinguished from psych verbs (stimulus-experiencer and experience-stimulus verbs). This raises the question of what kind of visuospatial asymmetries, if any, exist in our conceptualization of sentences like (2b,c)? In the present paper, we compare agent-patient verbs to stimulus-experiencer verb, and leave stimulus-experiencer verbs for future work.

(2) a. The dog$_{\text{AGENT}}$ chased the mailman$_{\text{PATIENT}}$

[3] See also Suitner et al. (2021) for evidence that languages with more flexible word order are less strongly influenced by the SAB. They used a verb-based drawing task where the arguments were not mentioned in sentence form.

b. The dog$_{\text{EXPERIENCER}}$ feared the mailman$_{\text{STIMULUS}}$
c. The dog$_{\text{STIMULUS}}$ frightened the mailman$_{\text{EXPERIENCER}}$

It is important to acknowledge at this juncture that the precise nature of thematic roles is still debated (see e.g. Rappaport Hovav & Levin 2007). As Dowty (1991) already noted, "there is perhaps no concept in modern syntactic and semantic theory which is so often involved in so wide a range of contexts, but on which there is so little agreement as to its nature and definition, as *thematic role*" (Dowty 1991, p. 547, see also Rissman & Majid 2019 for recent discussion). Indeed, even stimulus-experiencer sentences as simple as (2c) can differ in terms of how agentive the subject *dog* is. For example, the dog could frighten the mailman while doing nothing (e.g. while sleeping). Or it could frighten the mailman more agentively by barking and lunging.

In the experiments reported in this paper, we compare verbs that are traditionally categorized as stimulus-experiencer verbs (e.g. *to amaze, to irritate*) to agent-patient verbs (e.g. *to chase, to kick*). Thus, these two verb classes could be described as 'ambiguously agentive' and 'unambigiously agentive' respectively. If we find a difference in the SAB patterns elicited by these two verb classes, that would be strong evidence that thematic roles need to be taken into consideration when describing SAB effects. More specifically, comparing these two verb classes allows us to test whether effects of subjecthood or word order emerge in the absence of unambiguously agentive arguments. This is the second main question that we test in this work.

1.4 AIMS OF THIS WORK. In this paper, we report two experiments that systematically assess whether the Spatial Agency Bias is about agentivity and to what extent English speakers' bias to depict certain entities on the left is also influenced by passivization, word order and thematic roles. The broader question we are interested in is whether visuospatial asymmetries as reflected in left-right positioning can help us understand the general notion of 'prominence', a concept that is frequently alluded to in many aspects of linguistic research but lacks a unified definition.

Experiment 1 tests effects of passivization with both agent-patient verbs and stimulus-experiencer verbs, to broaden the domain of inquiry beyond clearly agentive arguments. Experiment 2 uses object it-clefts to dissociate first-mention from subjecthood, in order to assess whether order of mention, when not associated with agentivity or syntactic subjecthood, influences the likelihood of left-side placement. (In Experiment 2, word order is also related to information structure, as it-clefts of the type we use here focus the fronted argument.)

The studies reported here are part of larger project, which also investigates other factors, including (i) whether topical, pronominalized arguments pattern differently (e.g. A: *Tell me about the square.* B: *The circle chased it*), (ii) whether human agents differ from natural forces (e.g. *Lisa broke the window* vs. *the tornado broke the window*), and (iii) whether expected agents differ from unexpected agents (e.g. *the cheetah chased the gazelle* vs. *the gazelle chased the zebra*, see e.g. Kaiser 2025, 2026.) We do not report those studies in depth here, but provide a brief summary of their results in the context of the General Discussion (see below).

2. Experiment 1: Agentive and non-agentive verbs. Experiment 1 tests how passivizing agent-patient verbs and stimulus-experiencer verbs influences participants' left-right spatial biases in a web-based drawing task. This will allow us to see if (i) we can replicate the weakening of SAB effects with agent-patient verbs in the passive voice using a novel web-based task and, crucially, (ii) to test what kinds of spatial biases emerge when the verb lacks an unambiguously agentive argument, as is the case with stimulus-experiencer verbs pattern in the active and passive voice.

