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Strategic incentives undermine gaze as a signal of prosocial motives

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ABSTRACT

People often have to judge the social motives of others, for example, to distinguish truly prosocial people from those merely trying to appear prosocial. Gaze can reveal the motives underlying social decisions, as decision-makers dedicate more attention to motive-relevant information. We extend the use of eye-tracking and apply it as a communication device by providing (real-time) eye-tracking information of one participant to another. We find that untrained observers can judge the prosociality of decision-makers from their eye-tracked gaze alone, but only if there are no strategic incentives to be chosen for a future interaction. When there are such strategic incentives, the cues of prosociality are invalidated, as both individualistic and prosocial decision-makers put effort into appearing more prosocial. Overall, we find that gaze carries information about a person's prosociality, but also that gaze is malleable and affected by strategic considerations.
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1. Introduction

Humans are social beings evolved to thrive in complex social situations (e.g., Gallese et al., 2004; Saxe, 2006). Non-verbal communication, such as body posture and attire, hand gestures, tone of voice, facial expression, and eye contact is often as revealing in human interactions as verbal communication and can be used for type identification as well as type signaling (e.g., Nelissen and Meijers, 2011; Tracy et al., 2013; Centorrino et al., 2015; He et al., 2017). Type identification is important when deciding with whom to engage with, e.g., as team members or cooperation partners. However, little is known about how each non-verbal communication channel is used to send and receive cues of prosociality and how strategic incentives affect the social cognition of these cues.

In our study, we focus on attention (signaled by eye-tracked gaze) as the channel of non-verbal communication. We study (i) whether untrained participants are able to use the gaze of others to reveal their prosociality, (ii) how this ability depends on the strategic incentives of the observed person, and (iii) how easily malleable gaze actually is. We extend the

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use of eye-tracking from being a passive tool for decision-process analysis to an active component of the interaction. Since eyes present a natural means of communication, observing *non-strategic* gaze of an allocator (i.e., with no incentives to hide her true motives) should allow observers to reveal information about an allocator's true underlying motives. In contrast, it is unclear whether *strategic* gaze (i.e., with incentives for the allocator to hide her true motives) would still reveal the true underlying motives to observers.

Our work builds on Fiedler et al. (2013) who find that specific measures of information search are predictive of the level of prosociality of a person. In their experiments, these measures are used in post-hoc decision-process analysis by the authors, while in our experiment, we establish to what extent these measures can be used by participants themselves. The paper is also related to Hausfeld et al. (2021) who investigate whether box choices can be inferred from strategic and non-strategic gaze in hide-and-seek, coordination and discoordination games. Thus, in their experiments, people had to directly guess the action, while in our experiment, the task is to assess the underlying prosocial motive, i.e., the considerations behind a choice.[1]

Gaze is particularly suited for studying social preferences, as heterogeneity in the prosocial motive should be – and actually is – related to how much attention people devote to the others' outcomes (F. Chen and Krajbich, 2018; Melamed et al., 2020; Fiedler et al., 2013).[2] In general, eye-tracking is an affordable and precise method for measuring information acquisition; see, e.g., Duchowski, 2002; Orquin and Loose, 2013; Fiedler and Glöckner, 2015 for a survey of eye-tracking studies. Eye-tracking has been used to study how people interact in games by *ex post* inferring player types from recorded gaze (Wang et al., 2010; Polonio et al., 2015; Jiang et al., 2016; Amasino et al., 2019; Knoepfle et al., 2009; C.-T. Chen et al., 2018; Hausfeld et al., 2020; Marchiori et al., 2021; Devetag et al., 2016).[3] Gaze has also been shown to be predictive of choices (Shimojo et al., 2003; Krajbich et al., 2010; Thomas et al., 2019) including online purchase decisions (Shi et al., 2013), and externally manipulating gaze behavior can lead to changes in choices (Armel et al., 2008; Ghaffari and Fiedler, 2018; Pärnamets et al., 2015).[4] That recorded gaze is telling about behavior is pointed out by both C.-T. Chen et al. (2018) and Wang et al. (2010) who state that if there was a possibility for seeing the information search, this could have increased a player's payoff substantially. Studies show that people are able to interpret gaze information in studies, and problem-solving performance benefits from providing eye-tracking information of others who previously worked on the same task (Velichkovsky, 1995; Litchfield and Ball, 2011). In addition, bilateral real-time gaze transmission positively affects performance in visual search tasks (Brennan et al., 2008; Neider et al., 2010). However, gaze can be difficult to interpret if there are various motives for looking at a piece of information (Müller et al., 2013; Shenhav et al., 2018; Hausfeld et al., 2021; Foulsham and Lock, 2015).

Eye-tracking provides a largely unexplored tool for understanding the positive impact of communication on cooperation rates. Using face-to-face communication, He et al. (2017) demonstrate that the positive impact of communication (referred to as communication gap) is not only due to social identification or commitment, but also to type identification. Other studies have shown that such identification is not confined to face-to-face interactions, as there are also informative cues in written messages (e.g., Charness and Dufwenberg, 2006; J. Chen and Houser, 2017) and other types of communication media (e.g., Brosig et al., 2003). We could thus plausibly expect that also eye-tracked gaze includes cues for identifying more prosocial or less prosocial types. Interactive eye-tracking could then be relevant not only in academic research but also in organizations, e.g., human resources or strategic management; see Meissner and Oll (2019) for a recent review of eye-tracking applications in organizational research.

We show that type identification is possible – but only in the absence of strategic incentives. Strategic incentives affect people's gazing behavior, thereby invalidating gaze as a signal of prosociality. This result is in the tradition of the signaling literature in economics and psychology, which tackles the topic of credibly conveying information about oneself to another party. Classic applications examine signals of ability that the agent sends to the principal in a labor market context (Spence, 1974; Crawford and Sobel, 1982) and signaling in evolutionary biology extends this concept to biological markets with communication between and within species (Noë and Hammerstein, 1994; Barclay, 2013; Hammerstein and Noë, 2016). Numerous experiments have studied partner choice in situations of asymmetric information in different games (Brown et al., 2004; Holm and Engseld, 2005; Barclay and Willer, 2007; Coricelli et al., 2004; Sylwester and Roberts, 2010; Eckel and Wilson, 2004; Bornhorst et al., 2010). These studies tend to investigate the effects of either individual differences or *ex ante* cooperative behavior, but they do not consider signals that go beyond discrete messages – such as the allocators' continuous information search process. We advance the signaling literature by applying eye-tracking interactively instead of passively, such that gaze becomes a signaling device and, thus, part of the strategic consideration of the allocator: She not only needs to find the relevant information but also needs to take into account what signal her own gaze transmits to the receiving

[1] In addition, we expand the former results. We extend the scope of possible tasks, explore different variations of information visualization (dynamic or static) and introduce competing information transmitters.

[2] We explore prosociality-based type identification, given that people are prosocial (Kahneman et al., 1986; McClintock, 1972; Camerer and Fehr, 2006; Fehr and Fischbacher, 2002) and there is heterogeneity in prosociality (Murphy et al., 2011; Hein et al., 2016).

[3] Note that there is substantial heterogeneity across participants in the information search and behavior strategies, as recently presented by Polonio and Coricelli (2019) and Zonca et al. (2019).

[4] Fiedler and Hillenbrand (2020) use a gain and loss frame in dictator decisions and find that the loss domain shifts attention to one's own outcome and leads to more selfish choices compared to the gain domain.

observer. It is an empirical question whether deceiving the observer is possible or whether the gaze pattern conveys truthful information even if this is not in the sender's interest.

In our laboratory study, allocators make a variety of allocation decisions in slider-type Social Value Orientation (SVO) situations that are commonly used to measure social preferences (Murphy et al., 2011). In these situations, the allocators choose one of five allocation options with varying payoffs for oneself and another person. While allocators make their decision, both their choice and gaze are recorded. We then show either the eye-tracked gaze during the allocation decision (in GazeVideo or GazePicture format) or the actually chosen allocation (in Choice format) of the allocators to the observers, as depicted in Fig. 1. The observers subsequently attempt to assess how prosocial the eye-tracked participants are based upon this information. Specifically, the observers have to (i) predict the allocators' action in another decision and (ii) guess which one of two allocators is more prosocial. In our experiments, there are two types of situations for the allocators: In the *strategic* situations, the allocators have an incentive to appear prosocial because the seemingly more prosocial types are selected for a further profitable interaction. In the *non-strategic* situations, the decision is irrelevant for future interactions.

First, we confirm the finding that gaze in non-strategic situations carries information (Fiedler et al., 2013). We show that gaze has significant out-of-sample predictive power for the allocators' prosociality. Second, we demonstrate that untrained observers do intuitively understand that gaze presents a valuable source of information in non-strategic situations. Observers are able to distinguish the more prosocial allocators from selfish allocators more often than not and choose them as partners for a further interaction. Third, these results do not hold in strategic situations. We find that gaze becomes less informative when allocators have strategic incentives to signal prosocial motives. In these strategic situations, the eye-tracked allocators understand how to gaze strategically and simulate a higher level of prosociality, in order to shift the partner choice in their favor. As a result, the less prosocial subjects are chosen more often for future interaction in the strategic settings than in the non-strategic settings, which in turn leads to less profitable partnerships for the person choosing a partner. We conclude that people are skillful users of eye-tracking, both in interpreting as well as in signaling social preferences.

2. Material and methods

2.1. General setup

The experiment consists of several stages. First, all participants make 26 allocation decisions (see Fig. 1-top) between themselves and a recipient using slider-type Social Value Orientation situations (SVO, Murphy et al., 2011). The *Baseline* treatment finishes after these first 26 decisions, whereas the other four treatments, *Interactive, Recorded, Infopilot*, *Partnerpilot* (see Table 1) proceed to the next stage, the main part of the experiment.[5]

In this second, main stage, there are two types of participants in our study: "allocators" and "observers". The allocators make additional allocation decisions in SVO situations. The observers observe either the gaze or the choice of some allocators and assess the allocators prosociality based on this information (see Fig. 1-bottom). Specifically, they have to predict the choice of this allocator in another, randomly drawn, SVO situation, and (in *Interactive*, *Recorded* and *Partnerpilot*) choose an allocator for a future choice.

2.2. Information formats

We use three different ways to display the allocator's choice or gaze (see Fig. 1-bottom): In Choice information, a rectangle highlights the allocator's chosen option. In GazeVideo information, we show each piece of information that was looked at in order, with the correct timing. These pieces of information correspond to the areas of interest (AOI) for the eye-tracking analysis. They are highlighted with an orange frame for as long as they were inspected. In GazePicture information (see Appendix Fig. A.9), a scanpath connects the inspected AOIs in the sequence they were looked at, starting from the first (green) and ending with the last (red). The information in all formats is shown for the length of time the allocator took to make the decision (see Appendix for more details on information formats).

2.3. Treatments and decisions

The study consists of five treatments outlined in the columns 2 to 6 of Table 1. The treatment *Interactive* is the most complex treatment, with all other treatments being variants. Thus, we first explain the setup of *Interactive* and then describe how the other treatments differ.

Each round consists of several steps (indicated in Table 1, steps 2a-2g). In each round, two allocators (A1 and A2) and two observers (O1 and O2) are matched. The allocators sequentially decide in one of the SVO tasks. Both O1 and O2 receive information about the gaze (GazeVideo) or the choice itself (Choice). Next, both observers have to select one of the two allocators (A1 or A2). This selection determines who their own allocator is in the next allocation decision (i.e., the observer is the recipient in this allocator's next choice and receives the corresponding points). To avoid learning effects in subsequent

[5] See Appendix for more details on the treatments, matching of the participants, payment and randomization. Note that we only collect the gaze of allocators.

