



Title:

What is agentic about the Spatial Agency Bias?

How pragmatic relevance contributes to the spatial representations of actions

Key words: spatial dimensions in social cognition, Spatial Agency Bias, pragmatic relevance, word order, verb voice, passive voice, mental representations

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Abstract

The mental imagination of (social) actions has been shown to follow a left-to-right trajectory, with the thematic agent associated with the left position (Spatial Agency Bias, Suitner & Maass, 2016). For example, individuals asked to choose a picture that visualizes the sentence “Tom kicks George.” tend to choose an image where the agent, Tom, is positioned on the left-hand side rather than on the right-hand side. However, alternative to the thematic role of the agent, such findings may reflect a mental representation following pragmatic relevance. Specifically, a pragmatic perspective holds that word order and syntactic functions are strategic devices to communicate that the element is important for the sentence. Thus, positioning in the described picture-matching task may actually reflect the agent’s pragmatic relevance instead of agency per se. For a test, we vary whether sentences are written in active versus passive voice. Results from five studies indicate that passive voice results in the tendency to place the agent on the right-hand side rather than on the left-hand side of a picture. Instead, the acted-upon person is positioned on the left-hand side of a picture. A sixth experiment reveals that for passive voice, the agent is still seen as more agentic than the receiver, but is considered less relevant. The findings are congruent with the proposed pragmatic relevance account. Implications for the Spatial Agency Bias as well as for building mental representations in general are discussed.

How people form mental representations of verbal descriptions has long been of interest to psychologists (Johnson-Laird, 1983). This is often studied by asking participants to draw a verbally described scene or concept. In this realm recent theorizing in social psychology suggests that the mental representation of social concepts may involve a spatial dimension (for reviews see Smith & Semin, 2004). For example, power is associated with an upper vertical location (Giessner & Schubert, 2007). Political orientation is located on the horizontal axis from 'left' to 'right' (van Elk, Van Schie, & Bekkering, 2010). Turning to the topic of the present research, agency has been suggested to be represented on the left, following a left-to-right trajectory in cultures with a rightward script (Maass & Russo, 2003; Suitner & Maass, 2016). Part of the evidence for this so-called Spatial Agency Bias (SAB) comes from studies using a drawing task or a picture-matching task (Maass, Suitner & Nadhmi, 2014). In these tasks, participants are given generally or specifically described scenes (e.g. "an act of aggression"; "Tom kicks George") and are asked to draw the scene or to decide which of two mirrored pictures is better suited to illustrate the scene. Findings that the agent is predominantly positioned on the left-hand side in both tasks are interpreted as support for the correspondence of agency and the left position (Suitner & Giacomantio 2012; Suitner & Maass, 2016).

We propose an alternative account of the positioning bias based on the idea that the left position in the picture might be assigned according to pragmatic relevance inferred by syntactic functions and word order instead of agency attributions.

Before we go into these considerations in more detail, we will give an overview of the SAB.

The Spatial Agency Bias

Various studies found that the thematic agent identified in a sentence was placed on the left-hand side of the receiver in picture-matching or drawing tasks or variations of it (e.g., Suitner & Giacomantio 2012; Chatterjee, Maher, & Heilman, 1995; Acosta Williamson, & Heilman, 2014; Chatterjee, Southwood, & Basilico, 1999). Based on this evidence, Maass and colleagues (Maass et al., 2014; Suitner & Maass, 2016) proposed a general association between the concept of agency and a spatial representation, the Spatial Agency Bias (SAB). Noteworthy, the SAB differs between cultures depending on script direction in the respective culture. In cultures writing from left to right, agency is represented on the left. This association reverses in cultures writing from right to left (Maass et al., 2014).

Two processes explain the SAB (Maass et al., 2014; Suitner & Maass, 2016). Firstly, *script direction* shapes spatial cognitive representations of agency. Because reading and writing are such ubiquitous and prevailing tasks in modern life, script direction internalizes as a mental scheme of the directionality of action (Maass, Pagani & Berta, 2007, Suitner & Mass, 2016). According to this visuo-motor account, the starting point of reading represents the starting point of actions. When the

script direction is evolving from left to right – as in most Western cultures - activities are represented as flowing along the same direction.

Secondly, a *linguistic account* complements the influence of script-direction. It is proposed that the SAB is an overgeneralization of the word order of a typical sentence. In most languages (about 83%) the grammatical subject precedes the object in a sentence (Dryer, 2013). Given that in active voice sentences, the agent is the grammatical subject (e.g., “Tom kicks George”), and that active voice sentences are much more common than passive voice sentences in most languages, the agent most often precedes the object. For written sentences, this means that in cultures writing from left to right the word denoting the agent is typically positioned to the left of the word denoting the object and vice versa for cultures writing from right to left. The frequent exposure of the thematic agent on the left in written texts possibly causes an association between the left (and first) position and the agentic role in the respective cultures.

Supporting the assumptions of the culture specificity of the SAB, comparisons between cultures with left-to-right and right-to-left script directions found reversals in the directionality of the SAB (Maass et al., 2007; Maass & Russo, 2003; Dobel, Diesendruck, & Bölte, 2007). For instance, the participants were asked to draw “the exchange of a gift between two people” or “an act of aggression between two people. Italian participants (reading from left to right) tended to draw the agent on the left-hand side and Iraqi participants (reading from right to left) on the right-hand side. Further supporting this notion, people who are exposed to cultures with different script directions show a reduced SAB (Maas et al., 2014, Maass & Russo, 2003).

Pragmatic relevance account

We propose an alternative account that possibly contributes to the observed positioning bias. Namely, we argue that the position of the thematic agent in previous picture-matching tasks might be less due to its role as the thematic agent but to pragmatic inferences on relevance. We propose that participants choose the left-hand side of a picture for the person that is pragmatically relevant and therefore important for the mental representation of a scene. This hypothesis is based on the assumption that mental representations of a described event are built around the most relevant element and when participants transform their mental representation into a visual imagery they begin with the element that dominates the mental representation and serves as a reference point in the representation. Due to left-to-right script direction the first element is likely to be placed on the left side of the picture (Geminiani, Bisiach, Berti, & Rusconi, 1995).