2.1 PARTICIPANTS, DESIGN, METHOD. We report data for 62 native US-English speakers recruited via Prolific who completed the study over the internet using Qualtrics. In both Experiments 1 and 2, we used a drawing task.[4] On each trial, participants were presented with a sentence and a blank space (see Figure 1) and instructed to "draw an image (a quick sketch) showing the meaning of the sentence". People were encouraged to make the drawings simple and quick, and to include all shapes mentioned in the sentence. They were told that if they find it helpful, they can add arrows or other elements to their drawings. Each item was shown on its own screen. In this internet-based drawing task, people did the study remotely using their own device. They could use a touchpad or a mouse to make the drawings (or a touchscreen if their device has one).

Experiment 1 has a 2x2 Latin-Square design and 24 targets. We manipulated verb type (agent-patient vs. stimulus-experiencer) and voice (active vs. passive). An example is in Table 1.

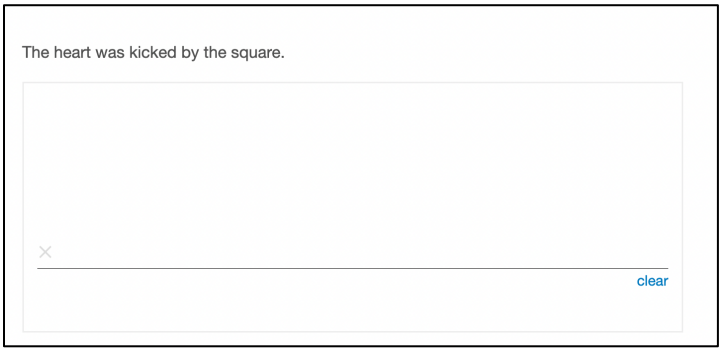


Figure 1. Example screenshot from Experiment 1

	Active	Passive
Agent-patient verb	*The triangle chased the circle.*	*The triangle was chased by the circle.*
Stimulus-experiencer verb	*The triangle amazed the circle.*	*The triangle was amazed by the circle.*

Table 1. Sample item for Experiment 1

The study included 12 agent-patient verbs (e.g. *chase, kick, tickle*) and 12 stimulus-experiencer verbs (e.g. *amaze, impress, irritate*).[5] Thus, a participant encountered a particular verb only once, thus avoiding repetition and minimizing verb-specific effects.

All sentences used simple geometric shapes (e.g. circle, square, triangle, star, semicircle), rather than humans or animals. In this regard, our study resembles Chatterjee et al. (1999) and others, who also used shapes. We chose to use shapes for two reasons. First, shapes are easy to draw. Second, they are easy for coders to distinguish during the annotation phase when people's drawings are analyzed in terms of where the shapes were drawn. We used 12 different shapes; the occurrence of each shape in subject and object position of target items was counterbalanced.

In addition to 24 targets, the study included 24 fillers, also involving shapes. Fillers used a variety of structures, including intransitives and conjoined subjects (e.g. *The square rested, the*

[4] The drawing task means people are explicitly asked to create visuospatial event representations. We do not test what mental representations are generated spontaneously with no task (see Boiteau & Almor 2017a for discussion).

[5] Chatterjee et al. (1999) tested what they call 'state verbs' (*love, know, hate, like, admire*, *bore*) but do not report detailed results for these. Furthermore, as thematic roles for these verbs vary (e.g. *admire* is an experiencer-stimulus verb, *bore* is a stimulus-experiencer verb), grouping them into one condition can mask thematic role effects.

diamond is very close to the oval, the rectangle and the diamond ran up the hill).

2.2 PREDICTIONS. For completeness, let's first consider the (overly simple) prediction that *agent status* is the key factor that favors placement on the left – i.e., in line with the classic version of the Spatial Agency bias. Under this view, we expect that, regardless of voice, the agent argument in agent-patient verbs will be drawn on the left. However, prior work on passivization of agent-patient sentences already argues against this possibility.

Given that stimulus-experiencer verbs have no unambiguously agentive argument, a purely agent-based version of the Spatial Agency Bias makes no clear predictions for the stimulus-experiencer conditions. If we consider the possibility of stimulus arguments being construed as agentive in some contexts (as discussed above), then we might find that the stimulus argument is more likely to be drawn on the left than the experiencer argument.