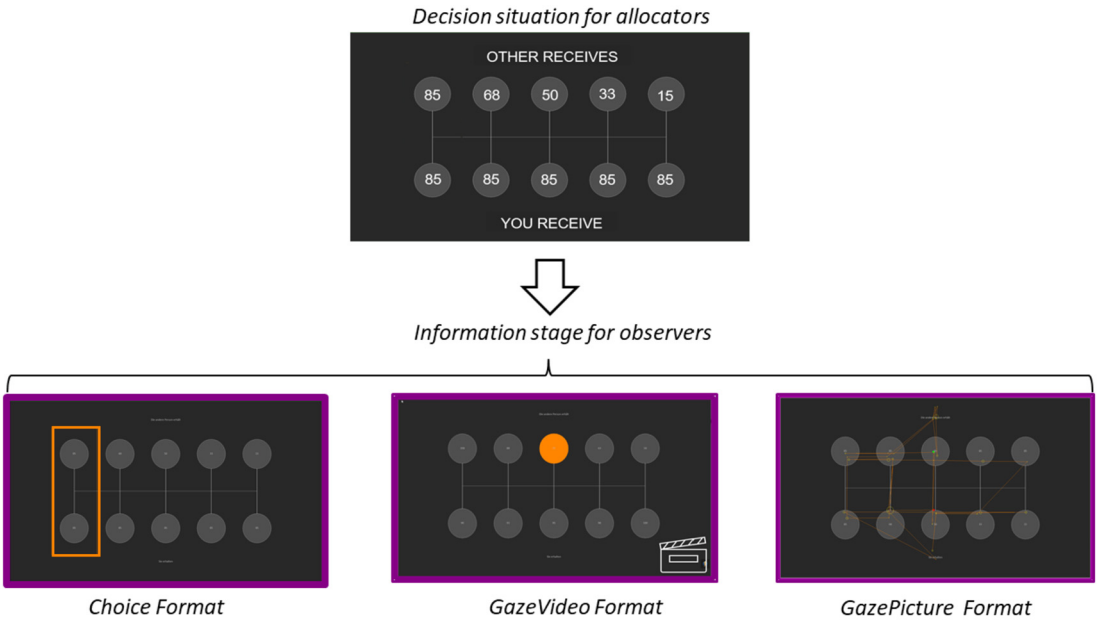

Fig. 1. Screenshots of choice and information. The top image shows the decision screen for the allocators. For illustrative purposes, we magnified the font size. The lower three images show the three information formats for the observers, *Choice*, *GazeVideo*, and *GazePicture* in the original font size. In Choice information, a rectangle highlights the allocator's chosen action. In GazeVideo information, whenever an option is being looked at, the respective area of interest (AOI) lights up for as long as it is being inspected. In GazePicture information (only used in *Infopilot*), a scanpath connects the inspected AOIs in the sequence they are looked at, starting from the first (green) and ending with the last (red; a larger screenshot is provided in the Appendix Fig. A.9). (For interpretation of the colors in the figure(s), please refer to the web version of this article.)

rounds, A1 and A2 do not receive feedback on the choices by O1 and O2. Then, both A1 and A2 make the second SVO-decision where no information is transmitted. The allocators are paid for these allocation decisions as often as they are chosen by O1 and/or O2, i.e., twice if chosen by both, once if chosen by one, and not at all if chosen by none. At the time of the second allocation decision of the allocators, both observers have to predict both A1's and A2's behavior in this second decision without any transmitted information. These steps are repeated for 4 rounds with rematching the groups of 4 in between rounds. After 4 rounds, the information format changes from Choice to GazeVideo or vice versa. The allocators and observers were informed which information (Choice or GazeVideo) was transmitted.

In the *Interactive* sessions, we introduce strategic incentives for allocators. In the first decision of each round, we transmit their gaze or choice to observers who will attempt, implicitly, to choose the more prosocial allocator. Thus, the allocators have an incentive to appear prosocial in this choice. If the choice is transmitted, they also have an incentive to make an altruistic choice: The maximum cost of an altruistic choice is 50 points, and the average gain of being selected equals 86.67 points. By appearing prosocial, one can increase the chance of being selected by 50% for each of the two observers. Since no selection is based on the second choice of the allocators, they have no strategic incentives in the second choice in each round.

The *Recorded* sessions consist only of observers (not eye-tracked) who are matched with the non-strategic allocators' decisions from *Interactive* (Table 1, stage 1-SVO). This effectively excludes the strategic component in the transmitted decisions. This treatment serves as a non-strategic control for *Interactive*. These two treatments allow us to establish the impact of strategic incentives on the allocators' intuitive understanding of how to use gaze and choices, as well as the observers' comprehension of this information.

Before conducting these two treatments, especially before introducing any strategic considerations, we needed to check and explore several issues, e.g., whether participants can infer intentions from gaze, which information format is suited, and whether participants are able to choose the more prosocial allocator. This is achieved via the *Baseline*, *Infopilot* and *Partnerpilot*.

The *Baseline* sessions consist only of eye-tracked subjects who participate only in the first stage of the experiment, the non-strategic SVO-decisions. The gaze and behavior in these sessions are used to investigate whether gaze allows us experimenters to infer the prosociality of an allocator in a non-strategic setting (similar to Fiedler et al., 2013).

The decisions and gaze of the *Baseline* allocators are then re-used in two different treatments, *Infopilot* and *Partnerpilot*. In these two treatments, observers first see the non-strategic gaze or choice of allocators. Then, the observers have to predict the allocator's behavior in new decisions. These treatments focus on our methodological contributions, test different displays of gaze, and attempt to establish a standard for using eye-tracking interactively. Both these treatments feature only one observer who is repeatedly matched with allocators from *Baseline*.

Table 1
Summary of the treatments.

	Interactive	Recorded	Baseline	Infopilot	Partnerpilot
1-SVO: 26 non-strategic SVO decisions	48 Allocators 48 Observers	94 Observers (*Allocators* from Interactive)	46 Allocators	56 Observers (*Allocators* from Baseline)	54 Observers (*Allocators* from Baseline)
2-GAZEVIDEO:	4 rounds:	4 rounds:		12 rounds:	12 rounds:
2a. A1 makes one decision	✓	From Interactive		From Baseline	From Baseline
2b. O1 & O2 get GAZEVIDEO about A1	✓	✓		✓	✓
2c. A2 makes one decision (same situation as A1)	✓	From Interactive		-	From Baseline
2d. O1 & O2 get GAZEVIDEO about A2	✓	✓		-	✓
2e. O1 & O2 decide whether to interact with A1 or A2	✓	✓		-	✓
2f. A1 & A2 makes a second decision (no info is transmitted)	✓	From Interactive		From Baseline	From Baseline
2g. O1 & O2 predict A1 & A2's future decision	✓	✓		3x	3x
3-CHOICE: Same as 2-GAZEVIDEO, but with CHOICE information (order of CHOICE or GAZEVIDEO is counterbalanced)	As above	As above		As above	As above
4-GAZEPICTURE: Same as 2-GAZEVIDEO, but with GAZEPICTURE information (order is counterbalanced)				As above	
Purpose	How do monetary incentives affect gaze and gaze comprehension?	Non-strategic control for Interactive.	Can intentions be inferred from gaze? Collect allocator behavior.	Can observers infer intentions? Which format is easy to use?	Can observers detect the more prosocial allocator?

Notes: In the first column, the possible parts are listed in the columns 2 to 6 describing the treatments, we show which of these actions are present in this treatment (symbol "✓") and which are not (symbol "–"). Further, we report how often these parts have been performed. Note that only the observers in *Interactive* interacted with allocators from the same session. In all other sessions, we used the pre-recorded (non-strategic) allocator gaze and choices (indicated by the "From" and the respective treatment). The allocators' first decision in each round of the *Interactive* treatment is strategic (i.e., 2a and 2c), which are transmitted to the observers who then make a partner choice. A second decision is non-strategic (2f, not transmitted), but is payoff-relevant with a multiple of 2, 1 or 0. The multiple depends on how often the respective allocator is chosen by the two observers (2 if chosen by both, 1 of chosen by one, 0 if chosen by none). The *Infopilot* and *Partnerpilot* consisted of 12 rounds and 3 predictions for each information format.

The *Infopilot* serves to assess whether participants can predict future choices of one allocator, and thereby their prosociality,[6] across three different information formats. In addition, this treatment allows us to decide whether to use GazeVideo or GazePicture in the other treatments.

In the *Partnerpilot*, we only use the information formats Choice and GazeVideo. In this treatment, the observers face the information of two allocators. This allows us to i) assess whether seeing the information of a second allocator improves the assessment accuracy, since the information of a second allocator could serve as a reference point, and ii) to see whether participants can choose the more prosocial allocator.

2.4. Hypotheses and measures

We analyze the allocators' attention using different process measures (similar to Fiedler et al., 2013). In line with this evidence, we expect that non-strategic gaze carries information about the prosociality of a person (using the *Baseline* treatment). More specifically, we hypothesize that with increasing SVO angle (i.e., higher prosociality), allocators (i) spend more time on the decision (logarithmized decision time), (ii) inspect more information (number of areas of interest, or AOIs, with information about the payoffs inspected at least once), (iii) allocate more attention to the recipient's payoff (percentage of

[6] Note that in the prediction stage (see Appendix Fig. A.2), observers get points for guessing the correct option, but also for guessing whether a person is rather prosocial or selfish. This is implemented by displaying an orange line. The orange line divides previous choices in such a way that roughly as many participants chose an option on the left side of the orange line as on the right side. Since most SVO slider task choices are designed such that the points for oneself increase while the points for the other decrease from left to right (or vice versa), the orange line divides the choices into rather prosocial and selfish ones.

time on other's payoffs), and (iv) make more comparisons that include the recipient's payoffs (transition index from −1 to +1, with lower values for more transitions including only own payoffs).[7]

However, if the allocators are able to control their gaze, then the information content of gaze should vanish as soon as gaze stems from a strategic situation (i.e., *Interactive* treatment). Here, the incentives to appear more prosocial should make all allocators alter their gaze to mimic higher prosociality, thus engaging in economically costless signaling. Accordingly, if the choice is transmitted, allocators should allocate more points to the observer in the strategic situation than in the non-strategic situation, thus engaging in costly signaling.

For the observers, we expect that they are also able to identify types and choose the more prosocial allocator in non-strategic situations (using *Partnerpilot* treatment), but to a lesser extent than models using process measures, since participants have never been confronted with such a task and gaze sometimes shifts very quickly. This ability to recognize types should disappear when gaze (and choice) stems from strategic situations (comparing *Interactive* and *Recorded*).

2.5. Procedures

We recorded the gaze using Tobii EyeX eye-trackers (60 Hz frequency, with 1920 × 1080-pixel resolution 22" monitors and chinrests at 58 cm distance).[8] We connected them to z-Tree (Fischbacher, 2007) such that (real-time) gaze data could be displayed and integrated in the interaction. We used ORSEE (Greiner, 2015) and hroot (Bock et al., 2014) for recruiting student participants. 346 participants took part in the whole study from 2017 to 2019, of which 94 were eye-tracked allocators: *Baseline* (only allocators: n = 46, age 21.3, 56.3% female, 50% prosocial)[9]; *Infopilot* (only observers: n = 56, age 21.3, 50% female, 62.5% prosocial); *Partnerpilot* (only observers; n = 54, age 21.9, 59.3% female, 66.7% prosocial), *Recorded* (only observers: n = 94, age 22.4, 56.4% female, 58.3% prosocial). In the *Interactive*, both allocators and observers participated (n = 2 × 48, age 21.5, 54.2% female, 60% prosocial). Informed consent was obtained from all participants, and their privacy rights were always observed. In terms of the SVO orientation, there were only prosocial and individualistic types in all sessions. The legends of the Figures and Tables specify the used statistical tests, while Table 1 shows the number of subjects for the treatments.

3. Results

3.1. Allocator gaze and prosociality in non-strategic situations

We first describe how the four process measures relate to the allocators' SVO angles in non-strategic situations from *Baseline* treatment (see Appendix Figs. A.6 and A.7 and Table A.2). We find that the more prosocial allocators spend significantly more time making decisions, they inspect significantly more information, they spend more time inspecting the recipients' payoffs and have a higher transition index – thereby confirming former results (Fiedler et al., 2013): The differences in the SVO angles are reflected in the information search patterns in social decision making. Furthermore, we use the leave-one-out cross-validation method to predict allocators' SVO angles from their gaze (see Appendix for further details). Using all choices from all but one participant, we estimate the SVO angle of the left-out subject(s) for any given decision. Our best model that uses all four measures together indicates a medium-to-strong positive correlation between the actual and predicted SVO angles (Pearson's $\rho = 0.6$, $p < 0.001$). The four other models that use each of the four process measures separately indicate a weak-to-moderate Pearson's ρ of 0.48, 0.35, 0.22 and 0.40 (all $p < 0.001$), respectively, for the decision time, the share of inspected information, the attention to other's payoffs and the transition index.

3.2. Allocator behavior and gaze in strategic and non-strategic situations

Fig. 2 shows the actual choices and Fig. 3 shows the four process measures from allocators in the *Interactive* sessions, separated by prosociality type (between-subjects comparison using prosocial and individualistic types) and strategic and

[7] The transition index (TI) uses the variables $trans_{other}$ and $trans_{self}$. They are defined as follows: $trans_{other}$ indicates the number of transitions between AOIs, for which at least one AOI contains payoff information of the recipient and $trans_{self}$ indicates the number of transitions solely between own payoff information. We normalize the transitions based on the fact that there are more possible transitions including $trans_{other}$ than $trans_{self}$ by using $k_{self} = 20$ and $k_{other} = 20 + 10 = 30$ to indicate the number of *possible* (non-diagonal) transactions involving solely own or also other payoffs, respectively (Fiedler et al., 2013). The transition index is then defined as

$$TI = \frac{\frac{trans_{other}}{k_{other}} - \frac{trans_{self}}{k_{self}}}{\frac{trans_{other}}{k_{other}} + \frac{trans_{self}}{k_{self}}}$$

Values above zero indicate that the allocator prefers comparisons involving the payoffs of the observer, whereas values below zero indicate a preference of transitions only involving own payoffs.