Relevance is a central theme in communication as it determines how receivers will allocate their attention and form mental representations. While according to the communicative principle of relevance (Sperber & Wilson, 1986) any communicative act is initially presumed as relevant, communicators are finely tuned to extract what is relevant within utterances. One of the tools that help recipients in this task is the syntax of a sentence, namely word order and grammatical functions. With

regard to grammatical functions, the grammatical subject dominates the representation of the described scene (Johnson-Laird, 1968). It is what the sentence is all about, it “is the part on which we wish to focus, it is the center of the discourse” (Geminiani et al, 1995, p.1566). With regard to word order, it is the first position in a sentence that indicates relevance. Although confounded with the grammatical subject in many languages, the first position also seems to independently emphasize what is of central interest in a sentence (Prat-Sala & Branigan, 2000). The first mentioned element is the one that immediately captures attention, is ascribed more causality, and results in a memory advantage (Bettinsoli, Maass, Kashima, & Suitner, 2015; Bettinsoli, Maass, & Suitner 2019). The beginning of a sentence prepares the ground for how receivers understand a sentence (Gernsbacher, Hargreaves, & Beeman, 1989; Giora, 1997). In the words of Giora: “comprehenders [...] develop their mental structures by mapping the subsequent information onto the first clause” (Giora, 1997, p. 25). Thus, one may expect that what is mentioned first also determines the mental representation of the described scene due to its pragmatic relevance. Taken together, the sentence “Tom kicks George” proposes that Tom is pragmatically most relevant because he is mentioned first and is also the grammatical subject (as these two criteria are often confounded at least in German, English, and many other languages we will not distinguish between the two).

As the example illustrates the role of agent and the grammatical subject/first position are confounded in active voice sentences (and this is true for most languages). Tom is the agent and the grammatical subject, and should he be placed on the left side of a picture we cannot distinguish whether this is because of his role as agent or because he is the central element of the sentence. However, this is only the case for sentences in active voice. Phrasing scene descriptions in passive voice (“George is kicked by Tom” dissolves the confound between the agent functioning as the grammatical subject and allows a critical test in order to differentiate between an agency and a relevance account of the spatial bias.

Passive voice

Varying active vs. passive voice changes the order as well as the syntactic functions in which thematic agent and recipient¹ appear in the sentence (active: “Tom kicks George” vs. passive: “George is kicked by Tom”). Tom is still the thematic agent but turns from grammatical subject into grammatical object. George, the former object, now is mentioned first and figures as the subject and thereby becomes the focus of the sentence.

Passive voice directs attention away from the agent and toward the recipient (Henley, Miller, & Beazley, 1995). By functioning as the subject more emphasis is placed on the recipient of the action (e.g. Johnson-Laird, 1968; Bohner, 2001). This association between verb voice and discourse focus is prominent in linguistics (see Tannenbaum & Williams 1968). For example, active voice is used more frequently when the thematic agent is made salient. But, the use of passive voice increases when the recipient is made salient (Prat-Sala & Branigan, 2000). This would suggest that the pragmatic

relevance attributions shift from the thematic agent toward the recipient when passive voice is used compared to active voice.

Accordingly, given the sentence “George is kicked by Tom”, one would predict that participants choose George, the recipient, and not Tom, the agent for the left position in a picture-matching task if positioning is based on pragmatic relevance. In contrast, if positioning is solely driven by thematic agency, passive voice should not moderate the result, as the thematic agent is constant in both versions.

Support for our hypothesis (or rejection of it) would contribute to our understanding how verbal descriptions are transformed into mental representations as these are the base for visual imagery. The SAB account implies that social interactions are encoded according to an agency dimension. In order to form a mental representation of a described interaction receivers will first have to identify who is the agent. This may well be the case and is quite likely for many interactions as agency certainly plays a fundamental role in the social world (Koch, Imhoff, Dotsch, Unkelbach, & Alves, 2016). However, understanding the meaning of a sentence goes hand in hand with identifying the most relevant elements and is not possible without it. Therefore, it seems likely that the mental representation formed once the sentence is understood reflects this process. Note also, that the question whether it is the agent or the most relevant protagonist who serves as the reference element in the mental representation around which the visual image is created parallels a debate in linguistics. Namely, whether mental representations are organized around the logical subject (the one that performs or initiates the action = agent) or the grammatical subject (Geminiani et al, 1995). As proposed by Geminiani and colleagues (1995) the former would be in line with the assumption of a symbolic representation, which implies that the visual image of utterances of identical meaning but different grammatical structure should not differ (as is the case for active vs. passive voice). If, however, visual images of utterances differ depending on different grammatical structures despite identical meaning, the mental representations are likely of a non-symbolic nature.

At present, the evidence regarding the role of active versus passive voice on positioning is inconclusive as the few studies that exist used different methodologies and do not show a consistent picture. Geminiani, and colleagues (1995) presented a battery of different sentences comparing active and passive voice utterances regarding spatial and temporal relations (e.g., “the car has overtaken the motor-bike” vs. “the pedestrian has been overtaken by the cyclist”) and non-spatial relations e.g. “John loves Mary” vs. “Susan is loved by Antony”). Participants indicated the imagined position of the mentioned items (e.g., pedestrian and cyclist) with their forefinger. The results were mixed with the agent in a non-spatial relationship being placed predominately on the left for active sentences and on the right for passive sentences but the pattern was less clear for sentences describing a spatial and temporal relation (statistical tests are missing).

Chatterjee and colleagues (1995) found that, when active voice sentences were presented, participants tended to place agents on the left, reflecting a SAB. Passive voice, however, eliminated

the positioning bias. It should be noted though that different verbs were used in the active and passive condition (study 1) and that the sample size was rather low ($N = 20$ in study 1 and $N = 16$ in study 2). Although the scarce evidence is not conclusive, it overall suggests that when the sentences are presented in passive voice there is no evidence that the thematic agent is placed on the left. This would speak in favor of an alternative process. However, clearly more evidence is needed.

Overview of the present studies

We ran six experiments to investigate whether positioning of the thematic agent reflects a spatial representation of agency solely determined by thematic roles or whether pragmatic relevance attributions contribute to this effect.

In Study 1, participants were asked to draw interactions between two persons. Each interaction was described either using active (e.g. “Luca attacks Marco”) or passive voice (e.g. “Marco is attacked by Luca”), scene instructions were given either orally or in written format. In Study 2, instead of drawing, a picture matching-task was used and active vs. passive voice varied within participants (Study 2a) and between-participants (Study 2b). Scene instructions were given in written format only. Study 3 replicated the findings of Study 2b with scene descriptions presented orally. In Study 4, scene descriptions were provided solely in verb form, which circumvents mentioning the protagonists completely. Further, Study 5 measured agency and relevance directly and analyzed how verb voice affects agency attributions and pragmatic inferences regarding the protagonists of a sentence.