Now, let's consider the other (over simple) prediction that *syntactic subjecthood* is the key factor that favors placement on the left. Under this view, we expect that in all four conditions, whichever argument is in subject position (i.e. agent and stimulus in active voice, patient and experiencer in passive voice) should be drawn on the left. Prior work on passivized agent-patient verbs suggests that this view is too simple.

If *both agentivity and syntactic subjecthood* contribute to the likelihood of left-side placement – a view that is plausible given prior work on agent-patient verbs – the novel prediction is that in stimulus-experiencer conditions, whatever is the syntactic subject (stimulus in active voice and experiencer in passive voice) should be drawn on the left, as there is no agent present. This prediction has not been tested in prior work, to the best of my knowledge. In the agent-patient conditions, in the active voice we expect a strong left side preference for the subject, since the subject is also agentive. But in the passive voice conditions, agent status and subjecthood compete against each other, so under this view we predict competition between the agent and the syntactic subject (patient) for the privileged left-side placement. This prediction is in line with some prior studies, but it's worth noting that earlier work has yielded mixed results in terms of whether passivization eliminates or simply weakens the agent=left preference.

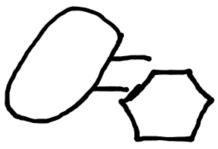
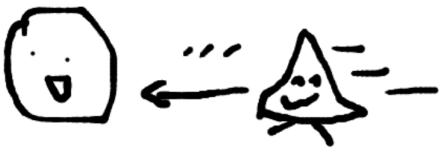
	
The oval tackled the hexagon	The oval tackled the hexagon
	
The rectangle infuriated the semicircle	The circle was chased by the triangle

Table 2. Sample drawings

3. Experiment 1 results. Participants' drawings were coded by trained annotators for the location of the two arguments. Examples are in Table 2. Further analyses, not reported here, are being conducted to analyze the presence of faces and arrows.

The results for Experiment 1 are in Figure 2, which shows the proportion of trials where the syntactic subject was drawn on the left. For agent-patient verbs in the active voice, where the subject is also the agent, it is overwhelmingly drawn on the left (>90%, significantly higher than chance). This pattern replicates the classic Spatial Agency Bias using a new remote web-based drawing task using a computer interface, and thus shows that even if people are not drawing using a traditional pen-paper approach, the same effects arise.

Furthermore, when agent-patient verbs are in the passive voice, the subject is only the left only around 60% of the time (significantly lower than in the active voice condition, glmer, $p<.05$). In other words, the patient (now realized as the syntactic subject) and the agent (now realized in the by-phrase) are competing for left-side placement.

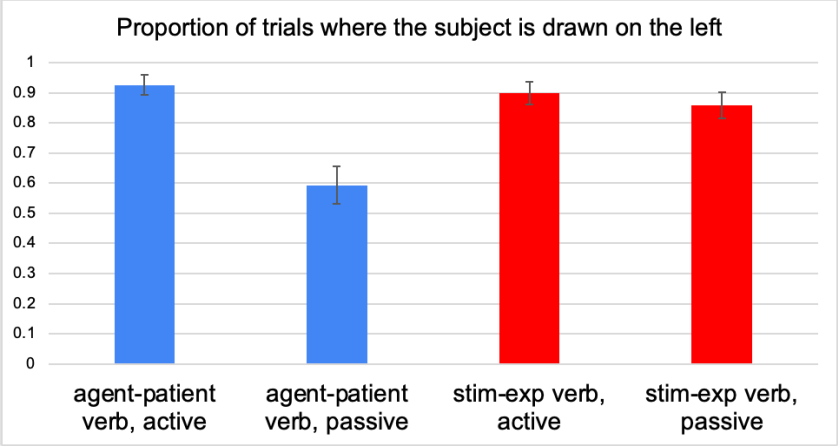


Figure 2. Experiment 1. Proportion of trials where the subject was drawn on the left (Only horizontally-oriented trials included)

Let us now consider what happens with stimulus-experiencer verbs, which lack an explicitly-identified agent. The stimulus-experiencer verb class has not been systematically investigated in prior work on the Spatial Agency Bias. As Figure 2 shows, now the entity realized in the syntactic subject position is drawn on the left side, regardless of whether the sentence is in active or passive voice (i.e., regardless of whether the subject is the experiencer or the stimulus). Both the active and the passive conditions with stimulus-experiencer verbs elicit > 80% left-side subject placement (significantly above chance). In other words, when there is no clearly agentive thematic role assigned by the verb, whoever is the subject tends to be drawn on the left.