[8] Gibaldi et al. (2017) test the Tobii EyeX and find the accuracy to be between 0.5° and 1° while the precision is at 0.25°. The points were written in font size 18 with a horizontal distance of 280 pixels between options, and the options were 320 pixels distance from the top and bottom end of the screen. This yields a sufficient distance between AOIs (Orquin et al., 2016).

[9] Two of the initial 48 participants needed to be excluded due to technical and comprehension problems.

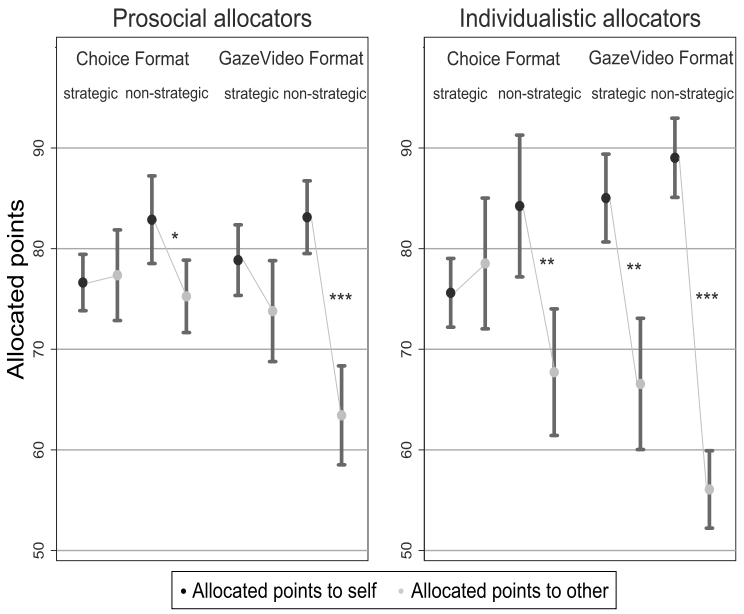

Fig. 2. Summary of the allocator's strategic and non-strategic processing and chosen Allocations. Allocated payoffs (allocator dark, recipient light) in the *Interactive* decisions by prosocial allocators (left) and individualistic allocators (right), separately by whether the decision was strategic or non-strategic (with the same situations in Choice or GazeVideo format).

non-strategic situations (within-subject comparison). We first investigate whether the allocators engage in costly signaling by comparing the points allocated to the observers depending on the strategic environment and the transmitted information (Fig. 2). We find support for strategic choices in the strategic situations as allocators choose particularly equal allocations between themselves and the observers when Choice information is transmitted, while the allocations are comparatively more individualistic when GazeVideo information is transmitted. The allocations are most individualistic when no information is transmitted (i.e., in the non-strategic situations in Fig. 2). Especially the individualistic allocators have an incentive to appear prosocial when Choice is transmitted, since this increases their chances to participate in a second profitable interaction. Indeed, distinguishing the allocators' types yields that the prosocial allocators do not change their behavior as much in response to the strategic incentives or information formats as the individualistic allocators do (i.e., all self-other differences in Fig. 2).

Interestingly, allocators do not only adapt their allocation choices, but also their gaze (Fig. 3). First, we observe mimicry behavior and "peacock" effects in strategic compared to non-strategic situations. Namely, both the prosocial and the individualistic allocators attempt to appear more prosocial in the strategic situations (in terms of the four measures, there are no significant differences between prosocial and individualistic allocators in strategic situations in Fig. 3). In fact, the two types are hard to tell apart in the strategic situations (Mann-Whitney-Wilcoxon rank sum tests all eight prosocial-individualistic comparisons in strategic situations yield $p > 0.07$, with six comparisons $p > 0.5$), while this difference is statistically significant in some of the non-strategic situations and in all *Recorded* situations. Thus, selfish allocators were able to make more selfish choices while simulating the gaze pattern of a prosocial allocator.

We now focus on the within-subject comparisons of how the two types of subjects adapt their processing in the strategic compared to the non-strategic situation. The individualistic allocators have more "prosocial-like" process patterns in nearly all (7 out of 8, the eight with $p = 0.0583$) of the sub-figures of Fig. 3, while the prosocial allocators exert more "prosocial-like" process patterns in four of the sub-figures of Fig. 3. This difference in the adaptation to the strategic situation between the prosocial and individualistic types stems from two effects. First, there is a ceiling effect for the prosocial types for some measures, e.g., the number of inspected information, which makes it difficult for the prosocial types to have a more "prosocial-like" gaze. This is different for the individualistic types who increase the number of inspected information in the strategic situations (both Wilcoxon signed rank tests $p < 0.04$). Second, in order to mimic a prosocial allocator, it would be sufficient if only the individualistic types adapt their behavior. As the differences between strategic and non-strategic situations in Fig. 3 show, the individualistic types adjust their behavior to the strategic situation with respect to all four measures and independent of whether GazeVideo or Choice is transmitted. They adapt gazing if Choice is transmitted because they have to take into account the same criteria as the prosocial types. They adapt gazing if GazeVideo is transmitted because the gaze serves as a signal for prosociality.

Actually, also the prosocial types change their processing if this increases their prosocial appearance. They adjust their behavior only with respect to response time if Choice is transmitted, consistent with the idea that they do not have to refocus their attention. However, if GazeVideo is transmitted, also the prosocial types adjust their gazing behavior and attach even more attention to the item relevant for prosocial behavior. The only exception is the inspected information where there

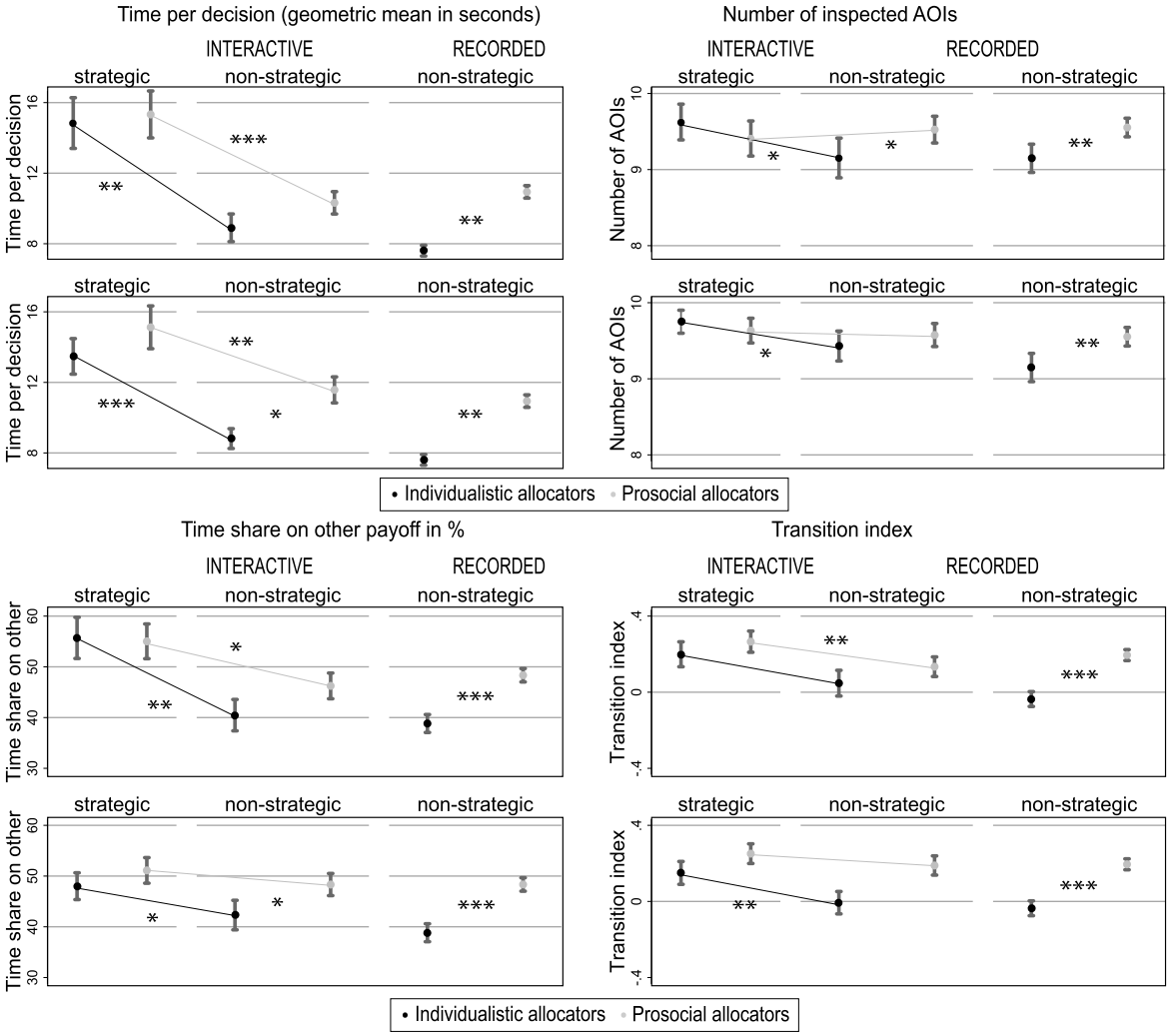

Fig. 3. The four process measures separated into prosocial (light) and individualistic (dark) allocators at the 22.45° SVO angle. The decisions used in *Recorded* are depicted on the right side of the sub-figures, the decisions used in *Interactive* are depicted on the middle and left side of the sub-figures. Note that these decisions stem from the same allocators. The decisions are separated by whether the decisions were strategic or non-strategic and whether GazeVideo (top) or Choice (bottom) was transmitted to the observers. The significance levels correspond to Wilcoxon signed rank tests (within-subject differences between strategic and non-strategic decisions) and Mann-Whitney-Wilcoxon rank sum tests (differences between individualistic and prosocial participants); $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$. For ease of comparison, the *Recorded* gaze is depicted twice for each of the four measures, even though they are the same. All error bars represent 95% confidence intervals using all choices, while the tests use means.

is a ceiling effect. Finally, across all sub-figures, both prosocial and individualistic allocators have similar process measures in the non-strategic decisions in the *Interactive* treatment and in the non-strategic decisions in the *Recorded* treatment.[10] Thus, we find that the allocators' non-strategic gaze yields information about their underlying prosociality, while strategic incentives change their gaze and behavior. We now examine whether observers can identify types based upon either non-strategic or strategic gaze.

3.3. Observer behavior: predicting allocators' future actions

The observers' first task was to predict the allocators' future actions. Throughout the following section, we consider two measures for prediction correctness, in line with our applied two-step incentive procedure (see Appendix for more details on the Assessment stage for observers). As depicted in Table 2, we examine (i) side predictions (i.e., correctly guessing whether

[10] In addition to the gaze and behavioral data, the allocators' statements in the post-experiment question ("Did you have a particular strategy for gazing when your gaze was transmitted?") further support that allocators adapted their gaze in the strategic situation (23 of 48), for example, "Yes, I focused my gaze on the best option for the observer", "I sometimes tried to mislead using my gaze", or "Yes, I looked at a positive option for the partner and took the best option for myself afterwards".

Table 2
Summary of prediction correctness in all experiments.

Treatment	N	Periods	Side predictions				Option predictions			
			Empirical chance	Choice	Gaze-Video	Gaze-Picture	*Empirical chance*	Choice	Gaze-Video	Gaze-Picture
Infopilot	56	12 × 3	*57.7%*	70.9%***	65.3%***	66.0%***	*55.4%*	59.5%**	53.0%	53.5%
Partnerpilot	54	12 × 3	*56.0%*	65.4%***	61.0%**	-	*47.0%*	53.0%**	48.8%	-
Recorded	94	4	*62.5%*	62.5%	59.4%	-	*42.0%*	48.0%*	45.1%	-
Interactive	48	4	*55.6%*	57.3%	57.3%	-	*47.2%*	44.5%	43.8%	-

Notes: "N" indicates the total number of observers, "Periods" indicate the number of periods per information type (three information types in the *Infopilot* treatment, two information types in all other sessions). The naïve chance levels are at 0.20 for option predictions or 0.50 for side predictions. The median empirical chance levels are higher in accordance to $\sum p_i^2$, where p denotes the empirical option or side probabilities for each situation, respectively. Note that the empirical chance levels differ for *Infopilot* and *Partnerpilot*, because different randomly drawn decision situations were used. All significance levels for the differences (both from the empirical chance levels in *Infopilot* and *Partnerpilot* prediction correctness, and between *Recorded* and *Interactive* prediction correctness) refer to regressions testing the average correctness per person minus the empirical chances; ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$.

the allocator was rather more prosocial or more individualistic than average) and (ii) option predictions (i.e., correctly guessing the allocator's exact chosen option). We chose this two-step procedure, because we expected that observers might be able to predict who is more or less prosocial than average, but not necessarily the exact correct option (see Appendix Figs. A.2 to A.4 for decision screens). Indeed, we find that the observers successfully use gaze information to predict the direction of the choice but are less successful in predicting the correct choice. Since not all options are chosen with equal probability, the chance to make the correct prediction is higher than the naïve chance level of 50% for the direction and 20% for the option. We focus on the empirical chance level as a benchmark and report it in the table.