Study 1

The current research systematically addresses the role of pragmatic relevance in the tendency to position the agent on the left-hand side of a picture. Therefore, scene descriptions were given in active or passive voice (e.g. “Luca attacks Marco” vs. “Marco is attacked by Luca”). As the thematic agent is constant in the two versions, a positioning bias based on the thematic agent would not predict any differences. In contrast, pragmatic relevance would predict a preference for the recipient being on the left-hand side for scene descriptions in passive voice.

In order to provide external validity, we provide scene descriptions in written and oral format. Additionally, oral instructions circumvent the potential influence of the visually present word order which might induce participants to draw the person on the left-hand side whose name is written left to the other protagonist in the text. If the bias to position the agent on the left results from a visual-spatial match instead from pragmatic inferences, we would expect smaller effects for oral scene descriptions, where no visual-spatial match is possible.

Method

Participants

In Study 1, a convenient sample of sixty-nine Italian-speaking participants (35 female, 34 male, mean age 26.51 years ($SD = 9.01$)) voluntarily participated in the study that was developed as part of a research activity in a master course on Social Cognition at University of Padova. No compensation was granted for participating in the laboratory study. At present, no standard procedures are available for sensitivity analyses for Generalized Estimating Equations (GEE, Wilson & Lorenz, 2015). As a proxy, we ran a sensitivity analyses for McNemar test for paired samples. In this test, our sample of $N = 69$ allowed us to detect an effect of medium size (Cohen, 1988), $OR = 3.46$, with $p_{01} - p_{10} = .25$, $\alpha = .05$, and $1 - \beta = .8$. (one-tailed).

Design and material

Participants read four simple sentences with clear subject-object order that described activities involving two protagonists in active or passive voice (e.g. “Luca attacks Marco” vs. “Marco is attacked by Luca”²). Verb voice of the scene descriptions varied within participants. Two counterbalanced versions of the questionnaire existed, varying which two sentences were presented in active voice and which two sentences were presented in passive voice. Whether scene descriptions were given orally or in written format varied between participants.

Participants were asked to represent each scene in a stylized and non-detailed drawing. The dependent variable was the binary coding of the side on which participants drew the agent.

Results and discussion

Figure 1 shows differences in the proportion of pictures with the agent drawn on the left-hand side and on the right-hand side. Table 1 shows the frequencies. Overall, the rate of pictures where the agent was drawn on the left dropped from 86.2% (written: 83.33%, oral: 89.39%) in the active voice conditions to 59% (written: 65.27, oral: 53.03%) in the passive voice conditions.

A binary logistic regression analyses was conducted by means of Generalized Estimating Equations (GEE, Wilson & Lorenz, 2015). The coding of the position of the agent served as our criterion variable (agent on the right = 0; agent on the left = 1) and verb voice (active = 0; passive = 1) was entered as predictor. Description format³ (oral = -1.04; written = 0.96) as well as the interaction term were included as further predictors. This analysis revealed that participants predominantly drew the agent on the left of the recipient when scene descriptions were given in active voice ($b = 1.86$, $SE = .29$, Wald's- $\chi^2(1) = 42.15$, $p < .001$, $OR = 6.42$, 95% CI [3.66, 11.25]). Descriptions in passive voice significantly reduce the frequency of drawing the agent on the left ($b = -1.47$, $SE = .28$, Wald's- $\chi^2(1) = 27.43$, $p < .001$, $OR = 0.23$, 95% CI [0.13, 0.40]). A simple intercept analysis reveals that despite a significant reduction, the tendency to draw the agent on the left remains significant in the passive voice conditions ($b = 0.39$, $SE = .14$, Wald's- $\chi^2(1) = 4.22$, $p = .040$, $OR = 1.47$, 95% CI [1.02, 2.13]). Description format does not reveal a significant main effect ($b = -0.26$, $SE = .29$, Wald's- $\chi^2(1) = 0.82$, $p = .365$, $OR = 0.77$, 95% CI [0.44, 1.36]). However, the results indicate a marginal significant

interaction between verb voice and instruction format ($b = 0.52$, $SE = .29$, Wald's- $\chi^2(1) = 3.27$, $p = .071$, $OR = 1.68$, 95% CI [0.96, 2.93]). This indicates stronger positioning differences for oral scene descriptions.

The results replicate the preference to depict the thematic agent on the left-hand side when scene descriptions are provided in active voice (Maass et al., 2014). Further, Study 1 provides evidence for the moderating effect of verb voice on the positioning of the thematic agent. Scene descriptions in passive voice result in a reduced bias to position the thematic agent on the left. However, the pragmatic relevance account would predict a reversal not merely a reduction. Previous literature showed, that a motor activity (drawing) congruent with script direction might foster the tendency to depict the agent on the left (Maass et al., 2014). This could have led to opposing positioning tendencies and might be the reason why the positioning bias did not reverse. In order to reduce the influence of motor activity, we use the picture-matching task in all following studies.

No main effect of instruction format (written vs. oral) emerged. However, we found a marginal significant interaction of instruction format and verb voice. If the bias to position the agent on the left resulted from matching the position of the agent in text and picture, we would have expected smaller effects for oral scene descriptions. By contrast, descriptive data suggests that passive voice affected the bias more strongly when descriptions were given orally. These effects were tested in subsequent studies, separated according to instruction format.

Study 2

With two studies, we tested whether verb voice (Study 2a: varied within subjects; Study 2b: varied between subjects) moderates the tendency to depict the thematic agent on the left. Study 2 used the picture-matching task in order to reduce effects of a motor activity (drawing) in line with the predominant script direction.

Method

Participants

In Study 2a, one hundred and twenty-one participants (99 female, 21 male, 1 unclassified, mean age 23.41 years ($SD=3.61$)) and in Study 2b one hundred and sixty-seven (134 female, 32 male, 1 unclassified, mean age 24.28 years ($SD=6.82$)).⁴ German-speaking participants were recruited via Facebook. In each study, participants had the chance to win one of two Amazon-Vouchers worth 10€ for compensation.

Design and material

We adopted the picture-matching task (Maass et al., 2014) to German, and extended the material by scene descriptions in passive voice. Participants read four simple sentences with clear subject-object order that described activities involving two protagonists in active or passive voice (e.g.

“Claudio kicks Georg” vs. “George is kicked by Claudio”). We varied verb voice of the scene descriptions within participants in Study 2a and between participants in Study 2b. In the within-subject condition, participants read two sentences in active voice and two sentences in passive voice. Which sentence was presented in active voice and which in passive voice was counter-balanced.