3.1 EXPERIMENT 1 DISCUSSION. In Experiment 1, we manipulated both verb type (agent-patient vs. stimulus-experiencer) and voice (active vs. passive). Unlike prior work that largely focused on agentive verbs, we wanted to assess effects of syntactic position with a wider range of thematic roles. This allows us to see what happens when no unambiguously agentive argument is present. For agent-patient verbs, our results replicate the well-known bias for agents to be drawn on the left, and the passive conditions show that this bias is weakened when the agent is not in subject position. In terms of methodology, we show that these findings can be obtained with a remote, internet-based computerized task. This opens the door to more remote data collection on SAB effects which can help diversify the languages under investigation.

Furthermore, our study is the first to systematically test a large set of stimulus-experiencer verbs. The drawings that participants produce in the stimulus-experiencer conditions reveal that, when the verb does not assign an agentive thematic role, syntactic subjecthood (here correlated

with order of mention) triggers left-side placement: Participants have a strong preference to draw the syntactic subject on the left, regardless of whether it is a stimulus or an experiencer.

The finding that participants are equally likely to draw the subject on the left regardless of whether it is a stimulus (in the active voice) or an experiencer (in the passive voice) contrasts starkly with what we find with agent-patient verbs. This provides a clear demonstration that even in the absence of clear agents, we find spatial asymmetries. Further, there are two additional reasons why this pattern is noteworthy. First, there is a large body of work on thematic hierarchies which agrees that the experiencer thematic role is more prominent than the stimulus role. A simplified version of a widely assumed thematic role hierarchy is: *agent* > *experiencer* > *goal / source / instrument* > *stimulus* > *patient* (see e.g. Fillmore 1968, Jackendoff 1987, Grimshaw 1990, see also Do & Kaiser 2022 for recent experimental work). It's worth noting that we see no sign of an experiencer/stimulus asymmetry (or an experiencer privilege) in the spatial domain as detected by the drawing task, even though we see a clear agent-patient asymmetry. This suggests that there is indeed something special about the agent role, relative to other thematic roles.

The second reason why this finding is noteworthy is that, as noted above, the argument in the stimulus thematic role can in some contexts be construed as intentional and/or agentive. However, our data show that the stimulus argument does not get a privileged status relative to the experiencer (e.g. when the stimulus is in the by-phrase in the passive, it does not compete with the experiencer in subject position, in contrast to passivized agent-patient verbs). This shows that sentence-initial subjects have a privileged status and suggests that even if a stimulus can be regarded as acting agentively (e.g. someone can annoy someone else on purpose), this does not grant it the same privileged agentive status that a 'true' agentive argument possesses.

In sum, Experiment 1 yields strong evidence for a clear asymmetry between agent-patient verbs and stimulus-experiencer verbs. Put together, the results indicate that the term 'Spatial Agency Bias' is an insufficient characterization of the phenomenon: We find a strong left-side preference with sentence-initial syntactic subjects even when they are not agentive, but at the same time we also find that entities with an agent thematic role are especially privileged. Ultimately, the asymmetry between active and passive voice with agent-patient verbs and the absence of any such asymmetry with stimulus-experiencer verbs indicates that both agentivity and subjecthood (at least when the subject is sentence-initial) favor placement on the left.

4. Experiment 2: It-clefts. Experiment 1 shows that even sentences that lack clearly agentive arguments can elicit spatial asymmetries: With stimulus-experiencer verbs, it is the syntactic subject that tends to be drawn on the left. Thus, we have evidence for both subjects and agents being privileged. However, in Experiment 1, subjects are also always sentence-initial. This raises the question of whether effects of subjecthood could actually be due to word order (i.e. being mentioned first), rather than due to being realized as the syntactic subject.