In the *Infopilot*, all three information formats—Choice, GazePicture and GazeVideo—consistently lead to significantly better prediction correctness of the side prediction than the empirical chance level (using regressions to test the average correctness per person minus the empirical chance). Among the three formats, Choice information outperforms GazePicture and GazeVideo information, considering all observers and all situations together, although the option prediction was never significantly better than the empirical chance level. In the *Partnerpilot*, we observe similar trends in the prediction correctness as in the *Infopilot*—again the side predictions are better than chance, but the option predictions were not particularly successful. The possibility to compare two allocators in the same situation (*Partnerpilot* compared to *Infopilot*) does not improve the prediction correctness of the observers. In the *Recorded* treatment, only Choice significantly helped to predict the option.[11] Even though the predictions were better in the *Recorded* treatment than in the *Interactive* treatment, this difference is not significant. Nevertheless, the next section shows that observers were able to choose the more prosocial of two allocators.

3.4. Observer behavior: choosing the more prosocial allocator for future interaction

Observers had to choose one of two observed allocators for further interaction. Throughout this section, we define partner choice correctness in terms of choosing the prosocial allocator when one allocator is prosocial and the other is individualistic (using the difference in the degree of prosociality leads to similar results; see Appendix Fig. A.8 for results with alternative definitions of partner choice correctness). Fig. 4 shows the frequency of choosing partner 2 depending on whether only partner 1 was prosocial, both partners were of the same type, or only partner 2 was prosocial.

First, we find a strong bias in favor of partner 1, but we will focus on whether the observers were able to interpret the available data. In *Partnerpilot*, we find that observers are able to correctly interpret non-strategic gaze and choose the correct partners in both GazeVideo (top sub-figure) and Choice (bottom sub-figure) as depicted in Fig. 4A. This is indicated by the increasing likelihood of choosing partner 2 from left (only partner 1 is prosocial) to middle (both are either prosocial or individualistic) to right (only partner 2 is prosocial). Further, observers perform moderately worse than the benchmark set by our best-performing model of out-of-sample predictions (black short-dashed lines in the figure as described in Appendix).[12] Importantly, only GazeVideo information allows to successfully choose the prosocial partner even if the two partners made the same choice in the Information stage. This is shown in Fig. 4 A-1 where the partner decisions are separated by whether the two matched allocators made the same (left sub-figures, 57% of decisions) or a different choice (right sub-figures). Furthermore, if we separate partner choice decisions by the observers' prosociality (Fig. 4 A-2 left sub-figures compared to right sub-figures), we find that the ability to judge the allocator's prosociality is mainly driven by the prosocial observers.

[11] The split into the two sides is based upon the *Baseline* data, which was also the basis for payment. If we use the split that results from the behavior in the actual prediction task, we find significantly better side predictions than by chance (55.6%) in *Recording*, $p = 0.002$ for Choice and $p = 0.022$ for GazeVideo.

[12] We do not find compelling evidence that one single gaze measure is a particularly good predictor for who is chosen: When calculating the correlations between the choice and the difference in each of our four measures, we get 0.04 ($p = 0.07$) for the log response time, 0.09 ($p < 0.001$ for the number of inspected payoffs, 0.08 ($p < 0.001$) for the share of time spent on the other' payoffs, and 0.07 ($p = 0.002$) for the transition index.

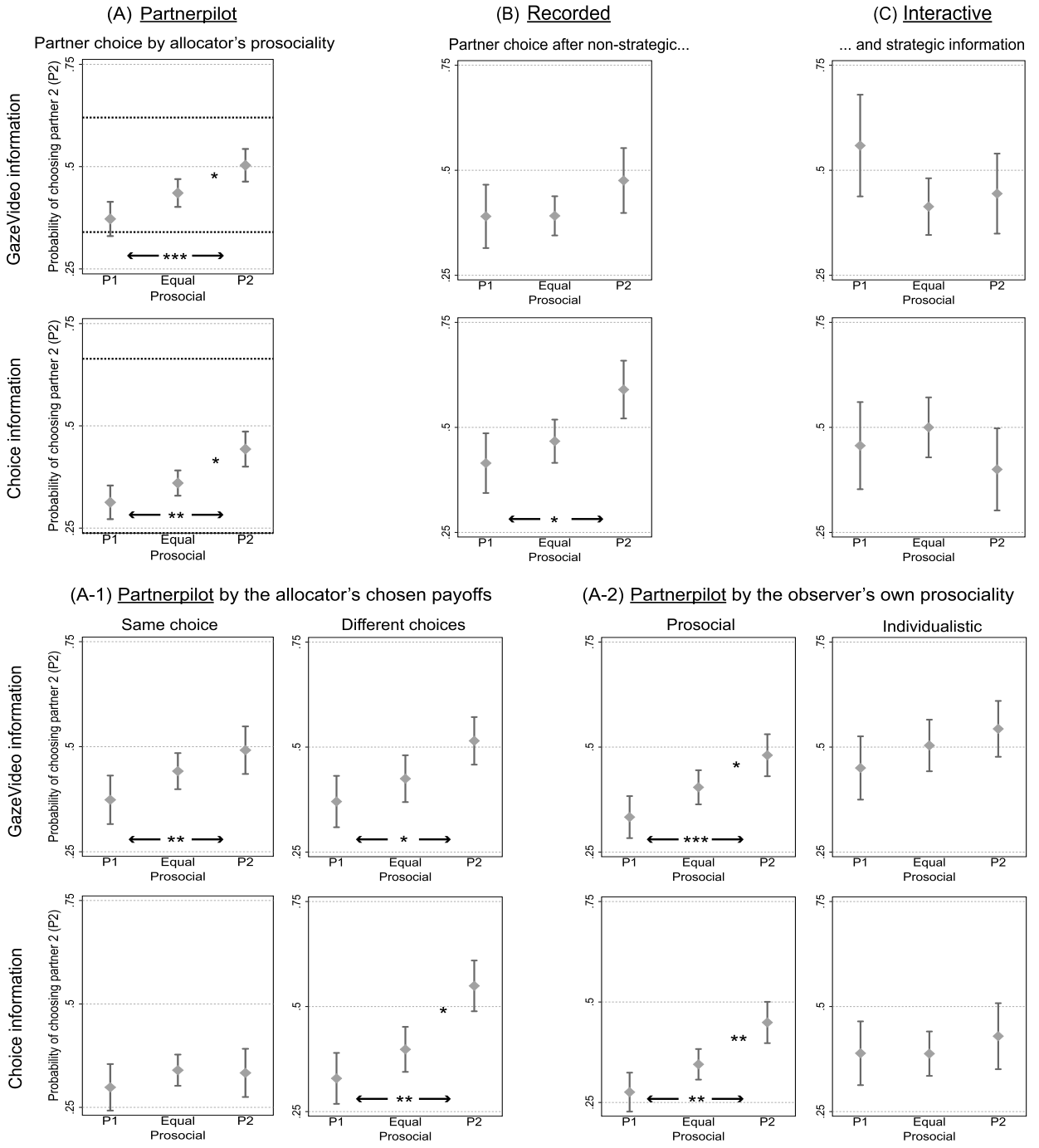

Fig. 4. Summary of the observer's partner choice results and allocators' prosociality. (A) The partner choice correctness in non-strategic situations in the *Partnerpilot*, with (A-1) separating these situations in which the actual choices of the allocators were the same or not the same, (A-2) separating partner choices made by prosocial and individualistic observers, and (B) contrasting the non-strategic *Recorded* with (C) the strategic *Interactive* situations. In all graphs, "Partner choice" is the probability of picking the second partner (on the y-axes), and "correct" partner choice predicts higher probabilities when only partner 2 is prosocial (right side on the x-axes) than when only partner 1 is more prosocial (left side on the x-axes). Here, the stars under "equal" yields comparison between those two cases. All error bars represent 95% confidence intervals. Note that the sub-figures (A) include black short-dashed lines of our best-performing leave-one-out cross-validation model for predicting allocators' choices from their gaze for GazeVideo or using choice and response time for Choice (as described in Appendix). All significance levels refer to coefficients of the respective comparison dummies from probit regressions; $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$.

Last, we examine the effects of the introduced strategic incentives. The observers in the non-strategic *Recorded* treatment (Fig. 4B) pick the more prosocial allocators, while the observers in strategic *Interactive* treatment (Fig. 4C) are unable to pick the correct partner. Second, we find that partner choices are more often correct in the non-strategic *Recorded* situations than in the strategic *Interactive* situations. In particular, the observers make the optimal partner choice less often in the strategic *Interactive* treatment than the non-strategic *Recorded* treatment (57.3% compared to 48.4% correct choices in terms of prosociality). This difference translates into an average payoff decrease of 7.9 points or 10.6% per decision for the observers (rank sum test, $p < 0.001$) and an average payoff increase of 9.4 points or 12.4% per decision for the allocators ($p < 0.001$, excluding the payoff multipliers). That is, if the allocators have incentives to gaze or choose strategically, the observers are less able to choose the correct partner for future interaction.

4. Discussion and conclusions

We use interactive eye-tracking to examine type identification and gaze behavior in non-strategic and strategic settings. Referring to the three main research questions that we listed in the introduction, we find that (i) untrained participants are able to use the gaze of others to reveal their prosociality; (ii) this ability disappears if the observed person has a strategic incentive to disguise the observer, because (iii) people are able to adjust the gazing behavior if they have an incentive to do so. In a recent review, Meissner and Oll (2019) propose various research questions in organizational research domains that can be addressed using eye-tracking. Our research question, specifically point (ii), is closely related to "Does eye-tracking allow the detection of fakers in actual selection contexts?", as we study how eye-tracking information helps to recognize types and how this ability deteriorates when strategic incentives play a role. In the non-strategic settings, allocators convey their type truthfully, albeit noisily. Using benchmark models for out-of-sample predictions of social value orientation, we establish that gaze can help to predict levels of prosociality. Further, we study in how far laypeople-observers can make use of gaze in non-strategic settings, which has been suggested by C.-T. Chen et al. (2018) and Wang et al. (2010). We find that there is clear benefit from gaze, as indicated by a higher type-recognition rate. That is, the observers can use the allocators' gaze to identify the more prosocial and generous allocators, even if their actual choices are unknown, and this ability has material consequences for future interactions. Non-strategic gaze is revealing even in situations in which the underlying choices of the allocators are the same. Although this might seem trivial at first, note that the Choice information format includes the choice and the decision times. It is thus purely the gaze that helps the observers to identify the more generous allocators.

The ability to recognize types vanishes when strategic incentives come into play. In the strategic settings, the allocators are able to strategically manipulate their gaze and choices, as to appear more generous and shift the observer's choice in their favor. The allocators also react to what type of information is being transmitted to the observers by splitting the payoffs relatively equally when choice is transmitted but allocating significantly more to oneself in equivalent situations when gaze is transmitted. Likewise, the allocators alter their gaze by shifting more of their attention to the observers' payoff when gaze is transmitted than when choice is transmitted. The allocators' strategic adaption of gaze and choices leads to consistently less optimal partner choices by the observers in the strategic settings than in the non-strategic settings. These bad choices of future interaction partners translate into significantly lower payoffs for the observers.

A key feature of our experiment is that subjects see another person's focus of attention either in real-time or in a recording. Even though the scope of applicability of our results seems not straight-forward now, tracking and surveillance techniques increase in quality and prevalence (CNBC, 2020). In addition, a recent study by Valliappan et al. (2020) showed that using smartphones as eye-trackers yields promising results. Especially using smartphones as eye-trackers has the potential to run larger studies to detect characteristics of the user, especially when the user has incentives to hide their types. In principle, it is possible to infer intentions and motives from attention data. However, people are also able to strategically respond by adjusting their attention in order to invalidate this information. That people's gaze responds to monetary incentives raises the question whether weaker incentives, such as social image concerns by simply being eye-tracked, also affects gazing behavior. Kee et al. (2021) investigate a range of economic games including a lying game and find no behavioral differences between people who are eye-tracked and people who are not.

Together with Hausfeld et al. (2021), this study is one of the first studies featuring real-time transmission of gaze with known incentives. Thus, all participants were unfamiliar with the used technology, which makes it more surprising that it worked. The prediction quality might strongly increase in an environment in which people get feedback about their prediction quality, as the higher accuracy in the *Infopilot* might suggest. It remains an open question whether more practice would help observers to identify strategic or sincere prosociality in the *Interactive* treatment. Another avenue of further investigation would be to look at the informational content within a trial, i.e., what is the minimum amount of information that helps observers to correctly determine the underlying motive of the allocator? In particular, how important is the final part of the gaze pattern?