For each sentence, participants chose which of two otherwise identical mirrored pictures represented the scene the best. Every picture showed the thematic agent (e.g., the person kicking) and the thematic recipient (e.g., the person being kicked) of the scene. By mirroring the images, the position of the agent and the recipient varied within the picture pairs. The two mirroring pictures were presented side-by-side. For two of the four scenes the picture with the agent on the left was presented on the left side and for the other two, he was presented on the right side. The position of the picture-pairs was also counter-balanced. The four different scenes appeared in randomized order.

Our dependent variable was the binary picture selection (i.e., agent left vs. agent right).

Results and discussion

Figure 2 shows differences in the proportion of picture choices in active and the passive voice conditions in Study 2a and Study 2b. Table 2 shows the frequencies of picture choices. In study 2a, choice rate of the picture with the agent on the left dropped from 77.7% in the active voice condition to 40.5% in the passive voice condition. Study 2b revealed a drop from 69.9% in the active voice condition to 44.3% in the passive voice condition.

As in Study 1, binary logistic regression analyses were conducted by means of GEE. Choices of pictures showing the agent on the left served as our criterion variable (agent on the right = 0; agent on the left = 1) and verb voice (active = 0; passive = 1) was entered as predictor. This analysis revealed that participants preferred choosing the agent on the left for scene descriptions in active voice (Study 2a: $b = 1.25$, $SE = .18$, Wald's- $\chi^2(1) = 50.81$, $p < .001$, OR = 3.48, 95% CI [2.47, 4.91]; Study 2b: $b = 0.84$, $SE = .15$, Wald's- $\chi^2(1) = 30.47$, $p < .001$, OR = 2.32, 95% CI [1.72, 3.13]). In both studies, the results indicate that scene descriptions in passive voice significantly reduced the choice of pictures with the agent on the left (Study 2a: $b = -1.63$, $SE = .22$, Wald's- $\chi^2(1) = 53.70$, $p < .001$, OR = 0.20, 95% CI [0.13, 0.30]; Study 2b: $b = -1.07$ ($SE = .20$), Wald's- $\chi^2(1) = 27.60$, $p < .001$, OR = 0.34, 95% CI [0.23, 0.51]). Simple intercept analysis revealed that passive voice significantly reversed the SAB in Study 2a ($b = -0.39$, $SE = .14$, Wald's- $\chi^2(1) = 7.56$, $p = .006$, OR = 0.68, 95% CI [0.52, 0.90]) and marginally significant in Study 2b ($b = -0.23$, $SE = .13$, Wald's- $\chi^2(1) = 2.85$, $p = .092$, OR = 0.68, 95% CI [0.61, 1.04]).

The results replicated the preference to choose the picture with the agent on the left in a picture-matching task when sentences were provided in active voice (Maass et al., 2014) for a German instead of an Italian participant sample. Further, the results indicate that passive voice reduces or even reverses the positioning bias. This speaks against a generalized tendency to position the thematic

agent on the left. Instead, positioning the pragmatically most relevant protagonist on the left can explain the results for active as well as passive voice sentences.

Study 3

Study 3 had the purpose to replicate the finding that passive voice reverses the positioning of thematic agent and recipient in the picture-matching task. In contrast to Study 2, scene descriptions were given orally, as in parts of Study 1. As explained before, oral scene descriptions omit a visual match between the arrangement of the protagonists in the text and the pictures. A replication of the findings from Study 2 would indicate that the reversal is due to the pragmatic processing of the sentence.

Method

Participants

Seventy-three German-speaking participants⁵ were recruited for a battery of laboratory studies at the University of Mannheim, Germany (66 female, 7 male, 1 unclassified, mean age 20.34 years (SD=3.23)). Participants started with this study and were then forwarded to the subsequent studies. Participants were able to choose between a monetary compensation (4€) or course credits.

Design and material

As in Study 2a and 2b, all participants were given four scenarios from the Picture-Matching Task (Maass et al., 2014). Verb voice of the scene descriptions varied between participants. All scene descriptions were given orally. In order to ensure that participants actually listened to the scene descriptions, we implemented Study 3 in a laboratory setting. Scene descriptions were given via headphones. Besides that, study material and measures were identical to Study 2a and 2b.

Results and discussion

Figure 3 shows differences in the proportion of picture choices in active and the passive voice. Table 3 shows the frequencies of picture choices. The proportion of choices of the picture with the agent on the left dropped from 72.3% in the active voice condition to 30.6% in the passive voice condition.

The same analyses were used as in Study 2. Results indicate that participants preferred the thematic agent on the left for active voice scene descriptions ($b = 0.96$, $SE = .24$, Wald's- $\chi^2(1) = 15.68$, $p < .001$, OR = 2.6, 95% CI [1.62, 4.20]). Scene descriptions in passive voice significantly reduced the choice of pictures with the agent on the left ($b = -1.78$ ($SE = .32$), Wald's- $\chi^2(1) = 30.50$, $p < .001$, OR = 0.17, 95% CI [0.09, 0.32]). Additionally, a simple intercept analysis reveals a significant reversal in the passive voice condition ($b = -0.82$ ($SE = .21$), Wald's- $\chi^2(1) = 14.90$, $p < .001$, OR = 0.44, 95% CI [0.29, 0.67]).

The results show that for descriptions in passive voice, pictures were chosen that depict the agent on the right rather than on the left-hand side. Again, this speaks against a bias to generally position the thematic agent on the left, as predicted by the SAB but is in line with the hypothesis that the pragmatically relevant protagonist is placed on the left-hand side.

Study 4

Although Study 1 and Study 3 already suggested that visual matching could not account for the results, Study 4 was designed to completely eliminate the influence of matching by presenting scene descriptions solely in verb form (e.g. “kick” vs. “being kicked”). This also tests whether the association between verb voice and pragmatic relevance is overgeneralized and is strong enough to affect positioning even when the protagonists are not mentioned and therefore explicit reference on word order and grammatical functions are not possible.

Method

Participants

Two hundred and forty-one German-speaking participants⁶ were recruited via the international online respondent service Prolific (104 female, 134 male, 3 unclassified, mean age 30.26 years (SD=9.96)). Each participant was compensated with US\$0.25 for participation in the study.

Design and material

As in the previous studies, all participants saw the four picture-matching scenarios. Instead of the full sentences that were used in the previous studies in Study 4, only a verb but no protagonists was given to describe the scenes (e.g. ‘kick’ vs. ‘being kicked’)⁷. Verb voice varied between participants.