In Experiment 2, we explore this issue using object it-clefts, exemplified in (3). In a focus-background it-cleft with a clefted object, the object of the lexical verb (e.g. *chased*) linearly precedes the subject and is focused (e.g. Prince 1978, Hedberg 1990, Delin & Oberlander 1995, Kaiser 2010, 2011). Thus, here we have a change in word order as well as information structure.[6]

(3) a. The triangle chased the circle. [canonical SVO]
b. It was the circle that the triangle chased. [object it-cleft]

[6] Word order is related to information structure; our use of terms like 'initial position' does not mean that information structure is not also at play (it is!). This study does not disentangle information structure from word order.

By comparing canonical SVO order to it-clefts, we test whether prominence on the level of word order and information structure can boost the likelihood of left-side placement. In reseach on pronoun interpretation – widely assumed to be sensitive to referent prominence – Kaiser (2011) shows that subjecthood and being the focus of an it-cleft have dissociable effects on how likely an entity is to be interpreted as the antecedent of a subsequent pronoun (cf. Arnold 1999, Cowles et al. 2007, see also Kaiser 2010; see Gernsbacher & Hargreaves 1988 i.a. on order-of-mention effects in pronoun resolution). Further support for the idea that clefts' foci have boosted prominence comes from findings that we attend more to the focus of clefts and recall it better (e.g. Hornby 1974, Zimmer & Engelkamp 1981, Sturt at al 2004, Birch & Garnsey 1995).

As a whole, if being conceptualized on the left taps into the same or related notion of prominence that is at play in it-clefts, we expect that the fronted objects in it-clefts will be more likely to be drawn on the left than will objects in canonical SVO order.

4.1 PARTICIPANTS, DESIGN, METHOD. We report data from 57 native US-English speakers. The recruitment approach and experimental method were the same as in Experiment 1. No one took part in both experiments. Like Experiment 1, this second study also includes 24 targets and 24 fillers. We again used a 2x2 Latin Square design, but now manipulated verb type (agent-patient vs. stimulus-experiencer) and sentence form (canonical SVO order vs. it-clefts). An example item is in Table 3. All sentences are in the active voice. The fillers are largely the same as in Experiment 1, but some were adjusted to include cleft structures, to help camouflage the targets.

4.2 PREDICTIONS. Given the word order manipulation at the heart of Experiment 2, the predictions and results for this study are presented in terms of how likely the first-mentioned argument is to be drawn on the left. For *agent-patient verbs*, let's first consider the possibility that packaging a sentence as an it-cleft – fronting and focusing the object – has no effect, and agentive subjects are drawn on the left, regardless of form. Under this scenario, in SVO conditions, we expect a very high rate of first-mentioned arguments drawn on the left, and in object-initial it-cleft conditions, we expect the mirror image: a very low rate of first-mentioned arguments drawn on the left (because the second-mentioned agentive subject will still be drawn on the left).

	SVO	Object it-cleft
Agent-patient verb	The triangle chased the circle.	It was the triangle that the circle chased.
Stimulus-experiencer verb	The triangle amazed the circle.	It was the triangle that the circle amazed.

Table 3. Sample item for Experiment 2

What if focusing and fronting an object boosts the likelihood of it being drawn on the left? Under this scenario, SVO order in agent-patient conditions should yield a high rate of the first-mentioned argument (subject) being drawn on the left, just like Experiment 1. More revealingly, it-clefts in agent-patient conditions are predicted to show competition between the fronted object and the agentive subject, as both of these arguments presumably complete to be drawn on the left, thereby yielding a lower rate of the first-mentioned argument (object) being drawn on the left than in the SVO condition where word order and agentivity converge.

What about *stimulus-experiencer verbs*, lacking unambiguous agents? The results of Experiment 1 leave open whether it is the subject or the first-mentioned argument that tends to be drawn on the left. The use of it-clefts in Experiment 2 allows us to disentangle these two possi-

bilities. If subjecthood is what matters for left-side placement, this predicts that the first-mentioned argument is drawn on the left more with SVO sentences than object it-clefts. If what matters is word order, the first-mentioned argument should be equally likely to be drawn on the left with SVO sentences (where it's the stimulus and the subject) and object it-clefts (where it is the experiencer, the object of the verb).