In general, our findings reveal that it is an easier task to identify which allocator is more prosocial than to predict which option an allocator will chose in future decisions. Especially the prosocial observers tend to choose the more prosocial allocators more often. This could be due to the prosocial participants identifying their own types better, although this reasoning should then also hold for individualistic participants who should avoid choosing their own type. These results present a potential direction for future research, namely examining the heterogeneity (De Haas et al., 2019) in how different types learn from others' motives and actions.

On a more abstract level, our experiment has shown that people are able to derive other people's motives from their attention that is revealed in the gaze—as long as people do not have an incentive to conceal their motive. We have shown that this works in the context of social preferences, where heterogeneity in the strength of a motive naturally occurs. It remains open whether this result applies to other applications like product choice, time preferences or risk preferences. Interactive eye-tracking is quite a new research field for studying type identification, e.g. in job-market settings, and this study in combination with Hausfeld et al. (2021) opens further directions that can be pursued, including what types of information can be conveyed using interactive eye-tracking and the recognition of the conveyed information's quality or truthfulness.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: We received financial support from the German Research Foundation (DFG) through research unit FOR 1882 "Psychoeconomics".

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Appendix A

Decision situations for allocators. The decision situations are slider-type Social Value Orientation (SVO) allocation decisions with five possible allocation options adjusted from Murphy et al. (2011), as depicted in Table A.1. The SVO situations were originally designed to measure the magnitude of concern that allocators have for others. For the purpose of eye-tracking processing, we reduce the number of available options within each SVO allocation decision to five and standardize the displayed values from 0 to 100. All sessions included a first part in which participants had to make 26 different allocation decisions (13 situations plus the same 13 situations jittered). These decisions were incentivized via one randomly chosen paid-out allocation (random dictator procedure, i.e., random pairs were formed and in each pair one of the participants was randomly selected as the dictator and the other as the recipient). These decisions were *non-strategic* because they had no impact on future earnings. In the *Baseline* and *Interactive* treatments, both gaze and choices from this part were recorded and transmitted to subsequent sessions as information (*Baseline* to *Infopilot* and *Partnerpilot*, *Interactive* to *Recorded*). Note that we only transmitted the information of 12 (plus 12 jittered) situations: We dropped the competitive item of the primary items due to non-existing heterogeneity (see Fig. A.1 for all used situations). Importantly, in the *Interactive* treatment, there were nine periods, and in each period, the allocators had to take decisions that stem from the same set of SVO decisions. In each period, two observers could choose with whom to interact, based on the information from a first decision in the same period. The payoff of the allocators consisted of two parts: 1) the payoff that they chose for themselves in the first decision and 2) the payoff that they chose for themselves in the second decision, multiplied by the number of the observers (two, one or zero) who chose this allocator in the partner choice stage. Thus, the first decision was a *strategic* situation because it could also affect the payoff in the second decision, and the second decision was a *non-strategic* situation since it did not affect future earnings.

Information stage for observers. All sessions except *Baseline* featured observers (see Table 2). The observers were first in an "Information stage": In the *Infopilot*, the observers saw information about a decision of one matched allocator. In the *Partnerpilot*, *Interactive* and *Recorded* treatments, observers saw information about the same situation of two allocators, one after another. After this information, they had to assess the allocators' next actions. After this assessment, they were re-matched with a new allocator or new allocator pair. We initially used three information formats for showing information of the allocators' decisions to the observers, as illustrated in Fig. 1: (i) "Choice" (action information), (ii) dynamic "GazeVideo" (process information) and (iii) static "GazePicture" (process information). For comparability, the information in all formats is shown for the length of time the allocator took to make the decision. Note that we analyze the allocators' eye-tracking data in a format that exactly reflects how the observers saw the gaze.

Table A.1
The twelve different choice situations (in monetary units).

Primary items					
You receive	85	85	85	85	85
Other receives	85	68	50	33	15
You receive	100	96	93	89	85
Other receives	50	59	68	76	85
You receive	50	59	68	76	85
Other receives	100	96	93	89	85
You receive	50	59	68	76	85
Other receives	100	79	58	36	15
You receive	100	88	75	63	50
Other receives	50	63	75	88	100

Secondary items					
You receive	100	93	85	78	70
Other receives	50	63	75	88	100
You receive	100	88	75	63	50
Other receives	70	78	85	93	100
You receive	50	63	75	88	100
Other receives	100	98	95	93	90
You receive	90	93	95	98	100
Other receives	100	88	75	63	50

Additional items					
You receive	15	15	15	15	15
Other receives	85	68	50	33	15
You receive	85	68	50	33	15
Other receives	85	85	85	85	85
You receive	85	68	50	33	15
Other receives	15	15	15	15	15

Notes: The full dataset comprised the twelve situations two times, once as depicted and once with jittered values (5 or −5). In addition, a thirteenth situation between Competitive and Individualistic points (the final SVO primary item, by Murphy et al., 2011) was added in the recording stages for SVO angle calculation.

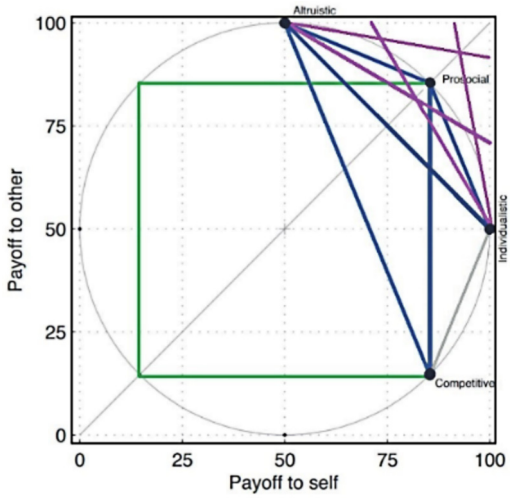


Fig. A.1. Graphic illustration of the twelve different choice situations. Selected SVO primary items in blue, selected SVO secondary items in purple, additional custom-created items in green.

Assessment stage for observers. After the Information stage, observers entered the "Assessment stage". Here, one new randomly drawn situation was displayed to observers in the *Interactive* and *Recorded* treatments and three new randomly drawn situations were displayed in the *Infopilot* and *Partnerpilot* treatments. Then, the observers had to assess the prosociality of the allocators based on the information they received in the previous Information stage. More specifically, the observers had to make predictions (and non-incentivized prediction certainty) about the allocators' actions in these situations. We examine how the observers assess the preferences of the matched allocators using two methods: predictions of next decisions (i.e., 1 out of 5 options) and partner choice (i.e., 1 out of 2 allocators).

(i) *Prediction stage for observers* (*Infopilot, Partnerpilot, Interactive, Recorded*). The observers were rewarded based on a two-step procedure. Firstly, the observers received a fixed payment if they correctly guessed the exact chosen option (1 of 5). Secondly, they additionally received a fixed payment if they correctly guessed the correct side of the choice. Here, we separated the five options into two sides such that the allocators from *Baseline* chose the two sides as similarly

frequently as possible. This information was also made available to the observers: They saw an orange "average choice" line that separated the two sides (see the decision screens and instructions).

(ii) *Partner choice stage for observers* (*Partnerpilot, Interactive, Recorded*). The observers first saw the information about two different allocators and then had to decide with whom they want to interact in the next situations. The observer received the payoff allocated to the recipient by the chosen allocator in these next situations. The implicit task for the observers was to identify the more prosocial or generous of the two matched allocators in the group. We always used purple and blue colored frames around the decision screens to color-code the first and second allocator to the observers.

Design of the Infopilot treatment. The *Infopilot* served to pilot the information representation for the observers and to pilot whether observers do understand information content of non-strategic gaze. In this treatment, observers saw non-strategic choice and gaze data from *Baseline* treatment. In each period, the observer saw information about one single allocator in one decision and then stated her predictions of this allocator's actions in the next three decisions. The *Infopilot* comprised 36 periods in total: 12 periods for each of the three information formats (Choice, GazePicture and GazeVideo) respectively in counter-balanced blocks. The incentives for the observers were the prediction correctness one randomly chosen allocator's decision in one of the three next decisions for each of the three information treatments.

Design of the Partnerpilot treatment. In the *Partnerpilot*, observers saw non-strategic choice and gaze data from *Baseline* treatment. Importantly, they saw the information about two allocators and then not only stated their predictions of the two allocators' actions in the next three decisions, but also made a partner choice, i.e., they picked with whom of the two allocators to interact in these decisions. The *Partnerpilot* comprised 24 periods in total: 12 periods for Choice and GazeVideo information formats respectively in counter-balanced blocks. The incentives for the observers were: (i) prediction correctness for each information treatment about a randomly chosen allocator's decision in one of the three next decisions and (ii) the payoff that the selected allocator allocated to the recipient in one of the next three decisions.

Design of the Interactive and Recorded treatments. In the *Interactive* treatments, the observers saw strategic (interactive) information from two allocators within the same session. In *Recorded* treatment, the observers saw non-strategic recorded information from two allocators from the first part (SVO assessment stage) from the *Interactive* sessions. Thus, the information about the same eye-tracked allocators was transmitted in *Recorded* and *Interactive*. In the *Interactive* treatment (after the SVO assessment stage), it was known to all participants that the allocators' gaze or choice from a first decision will be shown to the observers. The allocators had an incentive to gaze strategically, as it was also common knowledge that their payoff in a second decision will be multiplied by the number of observers (two, one or zero) who choose this allocator in the partner choice stage after the transmitted decision. In the *Recorded* treatment, the same setup applied except that the first and second decisions stemmed from the non-strategic preceding part of Interactive. In both *Interactive* and *Recorded*, each period consisted of these first and second choices. In total, there were 9 periods: 4 periods with GazeVideo information and 4 periods with Choice information (counter-balanced blocks), and 1 final period in which the information format was determined by the observers (either GazeVideo or Choice). The incentives for the observers in the *Interactive* and *Recorded* treatments were the same: (i) payoff (for the recipient) that was chosen by a randomly determined allocator in the first decision, (ii) payoff (for the recipient) that was chosen by the picked allocator in a second decision and (iii) prediction correctness about a randomly determined allocators' second decision. Only *Interactive* treatment involved new allocators. The incentives for the allocators in the Interactive treatment were: 1) payoff that they themselves chose in the first decision and 2) payoff that they themselves chose in the second decision, multiplied by the number of the observers (two, one or zero) who chose this allocator in the partner choice stage.

Information formats. In Choice information, a rectangle highlights the allocator's chosen action. In GazeVideo information, whenever an option is being looked at, the respective payoff lights up for as long as it is being inspected. This results in a sequence of rectangles lighting up. The rectangles correspond to areas of interest (AOIs). There is an AOI for each payoff, which we define somewhat larger than the circles containing the payoff information, in order to allow for slight imprecisions in the eye-tracking data.[13] Accordingly, we define 10 AOIs in the vicinity of the payoff numbers. Further, we define 2 AOIs near the legend texts, and 2 AOIs covering the rest of the screen. In result, the whole screen is divided into (more or less informative) AOIs. Note that we analyze the allocators' eye-tracking data in a format that exactly reflects how the observers saw the gaze. In GazePicture information, a scan path connects the inspected AOI in the sequence they are looked at, starting from the first AOI (green dot) and ending with the last AOI (red dot). The hollow circles increase in size with the time spent looking at the respective AOIs in accordance with the rule $100 \times (1 - e^{-0.25 \times \text{DurationSeconds}})$ and move toward the center of the picture with decision time. We explored this information format only in the *Infopilot*.

[13] We used rectangular areas for the feedback for the observers because they create a smooth transition when the gaze moves from one payoff to the next. In order to be consistent, we also use these rectangles as areas of interest in the analysis.

Randomization and matching. *All experiments and sessions:* In the first part of every experiment, each subject had to make 26 choices. These 26 choices were 13 different SVO-type situations (see Fig. A.1, including the item in gray color) used twice—once jittered and once non-jittered. Each subject received a random order of the 13 situations and a random draw for each situation determining whether the jittered or non-jittered version was played first. We drop one situation (two decisions, see Table A.1) when displaying choice or gaze as everyone chose the same option.

In order to control for a potential top or bottom bias, half of the subjects saw "you receive" in the top part and "the other person receives" in the bottom part of the screen and vice versa for the other half of subjects. More specifically this counterbalancing was within a session in the *Infopilot* and *Partnerpilot* treatment, while it was between sessions in the *Interactive* and *Recorded* treatment. The *Interactive* sessions differed in two aspects—(i) whether GazeVideo came in the first four periods and Choice in the next four periods and (ii) whether "you receive" was located in the top part or the bottom part of the screen—resulting in four different sessions. In the *Recorded* treatment, the observers saw the behavior of the allocators from one of the *Interactive* sessions.