Results and discussion

Figure 4 shows differences in the proportion of choices in active and passive voice. Table 4 shows the frequencies of picture choices. The proportion of choices of the picture with the agent on the left dropped from 56.9% in the active voice condition to 47.3% in the passive voice condition.

Again, the results from the GEE indicate a preference for agents on the left for verbs given in active voice ($b = 0.28$ ($SE = .10$), Wald’s- $\chi^2(1) = 7.28$, $p = .007$, OR = 1.32, 95% CI [1.08, 1.61]). Further, verbs presented in passive voice significantly reduced the choice of pictures with the agent on the left ($b = -0.38$ ($SE = .16$), Wald’s- $\chi^2(1) = 5.83$, $p = .016$, OR = 0.68, 95% CI [0.50, 0.93]). However, a simple intercept analysis does not show a reversal of the positioning bias in Study 4 ($b = -0.11$ ($SE = .12$), Wald’s- $\chi^2(1) = 0.78$, $p = .377$, OR = 0.9, 95% CI [0.71, 1.14]).

As in the previous studies, passive voice moderated the positioning of the protagonists. Therefore, we assume that presenting a verb in active or passive voice affects the mental

representation of the scene. However, we did not find a reversal of the bias. Possibly, not mentioning the protagonists reduces pragmatic inferences on relevance. Therefore, a combination of word order and verb voice is needed to draw pragmatic inferences that are strong enough to result in a reversal of the positioning. Also, not mentioning the protagonists could result in inferring that the focus of the scene is on the activity described and less on the persons involved. This might explain why participants did not attribute pragmatic relevance to the protagonists, which therefore resulted in a weaker impact on the picture choice.

Small-scale meta-analysis (Study 1-Study 4)

Taking the agents drawn or chosen on the left from Studies 1-4, the proportion of agents on the left dropped from 68.58% in the active voice conditions to 44.79% in the passive voice conditions.

In our set of five studies we clearly find evidence that passive voice reduces the tendency to position the thematic agent on the left-hand side. However, not all studies find a clear reversal of the pattern. In order to check whether we find an overall tendency to position the recipient on the left for passive voice conditions we run a small-scale meta-analysis to combine the results of our studies.

In order to account for the dependencies of the two studies using within-participant design (Study 1 and Study 2a), we used the marginal odd ratios and estimated the sampling variance of the marginal log odds ratio of these two studies (Elbourne et al., 2002).

As expected, the result indicates that the overall effect of verb voice on the positioning of thematic agent and receiver is significant ($b = -1.16$ ($SE = .24$), $z = -4.84$, $p < .001$, 95% CI [-1.62, -0.69]). Further, we tested whether passive voice can actually reverse the positioning bias over all studies. This was done by meta-analyzing the proportions of the recipient being positioned on the left in the passive voice condition. In order to do so, the Freeman-Tukey (double arcsine) transformation was used ($b = 0.84$ ($SE = .02$), $z_{val} = 55.14$, $p < .001$, 95% CI [0.81, 0.87]). The back-transformed overall proportion to position the recipient on the left in the passive voice condition is .56 (95% CI [0.53, 0.59]). Not including the .5 in the CI speaks for an overall reversal in the passive voice condition.

However, the heterogeneity index was also significant (Q ($df = 4$) = 37.64, $p < .001$), leading us to test potential moderators. The only moderator⁸ we could identify was whether whole sentences or only verbs were provided as scene descriptions (Study 1-Study3 vs. Study 4) ($b = 0.97$ ($SE = .29$), $z = 3.36$, $p < .001$, 95% CI [0.40, 1.53]). This speaks for a strong impact of the word order of whole sentences on pragmatic inferences and mental representations of social interactions.

Study 5

The fact that passive voice seems to foster placing the thematic agent on the right rather than on the left sheds doubt that agency is responsible for the positioning in the picture-matching task. However, it might be argued that although objectively the agent stays constant independent of active

or passive voice, passive voice may reduce the perceived agency. Thus, it may not be the left position lacking an association with agency but the thematic agent in passive voice who lacks agency. It should be noted that this account is only compatible with the obtained reversal if we assume that in passive voice the thematic agent is perceived as less agentic than the recipient. Nevertheless, in order to test this alternative account, Study 5 was designed to measure perceived agency and pragmatic relevance directly. If we resort to an agency definition restricted “to its essential features, namely, acting or having the capacity to act autonomously in a given environment” (Suitner & Maass, 2016, p. 248), one would not expect that passive voice actually results in shifting agency attributions from the agent toward the recipient since the person who is acting does not change. As explained before, perceived pragmatic relevance however should shift to the grammatical subject, in other words from the thematic agent to the recipient.

Method

Participants

Forty-four German-speaking participants were recruited via the social network Facebook (35 female, 9 male; mean age 24.84 years ($SD = 6.77$)). For the omnibus test, we predicted an interaction of two repeated measures factors. A sensitivity analysis indicates that the sample allowed us to detect an interaction of small to medium size, $f = .18$, with $\alpha = .05$ and $1-\beta = .8$ (as determined with G*Power; Faul, Erdfelder, Lang, & Buchner, 2007).

As for compensation, participants were given the prospect to win a 10-EUR voucher for an online shop.

Design and material

Participants read the same four sentences as in the previous studies. Verb voice varied within-participants. We balanced which two of the four sentences were presented in active voice and which two in passive-voice. Participants answered six questions per sentence. Three of the questions measured agency⁹. Based on the concept of agency as the ‘capacity to act autonomously’ (Suitner & Maass, 2016, p. 248) and the ability to control or cause a situation (Bandura, 1989), the items refer to activity (“Who is active?”), motion (“Which person is moving?”) and controlling or determining an action (“Who determines what happens?”, Cronbachs Alpha = .81). The three remaining items measured pragmatic relevance¹⁰ (i.e. “Who is this sentence mainly about?”, “Which person is emphasized in this sentence?”, “On which person is the focus in this sentence?”, Cronbachs Alpha = .93). We alternately asked one agency and one pragmatic relevance question and balanced between participants which category of questions (agency or pragmatic relevance) was asked first. Participants answered the questions on a seven-point scale (ranging from -3 to +3). The names of the protagonists were used as scale end points. We balanced the sides on which the thematic agent and recipient appeared within participants so that each participant received two blocks of questions where

the agent's name appeared on the left scale end (-3) and two where it appeared on the right scale end (+3). The four different sentences appeared in randomized order.