5. Experiment 2 results. Figure 3 shows the proportion of trials where the linearly first-mentioned argument was drawn on the left. Thus, for SVO conditions, the bars show how often the subject (the first-mentioned argument) is drawn on the left, and for the cleft conditions, the bars show how often the fronted object (the first-mentioned argument) is drawn on the left.

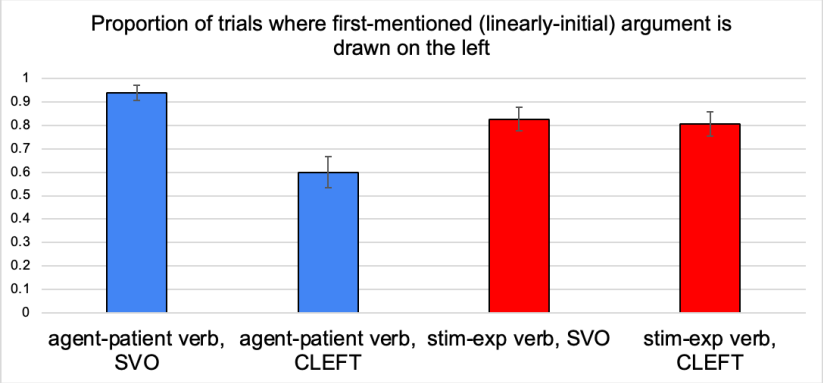


Figure 3. Experiment 2. Proportion of trials where the first-mentioned (linearly-initial) argument was drawn on the left (Only horizontally-oriented trials included)

For SVO order with agent-patient verbs, where the first-mentioned argument is the agentive subject, it is overwhelmingly drawn on the left (>90%); this replicates Experiment 1. However, in it-clefts with agent-patient verbs, where the first-mentioned argument is the fronted object, this object is drawn on the left only approx. 60% of the time. We view this decrease as evidence that the first-mentioned object (patient) and the agentive subject (now realized later in the sentence) compete for left-side placement. This shows that word order (and information structure) impacts our visuospatial biases, in addition to agentivity.

Let us now consider what happens with stimulus-experiencer verbs. As the figure shows, in both the SVO and it-cleft conditions, whichever argument is mentioned first (the stimulus in SVO order and the fronted experiencer in it-clefts) is drawn on the left around 80% of the time (above chance, p's<.01). This shows that when there is no clearly agentive thematic role assigned by the verb, what matters is order of mention: Whichever argument is mentioned first tends to be drawn on the left, regardless of whether it is the subject (SVO) or the object (it-cleft).

5.1 EXPERIMENT 2 DISCUSSION. Experiment 2 aimed to answer an issue left open by Experiment 1, namely to dissociate effects of word order (order of mention) and subjecthood, by comparing object it-clefts to SVO word order.

Let's first consider stimulus-experiencer verbs which lack an unambiguous agentive argument. In Experiment 1 we saw that whichever argument was the sentence-initial subject tended to be drawn in the left, regardless of whether it was the experiencer or the stimulus. Now, we see that even if the sentence-initial argument is not a subject, it still tends to be drawn on the left. Thus, word order seems to be the key factor with experiencer-stimulus verbs: In the absence of a clearly agentive argument, whichever argument is mentioned first tends to be drawn on the left, even if it is not the syntactic subject and regardless of its thematic role.

Turning to the agent-patient verb conditions, it becomes clear that agentivity and word order are both at play. In SVO order, the sentence-initial agent is overwhelmingly drawn on the left and when the object is fronted, it competes with the subject for left-side position. This provides novel evidence that agentivity and word order are at play. In particular, whichever argument is mentioned first gets a boost in the likelihood of left-side positioning, even if it is not a subject. Indeed, the figures for Experiments 1 and 2 look similar, suggesting that what we described above as effects of subjecthood can actually be subsumed under effects of order of mention.

It is worth repeating an important caveat, however. We have been using the terms "word order" and "order of mention", but these are correlated with information structure in Experiment 2, in that the fronted object is also in information-structural focus. (The subject in SVO order is not, though.) It is well-known that, as mentioned in Section 4, information-structural factors influence aspects of language processing commonly viewed as linked to prominence (e.g. recall, encoding and pronoun resolution). Thus, based on Experiment 2, we cannot tell whether the special status of the fronted object in clefts is due to purely to order of mention or to the joint effects of information structural focus and order of mention. This is an important direction for future work. Comparing subject it-clefts (e.g. *It was the circle that chased the triangle*) to object it-clefts and regular SVO sentences is an important future investigation that can shed light on this.