For the *Infopilot* and *Partnerpilot*, we used 24 pre-recorded decisions of 44 allocators from *Baseline*; the data on four of the original 48 subjects had to be dropped either due to misunderstood instructions, a loose cable, or a programming error. In the following description, a *situation* refers to both the jittered and non-jittered situation versions.

Infopilot: In the Information stage, each observer saw each of the 12 situations once in every information format (GazeVideo, GazePicture, Choice), while the three situations for the Assessment stage were randomly determined. The order of the information format was randomly determined for every subject. Before every choice, the observers saw whether the following situation was displayed with "you receive" on top or bottom and had the chance to familiarize themselves with the situation. This way, we avoided that observers might not have seen the whole situation, as the information display lasted only for as long as the corresponding decision took for the allocator.

Partnerpilot: In the Information stage, each observer saw each of the 12 situations once in both information formats (GazeVideo, Choice), while the three situations for the Assessment stage were randomly determined. As every observer saw the situations from two allocators, we matched these two allocators such that they both saw the information in the same manner ("you receive" on top or not) and no observer saw the same allocator couple twice, while four allocators were shown twice (48 Information stages, but only 44 allocators). The order of the information format was randomly determined for every observer, and the observers had the chance to familiarize themselves with the situation before every Information Stage.

For the *Interactive* and *Recorded*, we used the decisions that the 48 allocators in the *Interactive* treatment made in the experiment (either first task or main task).

Interactive: In the main part of the experiments, there were nine periods. Two observers always formed a group, and this group was kept constant across all periods. The sessions differed in whether the GazeVideo or Choice information was shown in the first four periods. In order to be able to control for decision situation effects, the situation in the two information formats of the Information stage were the same, e.g., the situations in periods 1 and 5 were the same, the situations in periods 2 and 6 were the same, and so on. The situation of the Assessment stage was randomly determined for every session. It should be noted that some situations are more diagnostic than others, as most subjects choose the same option in some of the situations (namely, decision situations 2, 4, 5, 6, 7, 9 were diagnostic, as determined by the data from Barrafrem and Hausfeld (2019) and the *Baseline* treatment). Therefore, the random draw for the first four periods always consisted of two diagnostic and two non-diagnostic situations. We further pre-programmed a matching for the observer-allocator pairs. The allocators were put in a group with a new allocator in each period, and they faced all observers at least once but never with the same situation in the Information stage, e.g., the matched observers differed between the periods n and $n + 4$. In period 9, the observers could choose themselves whether they saw the information in GazeVideo or Choice format. This format choice of both observers was shown to everyone in the group.

Recorded: These sessions mimicked the *Interactive* sessions, as the observers were assigned a number that was equivalent to an observer from the *Interactive* sessions. This way, they faced the same allocators and situations in the same order as a corresponding observer in the *Interactive* sessions. But in contrast to the *Interactive* sessions, the allocator information shown in the Information stage consisted of information recorded in the first part of the experiment, i.e., non-strategic decisions, in which the allocators had no incentive to boost their behavior.

Decision screens. The main components of the observers' decision screens, as depicted in Figs. A.2 to A.4, include (i) predictions of the allocators' choices (clicking 1 of 5 rectangles for each observed allocator; all treatments) and prediction certainty elicitation (clicking 1 of 5 circles for each prediction; all treatments except *Partnerpilot*) and (ii) partner choices for further interaction (clicking 1 of 2 longer rectangles; all treatments except *Infopilot*).

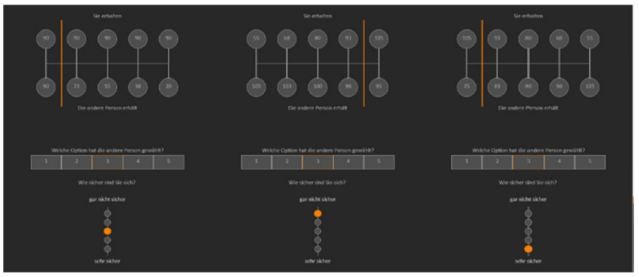


Fig. A.2. Decision screen as seen by all observers in the Assessment stages of the non-strategic *Infopilot*.

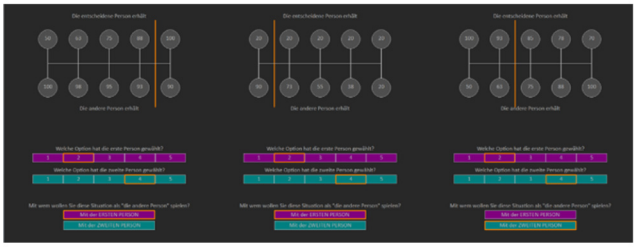


Fig. A.3. Decision screen as seen by all observers in the Assessment stages of the non-strategic *Partnerpilot*.

Fig. A.4. Decision screens as seen by all observers in the Assessment stages of both the strategic *Interactive* and non-strategic *Recorded*. Note that the decision screens include with illustrative translations in a larger font size.

Leave-one-out cross-validation method. In order to determine how well the different process measures were accurately predicting the SVO angle of the participants, we use a leave-one-out cross-validation approach. This approach first uses the data from all choices of $n-1$ participants and then estimates the model parameters for the respective models, e.g., using the four process measures mentioned in Table A.2 separately or all together for the GazeVideo information. The estimated parameters are subsequently used to predict the SVO angle for the left-out subject for every single decision (24 times). We then use the median of these 24 estimates for every subject as the predicted SVO score. We apply this approach without controlling for the decision situation (1-24), which is related to decision time and included in the models of Table A.2, as the observers in the experiments also faced the shown information without knowing the decision number of the situation and the allocators faced the situations in a random order. Using this approach, we mimicked an observer who is presented a random situation of a random allocator, but who knows how all the other allocators behaved in all situations.

For the partner predictions in Fig. 4A (main text, top), we used the leave-one-out predictions with all 4 gaze measures and estimated the SVO score based upon each individual decision situation. We did this for both people who were seen in the information stage. For Fig. 4A (main text, bottom), we used the choice and the decision time of the respective allocators to create the black dashed line.

Information treatments. As depicted in Fig. A.5, we compare the GazePicture and GazeVideo formats by examining self-reported prediction certainty and post-experiment evaluations. We conclude that there is a tendency for observers to slightly prefer GazeVideo over GazePicture information (Mann-Whitney-Wilcoxon rank sum tests, $p < 0.1$). We thus focus on the GazeVideo information format in the *Partnerpilot*, *Interactive* and *Recorded* treatments.

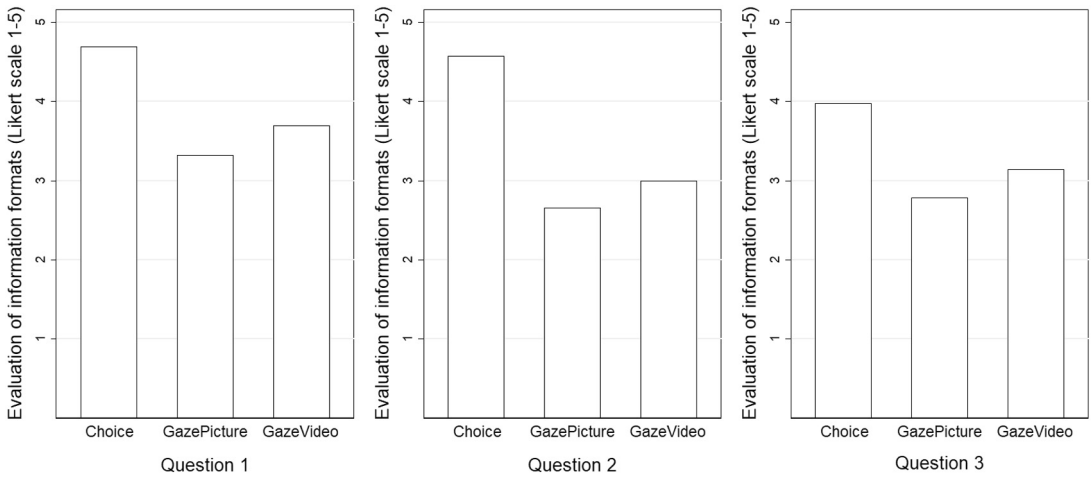


Fig. A.5. Self-reported evaluations of the information treatments in the *Infopilot*. The three evaluation questions were as follows. Question 1: How well did you understand the information that you saw? Question 2: How well could you tell from the seen information which option did the other person choose? Question 3: How well did the seen information help you predict, which option the other person would choose in another situation?

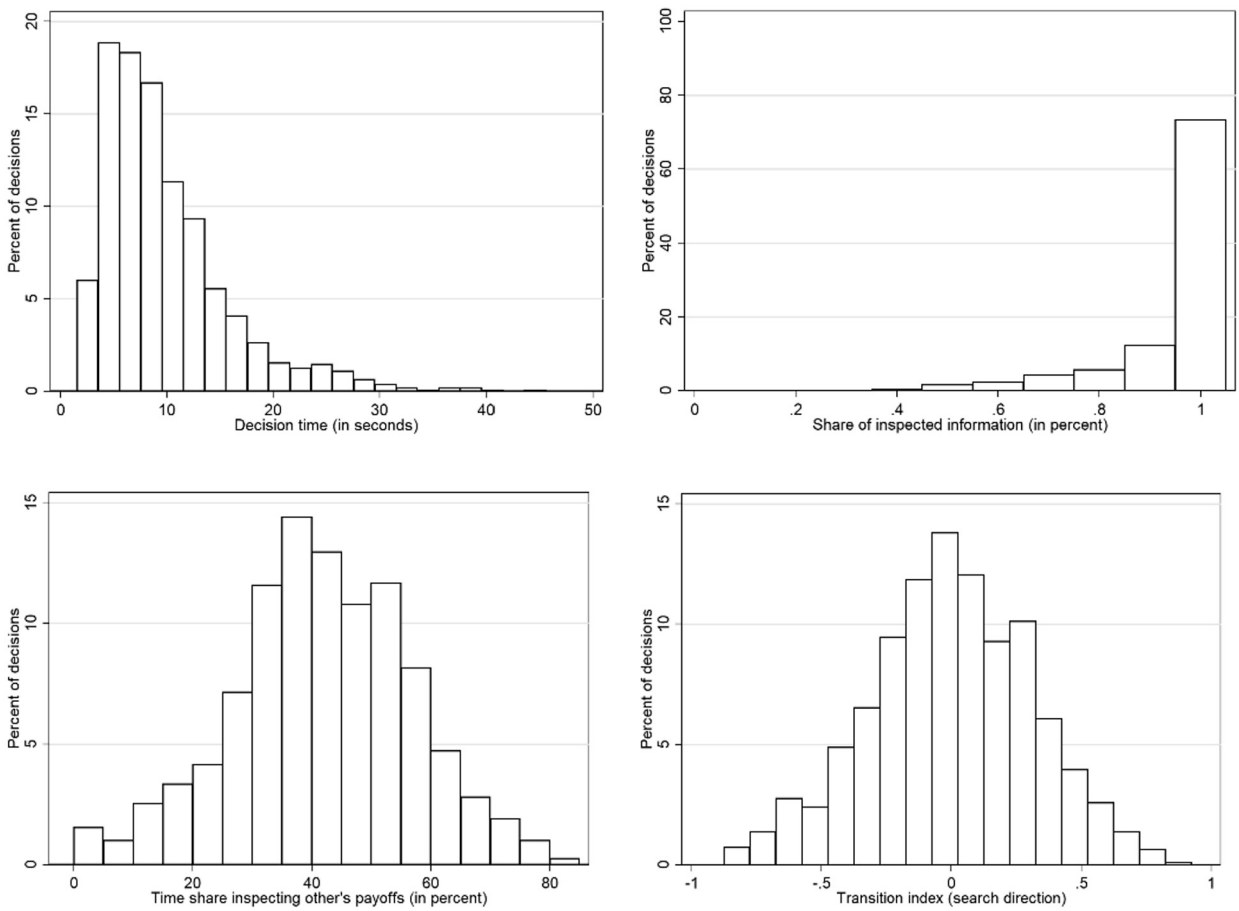


Fig. A.6. Descriptive results of allocators' processing measures. Shares of decision times (top left), inspected information (top right), attention to other's payoffs (bottom left) and transition index (bottom right) in the *Baseline* treatment.