Result and discussion

We carried out a 2 (verb voice: active voice vs. passive voice) x 2 (target dimension: agency vs. pragmatic relevance) x 2 (question order: agency first vs. relevance first) repeated-measures ANOVA. The four aggregate measures resulting from the variation of verb voice (active voice vs. passive voice) and target dimension (agency vs. relevance) varied within-participants. Order of questions (agency first vs. pragmatic relevance first) was counter-balanced between participants. The dependent variable was coded so that positive ratings represent a tendency to assign an attribute to the thematic agent. Vice versa, a negative score indicates that an attribute is assigned to the receiver (versus the agent). This analysis yielded a significant main effect of verb voice ($F(1,42) = 100.06$, $p < .001$, $\eta^2 = .70$), and target dimension, ($F(1,42) = 333.59$, $p < .001$, $\eta^2 = .89$). Moreover, the critical interaction was significant, too, $F(1,42) = 76.22$, $p < .001$, $\eta^2 = .65$.

To elaborate on these results, we calculated simple contrasts for verb voice for each of the target dimensions and contrasts against the scale means (0). With a score over 2.00 on a scale from -3 (recipient is ascribed more agency) to +3 (thematic agent is ascribed more agency) agency was clearly seen with the thematic agent in active ($t(43) = 26.11$, $p < .001$) as well as passive voice ($t(43) = 11.75$, $p < .001$). Yet, ascribed agency for the thematic agent was slightly reduced in sentences with passive compared to active voice, $M_{\text{passive}} = 2.05$, $SD_{\text{passive}} = 1.16$ vs. $M_{\text{active}} = 2.40$, $SD_{\text{active}} = 0.61$; $t(43) = 2.03$, $p = .048$, $\text{cohen's } d = .31$.

In contrast, pragmatic relevance was seen with the thematic agent rather than the recipient in active sentences ($M_{\text{active}} = 1.52$, $SD_{\text{active}} = .99$; $t(43) = 10.20$, $p < .001$) but shifted to the recipient in passive sentences ($M_{\text{passive}} = -1.46$, $SD_{\text{passive}} = 1.06$, $t(43) = -9.16$, $p < .001$). The effect size of the shift in pragmatic relevance was rather large, $t(43) = 11.28$, $p < .001$, $\text{cohen's } d = 1.69$.

The results suggest that passive voice indeed reduces the perceived agency of the acting person. However, this reduction cannot explain the reversal in positioning as the recipient was never ascribed more agency than the agent. The reversal in positioning parallels that of ascribed relevance with the agent being seen as more relevant in active sentences whereas the recipient is seen as more relevant in passive sentences.

General Discussion

In a series of experiments using a drawing task (Study 1) and the picture-matching task (Study 2-4), involving participants from two different countries and languages, we show that spatial positing of an agent is highly informed by verb voice. Participants placed the thematic agent on the left-hand side when scene descriptions were in active voice, which involves that the thematic agent functions as the grammatical subject and is mentioned first. In contrast, when the descriptions were in passive

voice and the thematic agent was neither the grammatical subject nor in first position the pattern did not hold. A small-scale meta-analysis provides evidence that passive voice reverses the spatial bias. This suggests that it is not so much agency that determines the spatial positioning but relevance as indicated by syntactic function and word order. More direct evidence for this assumption comes from Study 5 that shows that in passive voice the thematic agent is not seen as less agentic than the recipient but as less relevant. This shift in pragmatic relevance from thematic agent to recipient parallels the shift from the left to the right position in the picture matching task. In contrast, the reversal in positioning cannot be accounted for the quantitative reduction in agency that was observed for the agent in passive sentences.

Overall, the results of the presented studies support the hypothesis that pragmatic relevance rather than agency attributions guide the positioning of thematic agent and recipient in a described scene. Pragmatic relevance is critical in the emergence, strength and direction of spatial positioning. However, two caveats are in order. First, it should be emphasized that the reversal in the positioning was not so clear-cut. We did not observe a significant reversal in all studies and except for Study 3, the positioning bias (for the left) was stronger in active sentences than in passive sentences (for the right). Indeed, the meta-analysis revealed heterogeneity across the studies. A cautious interpretation is that the question is not whether spatial positioning is due to either agency or pragmatic relevance but to which extent each influence the positioning. For descriptions in active voice both influences work in the same direction. The thematic agent is also indicated as more relevant being the subject and being mentioned first. Both influences could add up to a rather strong bias for a left position. In passive sentences both influences work in opposite directions. Depending on the respective strength this could result in a reduction of the left-positioning bias or even a reversal. Therefore, an interplay of agency attributions and pragmatic relevance might affect the bias differentially across the studies. For example, presenting only the activities without the protagonists in Study 4 did not lead to a reversal either, possibly because the focus on the mere activity emphasized the agentic aspect of the pictured scene whereas the relevance of the protagonists was less emphasized. The fact that presenting merely the verb or a full sentence moderates the effect (see meta-analysis) underlines the role of linguistic aspects such as word order. Clearly, more evidence is needed to test a potential interplay of the agency and relevance account and to what extent specific linguistic aspects as word order or syntactic functions affect the bias. Overall, the inferences that guide positioning are quite complex and probably context dependent. In many contexts relevance and agency may be the same, for example in descriptions using descriptive or interpretative action verbs (Semin & Fiedler, 1988) in active voice.

This brings us to the second caveat, the concept of agency. When based on a strict definition that solely relies on actions and the capacity to act (Chatterjee, 2002; Suitner & Maass, 2016), it is difficult to maintain the idea that agency per se affects positioning. However, as Suitner and Maass already pointed out, the concept of agency seems to be “slippery and ill-defined” (Suitner & Maass,

2016, p. 248). Extending this, one could argue that a broader agency definition overlaps with relevance. Passive voice is often chosen not only to focus on the receiver but also to communicate some contribution or responsibility of the receiver for the action. For example, regarding the blaming of rape victims, Bohner (2001) argued that passive voice obscures agency by placing the actor in the background and “place[s] more emphasis or relevance on the victim” (Bohner, 2001, p.517). The use of passive voice when describing a rape case correlated positively with the perceived responsibility of the rape victim (Bohner, 2001). Likewise speakers may choose to say, “Gianni was kicked by Marco” to leak that somehow Gianni instigated the action. If so, placing Gianni on the left may well be due to perceived agency according to a broad definition that goes beyond thematic agency. This aspect of pragmatic relevance, a responsibility for the action even though the recipient is not performing an action, is well compatible with a broader concept of agency.