6. General discussion. The idea that our conceptualization of linguistically-described events exhibits a horizontal bias, with agents on the left (at least in languages with L-to-R writing systems) – called the Spatial Agency Bias (SAB) – has received considerable attention in recent decades (e.g. Chatterjee et al. 1995, Suitner & Maass 2016, Marklová & Delucchi Danhier 2025). However, there exists disagreement regarding the sources and robustness of this bias (e.g. Maass & Russo 2003 vs. Boiteau et al. 2020). We report two studies, part of a larger project, that assess effects of syntactic, semantic and pragmatic factors on our spatial conceptualizations of transitive sentences, with the ultimate aim of exploring what contributes to how prominent/salient referents are in the mental representations we build based on linguistic input.

Experiment 1 shows that once we test both agent-patient verbs (e.g. *chase, kick*) and stimulus-experiencer verbs (e.g. *amaze, irritate*), we can detect dissociable effects not only of agentivity but also of subjecthood (here correlated with order of mention). In particular, in the absence of an unambiguous agent, the first-mentioned argument, in subject position, tends to be depicted on the left. Experiment 2 uses object it-clefts to address a question left open by Experiment 1, namely whether there these results are due to word order or subjecthood. The results of Experiment 2 suggest that (at least in the configurations we tested) these patterns may be best described as order-of-mention effects: whichever argument is mentioned first tends to be drawn on the left, even if it is not the subject of the lexical verb – but crucially, when an agent is present, it competes with the first-mentioned referent for the left side position. Thus, by testing agent-patient verbs as well as stimulus-experiencer verbs and by dissociating subjecthood, agentivity and word order, these studies provide the first evidence that these factors have separable effects on our visuospatial conceptualization of transitive events. As a whole, our results provide evidence for a general *Prominence Bias* favoring left-side placement, not a specific Agency Bias.

It's worth noting that the object-initial word orders in Experiment 2 are non-canonical (object it-clefts) and differ from the object-initial orders in Malagasy (Maass et al. 2014) which are examples of the language's canonical word order. Because non-canonical orders are typically driven by information structure (e.g. topicality, focusing), more work is needed to assess effects of 'pure' order-of-mention vs. information structure. The fact that the fronted objects in Experiment 2 are information-structurally focused is in all likelihood boosting their prominence.

6.1 OUR WORK ON TOPICALITY AND ATYPICAL AGENTS. The idea that information structure contributes is supported by the results of our earlier work (Kaiser 2025). In that work, we used contexts like A: *Tell me about the square.* B: *The circle chased it*. The results show that when objects are pronominalized (discourse-old and topical), they compete with agents for left-side placement. This suggests that effects of discourse-level factors and information structure can emerge even in the absence of order-of-mention effects and with non-agents and non-subjects.

Another issue worth mentioning concerns the finer-grained nuances of agenthood. In Kaiser (2026), we explored two kinds of 'atypical' agents, namely natural forces (e.g. *{Lisa/The storm} broke the window*) and expected vs. unexpected agents (e.g. *the cheetah chased the gazelle* vs. *the gazelle chased the zebra*). Humans vs. non-sentient natural forces are known to differ in various aspects of their grammatical behavior, and many aspects of human cognition exhibit fine-grained sensitivity to (un)expectedness and predictability. These asymmetries suggest that the SAB may differ for these two kinds of atypical agents. But we find rates of left-side placement to be similar for natural forces vs. humans, and for expected vs. unexpected agents. These findings show, first, that 'perceived agency' (see Lowder & Gordon 2015) is sufficient; sentience and intentionality are not needed for a spatial agency bias. Second, although our cognitive sensitivity to animacy is related to unpredictability (New et al 2007), it does not seem to impact the SAB.

As a whole, these results suggest that syntactic, semantic and information-structural prominence guide our visuospatial representations of transitive events. Perhaps the SAB can provide a new 'tool' to assess whether it's possible to unify the infamously complex notion of prominence.

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