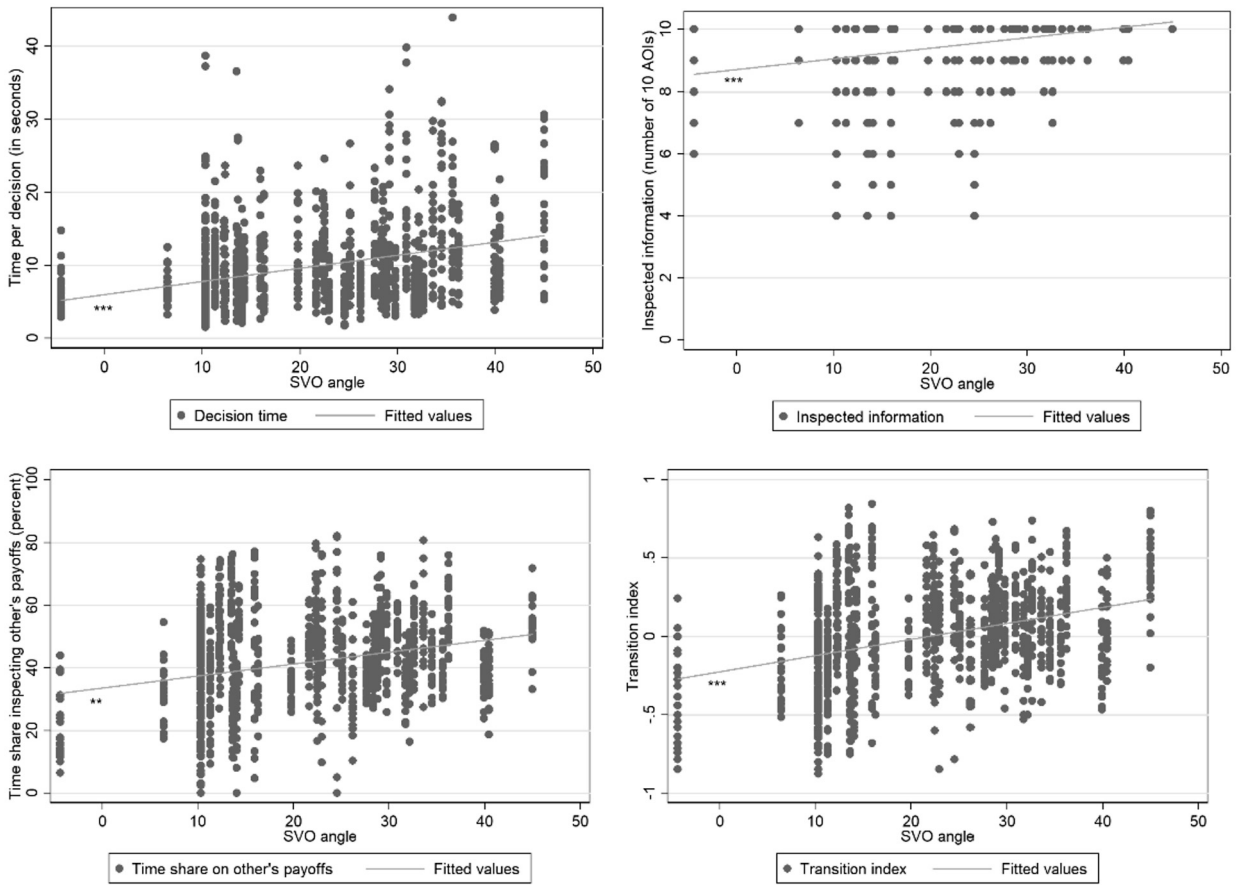


Fig. A.7. Processing measures and allocators' SVO. Relation between the allocators' SVO and their shares of inspected information (top left), decision times (top right), attention to other's payoffs (bottom left) and transition index (bottom right) in the *Baseline* treatment. All significance levels refer to the SVO angle regression coefficients in Table A.2; ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$.

Further allocator results I. As depicted in Fig. A.6, the allocators in *Baseline* appear to be quite attentive. The decisions were not made too quickly (median decision time at 8.3 seconds; top left sub-figure), and almost all decisions were made after looking at all 10 AOIs (top left sub-figure). The allocators considered both own payoffs and the observer's payoffs, although usually own payoffs more carefully (majority below 50%; bottom left sub-figure). Finally, the allocators' information search direction was quite balanced (bottom right sub-figure).

We chose these four gaze measures due to our expectation that the decision processes yield additional information about types in our heterogeneous sample, with type distribution ranging from (purely) individualistic to (purely) prosocial allocators. In line evidence accumulation models, e.g. Ratcliff and Smith, 2004; Krajbich et al., 2010, we expected that the information would be sampled proportionally to the weight it has in the decision process and a stochastic process of fluctuating attention between outcomes realizes the sampling process until a decision threshold for one of the alternatives is reached.

Further allocator results II. As depicted in Fig. A.7, we can largely replicate the results of Fiedler et al. (2013): all four gaze measures are directly proportional to allocators' prosociality in terms of the SVO scores. These results correspond to the results depicted in Table A.2. Note that our results here and in the main text are robust to omitting the transitions that correspond to the shortest fixations of less than 50 milliseconds.

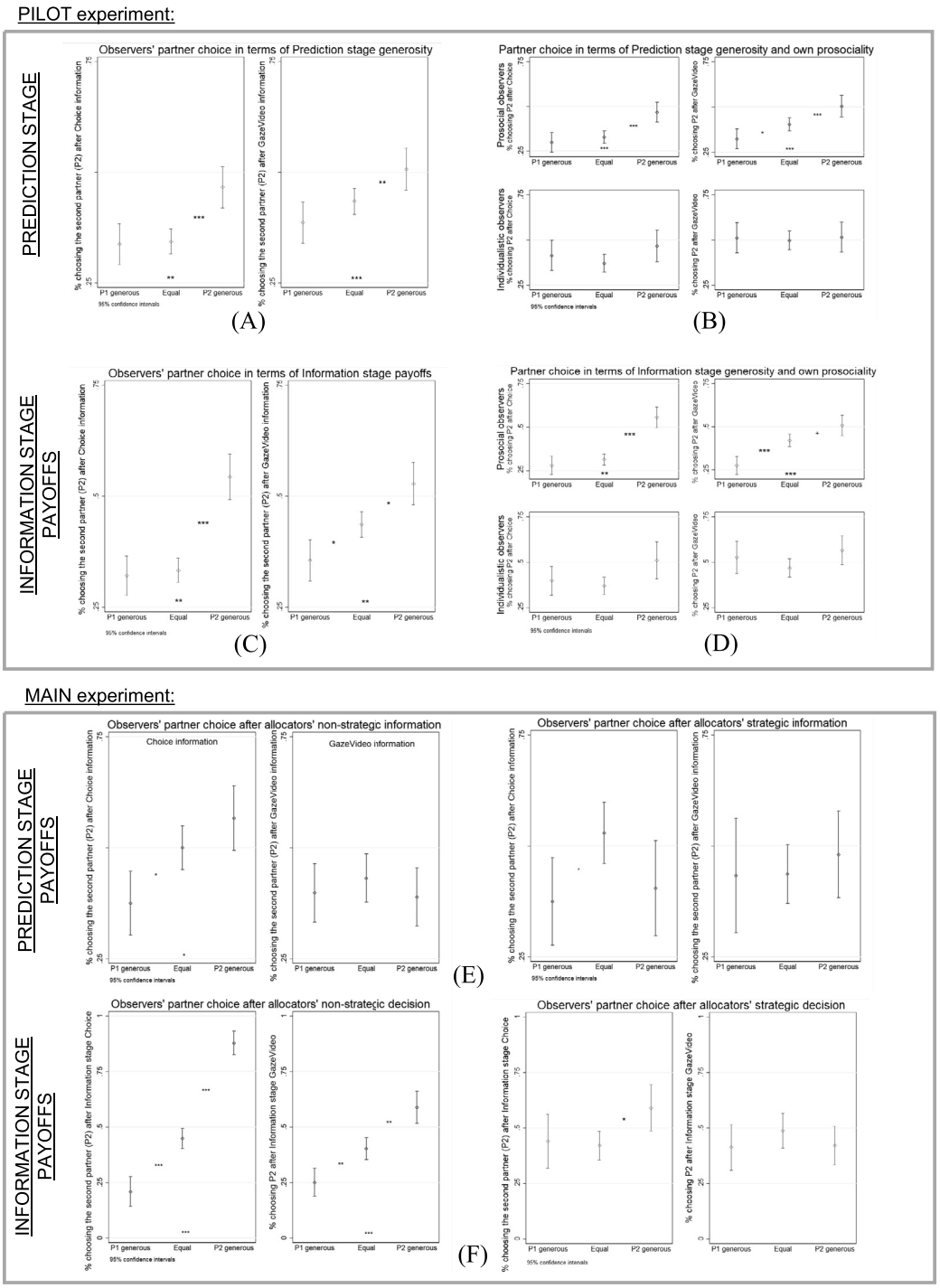


Fig. A.8. Partner choice and other measures for correctness. Partner choice correctness (A)-(B) in terms of Prediction stage payoffs and (C)-(D) in terms of Information stage payoffs in the non-strategic *Partnerpilot*, as well as (E)-(F) in the strategic *Interactive* compared to the non-strategic *Recorded*. Note that the Information stage payoffs constitute a less noisy indicator of the observers' comprehension of the allocators' motives than the Prediction stage payoffs, i.e., the slopes appear to be steeper in the Information stage compared to the Prediction stage. ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$.

Table A.2
Results of regression models for the allocators' gaze in *Baseline*.

	Log decision time	Inspected AOIs	Time share other	Transition index
SVO angle	0.018***	0.034***	0.380**	0.010***
	(0.004)	(0.009)	(0.133)	(0.002)
Period	−0.020***	−0.019**	−0.086	−0.002
	(0.002)	(0.006)	(0.064)	(0.001)
Constant	2.022***	8.961***	34.750***	−0.198**
	(0.092)	(0.240)	(3.597)	(0.065)
R^2	0.183	0.116	0.075	0.129
N	1104	1104	1104	1087

Notes: Four measures of allocators' gaze: (i) "Log decision time" includes logarithmized total decision time (seconds) per decision, (ii) "Inspected AOIs" include number of inspected information areas (of the total 10 AOIs seen at least once) per decision, (iii) "Time share other" includes the share of decision time spent inspecting other's payoffs (percent) per decision, and (iv) "Transition index" describes transitions between the payoffs for self and other (index from −1 to +1, with −1 meaning only transitions between own payoffs) per decision. Unstandardized regression weights, robust standard errors clustered at participant level in parentheses. ***p < 0.001, **p < 0.01, *p < 0.05. Note that the regressions include 46 recorded allocators in 24 allocation situations, but some observations lack transitions including the observer.

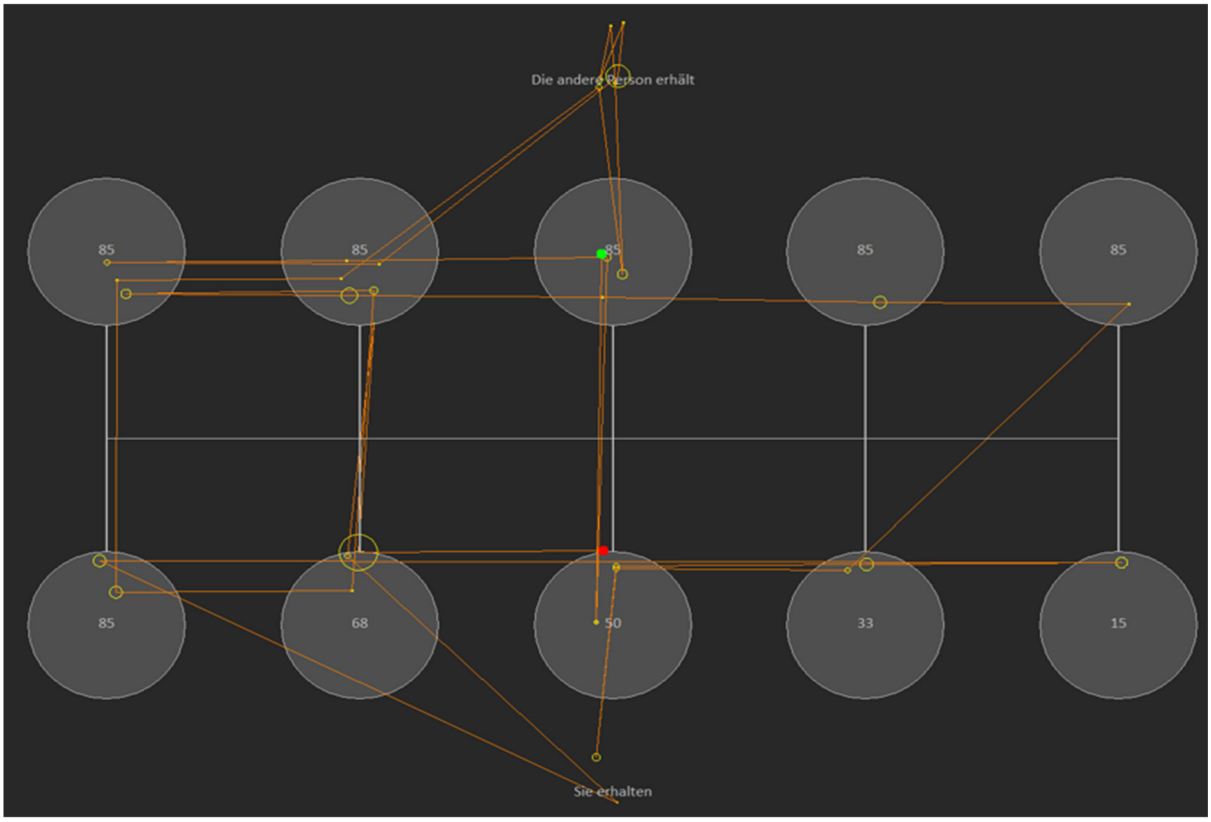


Fig. A.9. Decision screen for the information treatment GazePicture. Participants learned that the decision process always started at the fixation of the green dot and ended at the red dot. The yellow hollow circles represent fixations where the distance to the end of the circle around the payoff also mimics the order (i.e., closer to the border is later in the decision process). The size of the hollow "yellow circle" is indicative of the time spent.