Still, the relevance account is broader and comprises scenarios where passive voice is not intended to communicate a subject’s agency in the sense of having caused the event. Speakers may also choose to say, “Gianni was kicked by Marco” in order to highlight poor Gianni’s plight and explain his limping. Inferences in this context could affect compassion and empathy towards Gianni, which would be rather non-agentic attributions. Thus, while in some situations pragmatic relevance and agency may overlap they are distinct concepts.

As a by-product of our manipulation of pitching active sentences against passive voice sentences and assessing the effect on visual imagery also shed light on the question whether the mental representations from which the visual images are derived are of a symbolic (linguistic) or non-symbolic (analogue) nature. As Geminiani and colleagues argued (1995), given that the meaning of a sentence does not change whether it is phrased in active or passive voice the visual images created from a symbolic representation of the meaning should not have differed. In both cases the agent should have served as the reference item which would be reflected in placing this element on the left in an image. Thus, our results suggest that mental representations are non-symbolic. This is also in line with the assumptions of Giora (1997) as well as Gernsbacher and colleagues (1989) that it is the first mentioned element in a sentence around which mental representations are organized.

Our findings may also have wider implications. We only looked at how recipients of verbal descriptions translate these into images. Extending the findings, one may perhaps speculate on the reverse process and look at what recipients of pictorial information read from pictures. Since use of language and use of images coincide in mental representation and draw on the same scripts and mental models (Stöckl, 2011), one might expect that people also use positioning within a picture in order to draw inferences on the relevance of the depicted persons. A person who is depicted on the left side in a picture might be assumed to be especially important for the scene. From this, depending on the context recipients might draw further inferences for example on the hierarchy of the persons depicted or the dynamics of the social interaction.

Taken together, the findings corroborate the notion that language determines the mental representations of (social) interactions (Johnson-Laird, 1983; Lakoff & Johnson, 2008; Altmann & Kamide, 2009). Importantly, language as well as pictorial language serves a pragmatic goal. Accordingly, communicators craft their messages and use word order and verb voice strategically in order to make the receiver form specific mental representations which shape further responses.

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Figure legends

Figure 1. Proportion of drawn positions of the thematic agent in Study 1.

Figure 2. Proportion of picture choices in Study 2a and Study 2b.

Figure 3. Proportion of picture choices in Study 3.

Figure 4. Proportion of picture choices in Study 4.

Table 1

Number of drawings Study 1

	agent left	agent right	total number of choices per verb voice
active voice	119	19	138
(written / oral instruction)	(60/59)	(12/7)	(72/66)
passive voice	82	56	138
(written / oral instruction)	(47/35)	(25/31)	(72/66)

Note. Four drawings per participant.

Table 2

Number of picture choices Study 2

	agent left	agent right	total number of choices per verb voice
Study 2a (within participants)			
active voice	188	54	242
passive voice	98	144	242
Study 2b (between participants)			
active voice	232	100	332
passive voice	149	187	336

Note. Four picture choices per participant.

Table 3

Number of picture choices Study 3

	agent left	agent right	total number of choices per verb voice
active voice	44	100	144
passive voice	107	41	148

Note. Four picture choices per participant.

Table 4

Number of picture choices Study 4

	agent left	agent right	total number of choices per verb voice
active voice	229	255	484
passive voice	273	207	480

Note. Four picture choices per participant.

Footnotes

¹ In the field of linguistics it can be differentiated between the grammatical role of recipient and patient. For easier understanding we use the term “recipient” for the acted-upon person.

² Instructions and scene descriptions were in Italian (see supporting information).

³ Effect coding adjusted for different sample sizes.

⁴ A power analysis as the one used in Study 1 indicates that the sample size in Study 2a was sufficient to detect an effect of $OR = 2.67$. As Study 2b was between participants, a goodness-of-fit test for chi2-tests was used to determine sensitivity. Again, the sample size was suited to detect a small to medium sized effect, here, $w = .22$, with $N = 167$, $df = 1$, $\alpha = .05$, and $1-\beta = .8$.

⁵ A sensitivity analysis as in Study 2b indicates that the sample size in Study 3 was sufficient to detect a medium effect, $w = .33$, with $N = 73$, $df = 1$, $\alpha = .05$, and $1-\beta = .8$.

⁶ A sensitivity analysis as in Study 2b and Study 3 indicates that the sample size in Study 4 was sufficient to detect a small to medium effect, $w = .18$, with $N = 241$, $df = 1$, $\alpha = .05$, and $1-\beta = .8$.

⁷ We changed the verb from the scene ‘offering ice cream’ (German: “Eis anbieten”) to ‘bestow’ (German: “beschenken”) for easier understanding. Instructions and scene descriptions were in German (see supporting information).

⁸ We ran three additional meta-analyses. One included design variation (within-participants versus between-participants design) as moderator, a second included instruction variation (written versus oral instructions) as moderator, and the third included task variation (drawing vs. picture matching task) as moderator. However, none of the analysis yielded a significant moderation effect (design variation: $b = -0.30$ ($SE = .53$), $z = -0.57$, $p = .568$, 95% CI [-1.34, 0.73]; instruction variation: $b = -0.74$ ($SE = .46$), $z = -1.59$, $p = .111$, 95% CI [-1.64, 0.17]; task variation: $b = -0.12$ ($SE = .70$), $z = -0.17$, $p = .864$, 95% CI [-1.48, 1.25]).

⁹ Original items in German: “Wer ist in diesem Satz aktiv?“, „Welche Person ist in Bewegung?“, „Wer bestimmt das Geschehen?“

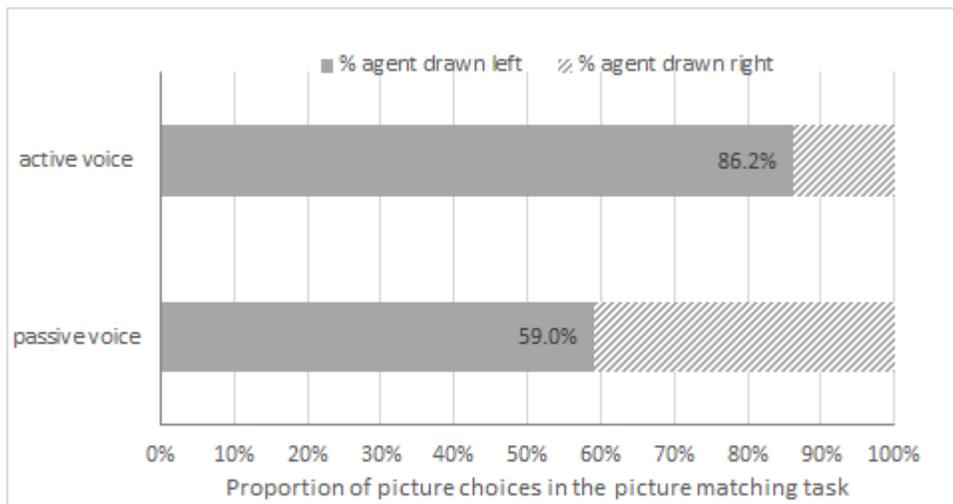
¹⁰ Original items in German: „Um wen geht es hauptsächlich in diesem Satz?“, „Welche Person wird in diesem Satz hervorgehoben?“, „Auf welcher Person liegt der Fokus in diesem Satz?“

Research and Publication Ethics

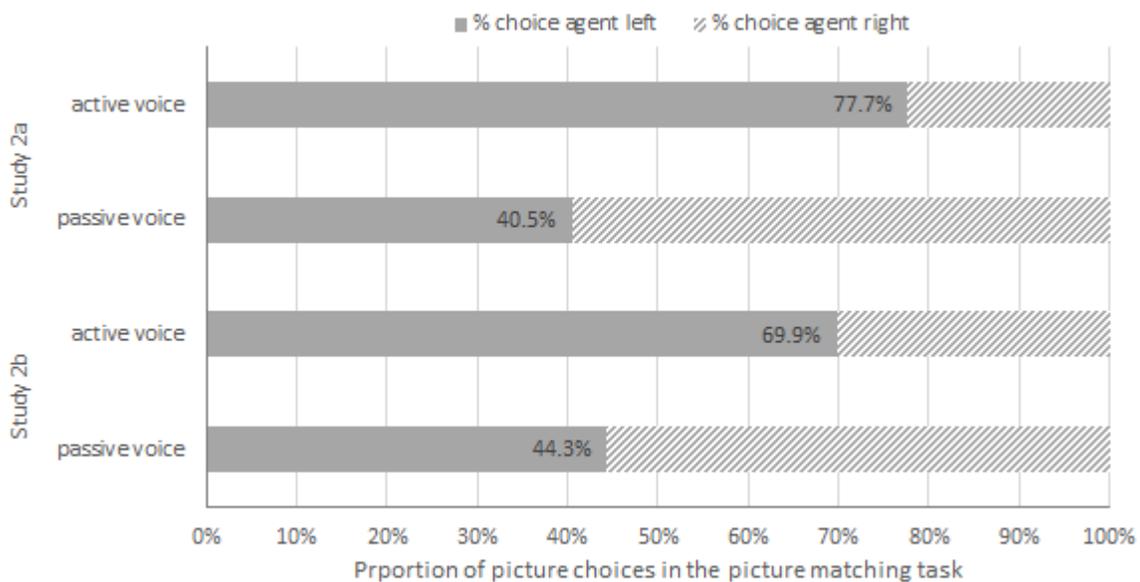
(a) Research was conducted ethically, responsibly, and legally. (b) Results are reported clearly, honestly, and without fabrication, falsification or inappropriate data manipulation. (c) New findings are presented in the context of previous research, which is accurately represented. (d) Researchers are willing to make their data available to the editor when requested. (e) Methods are described clearly and unambiguously. (f) Submitted work is original, not (self-)plagiarised, and has not been published elsewhere. (g) Authorship accurately reflects individuals’ contributions. (h) Funding sources and conflicts of interest are disclosed.

Data Archiving and Sharing

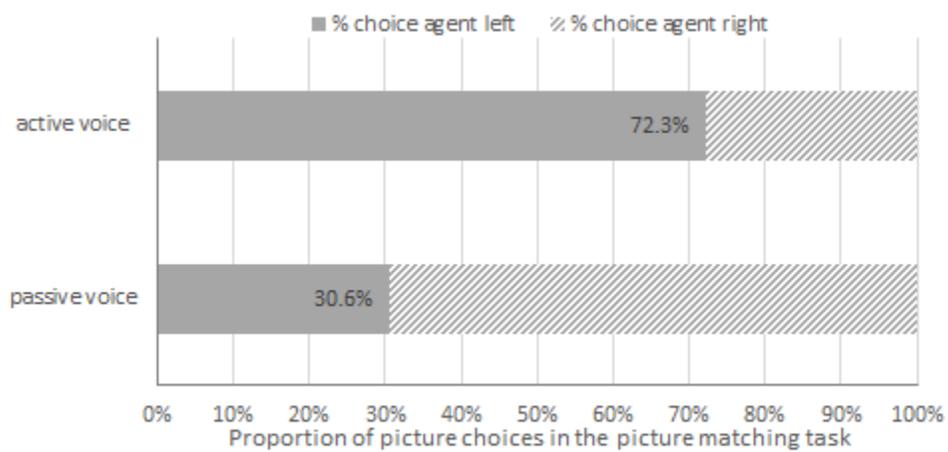
Supporting information including study material will be available as soon as the review process is finished. Researchers are willing to make their data and material available to the editor when requested.



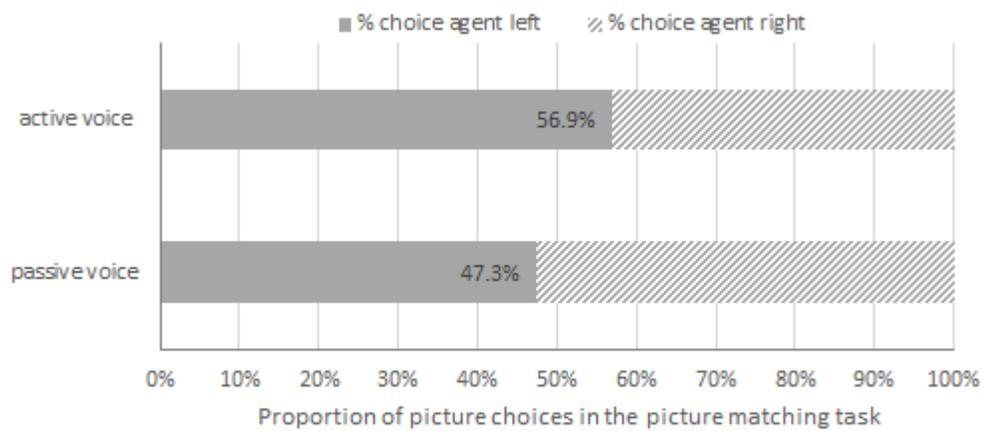
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