Instructions. The following instructions (translated from German) correspond to the *Interactive* treatment that includes both allocators and observers in the same session. It is, in a sense, the fullest version of instructions from all four treatment designs, and the other three treatments can be seen as partial versions of these instructions. Namely, (i) the *Recorded* sessions exclude the instructions for allocators and only include equivalent instructions for the observers—except that the allocators' decisions are not transmitted live but from a recording at an earlier session (thus effectively excluding the strategic component in the transmitted decisions). On top of this, (ii) the *Partnerpilot* sessions additionally exclude the second observer in the same group, and (iii) the *Infopilot* sessions additionally exclude the second allocator in the same group (and the partner choice stage, accordingly) but include the GazePicture treatment.

Instructions in the Interactive sessions

Printed instructions 1 start here

General instructions

We warmly welcome you to this economic experiment. Your decisions and, if applicable, the decisions of other participants influence your payout in this experiment. It is therefore very important that you read these instructions carefully. **You are not allowed to communicate with other participants for the entire duration of the experiment.** We therefore ask you not to speak with each other. Please switch off your mobile phones and tablets as well. If you do not understand something, first take a look at the experiment instructions again. If you still have questions, please give us a sign by raising your hand. We will then come to you and answer your questions personally.

The experiment consists of 2 parts. Part 1 consists of 26 decisions, of which 1 decision is paid out. You can find the instructions for Part 1 on the screen. Part 2 consists of 9 rounds, of which the decisions of 1 round are paid out. The detailed instructions for this part will be provided later. After Part 2, a questionnaire will follow.

During the experiment, we are not talking about euro, but about points. Your total income is therefore calculated first in points. The total score achieved by you during the experiment is converted into euros at the end, such that 10 points $= 1$ euro. In addition to your income from the experiment, you will receive a 6 euro show-up fee.

Please note that this experiment is an eye-tracking experiment. The eye trackers must first be calibrated for this. The calibration takes place after reading the instructions. On the next page, you will see an explanation of how the calibration works. Please use the chin rest no later than when you can read that calibration now follows on your screen. After completing Part 1, you can remove your head from the chin rest. You will receive a corresponding message for this. After you will have read the instructions for Part 2 (you will receive these later), a calibration will follow again. Please click "Next" on your screen once you have read and understood these instructions.

Printed instructions 1 end here

Please click "Next" once you have read and understood the printed instructions.

Welcome to the Lakelab. Please note the following rules: 1. There is a ban on communication while you are in the lab. 2. If you have questions, please direct them to the experimenters. 3. You may only use the computer functions provided for the experiment. 4. Mobile phones must be switched off. Thank you for supporting our research. Please press "Next" (with the left mouse button) to continue.

Part 1

In this part, groups of two participants are formed. So, you are in a group with another participant. You do not know who that person is, and vice versa, that person does not know that they are in a group with you. This part consists of 26 decision situations. In each decision situation, there are 5 ways you can split points between yourself and the other participant in the group. You can choose one of the 5 options. At the end of the experiment, a random draw will determine which situation will be paid out and whether you or the other group member will decide on the allocation. The points in this experiment are converted as follows: 1 point $= 0.10$ euro. Furthermore, you will receive additional 6 euro for your participation. After the instructions, control questions will follow. Until then, you can always click "Back". Please click "Next" to continue.

Decision on the computer 1

The decision will be shown at the bottom of the page. Each option consists of a circle at the top and a circle below, which are connected with a gray line. The upper number indicates how many points you receive. The bottom number shows the points the other person in your group receives. For example, in the fourth option from the left, you get 90 points and the other group member gets 50 points. You select an option by typing 1, 2, 3, 4 or 5. When you have done so, an orange frame

appears around the selected option. As a suggestion, please use the keys 1, 2, 3, 4 and 5, which are located above Q W E R T. You can try this out now. If you press "1", a frame around the leftmost option appears, etc. Click "Next" to continue.

Decision on the computer 2

During the first part, you have to confirm your choice with the spacebar. This means that you first have to select the respective option with 1, 2, 3, 4 or 5, and then an orange-colored frame appears. Then you have to confirm your choice with the spacebar. During the first part, you no longer need the mouse. You can place your fingers on the 5 keys and the spacebar. You must also press the spacebar once before each decision. Then a cross appears on the screen for about 1 second. Only then the decision situation follows. If you click on "control questions", you will get to the control questions and cannot read the instructions anymore.

Control questions

1. Please select the option that earns you 60 points. [...] 2. Please select the option that earns 70 points to the other person. [...] 3. Please choose the option that gives you 80 points and 60 points for the other person. [...]

That was correct. It will continue soon. [or] That was wrong, click the spacebar to get back to the question.

Now part 1 follows. As a reminder: There are 26 decision situations. You select an option with 1, 2, 3, 4 or 5 and then confirm with the spacebar. Please place your fingers on the 5 keys and the spacebar. You do not need the mouse now. Please click the spacebar to start the first part.

Please click the spacebar to start. Part 1 then begins. [...]

You are done with Part 1. The instructions for Part 2 will be distributed right away. Please wait. Please read the printed instructions. If you have any questions, let us know by raising your hand. Please click on the "w" button after reading and understanding the printed instructions.

Announcement*: We will now distribute the instructions for Part 2. Part 2 consists of 9 rounds. In general, there are always 2 observers and 2 allocators in a group, with the groups being shuffled before each round. If you have an eye tracker in front of you, you are an allocator. First, the allocators decide successively. Here, the observers either see the allocator's decision itself or a live video that shows where an allocator is looking. Then the observers decide with which allocator they choose to play in the next decision. The allocators then make that second decision and get the points as often as they have been chosen: twice, once or not at all. The observers get the points from the option picked by the chosen allocator. The observers also have to make predictions for both allocators. Everything else can be found in the instructions.*

Printed instructions 2 start here

Part 2

The second part of the experiment consists of a total of 9 rounds with several decisions per round. In each round, a new group of **two allocators and two observers** is formed. Each round runs as follows: **decision 1, information, choice, decision 2, prediction**.

Allocators: The allocators (people with eye trackers) make distribution decisions as in the first part, and they make **two different decisions in each round**. Decision 1 is always relevant for payment. Decision 2 counts for the allocators twice, once or not at all, depending on how many observers have chosen them after decision 1.

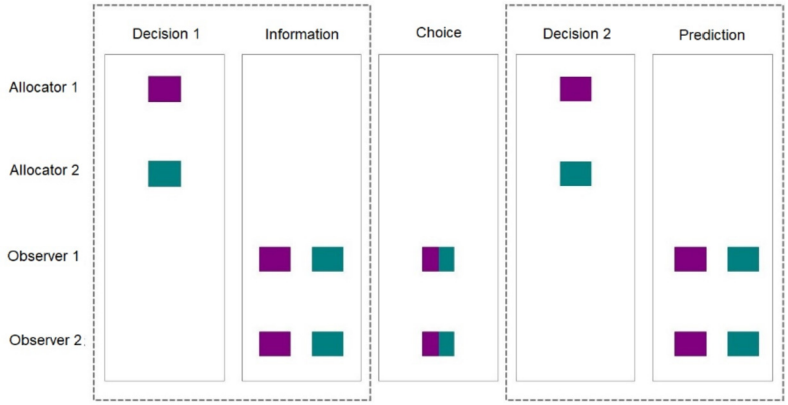
Observers: The observers (people without eye trackers) receive information (either the allocator's decision or the eye movement) about **decision 1** from two allocators and then select one of the allocators for decision 2. The **decision 2** of this allocator is then relevant for this observer. After this selection, the observers see a situation and must predict what both allocators will choose in decision 2.

Allocation and payment: In decision 1, the allocators and observers are randomly assigned to each other; each one allocator is assigned to one observer. In decision 2, the assignment is based on the choice of observers. Each observer is assigned to the selected allocator, but the allocators can be assigned to two, one or no observer. Accordingly, the decision for the allocators counts twice, once or not at all.

In Part 2, the following colors are used. The observer sees the decision for allocator 1 framed purple and for allocator 2 framed turquoise. The observer briefly sees a green frame at the time when the indicated allocator has decided. The allocator sees the decision situation framed in color when information (either green for the choice or orange for a live gaze video) is transmitted to the observers. The figure explains the sequence of rounds 1-8.

There are 9 rounds in total. After the first 4 rounds, the information type is changed, and after the 8th round, the observers decide on the information type for the 9th round. For each group in rounds 1-8, the following applies:

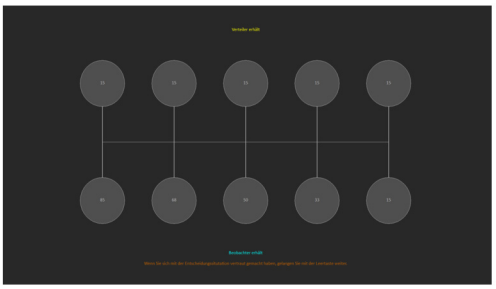
1) Each allocator is at most once in a group with the same allocator.
2) Each observer sees any allocator only once per type of information.



Decision 1

Like in Part 1, there are again 5 ways in which the allocators can divide points between themselves and an observer in each decision-making situation in Part 2. The decision 1 for the allocators is framed in color: green (CHOICE) or orange (GAZE VIDEO). A colored frame around the screen indicates to the allocators that information is transmitted to the observers.

In this case, both allocators and observers see the decision situation exactly as the allocator sees it. This means that the points for the observer are "Observer obtains" and the points for the allocator are "Allocator obtains".



The observers see the decision situation before the allocators decide and can familiarize themselves with the decision that the allocators will then make. The allocators do not see the situation until they decide.

Information

The observers first see decision 1 with the information from the first allocator. This information is framed purple for the observers. After information about the first allocator, the decision 1 follows with information about the second allocator. This is framed turquoise. Which allocator starts is randomly determined before each round. In each round, there are 2 observers and 2 allocators in a group. The following applies: Each allocator is at most once with the same other allocator in a group. Within an information type, the observers encounter the same allocator only once.

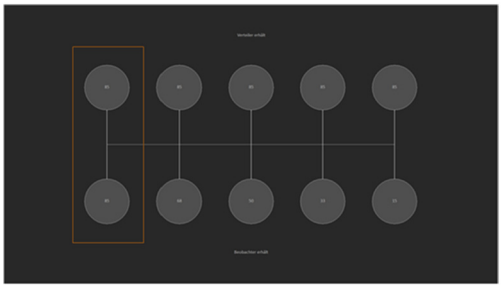
There are 2 ways in which the information is displayed: **choice** and **gaze video**. You will be informed before each round which type of information you will receive or share about the decision. The information type is the same in rounds 1-4, then changes in rounds 5-8. At the beginning of the 1st and 5th round, all participants see **3 examples**, which are the same between the 2 different types of information.

CHOICE

When the **choice** is displayed, the exact decision of the allocator is displayed. An orange frame appears around the option that the allocator has chosen. The observers will see the decision for as many seconds as the respective allocator required for the decision. The observers will see a green frame after the respective allocator has decided. After the observers

have seen the information from the first allocator, the second allocator decides. Then also the information from the second allocator follows in the same way.

The observers see this information in 4 rounds. First, they see the information of the first allocator and then the information of the second allocator. The allocators transmit the information in these rounds. A green frame on the screen signals this to the allocators.

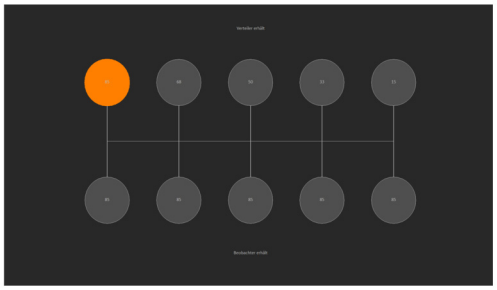


GAZE VIDEO

When the **gaze video** is displayed, a video of the eye movements of the allocator is displayed during the respective decision. Here, the viewing order during the decision is displayed. It depicts whether the gaze is on one of the ten payoffs (see picture). More specifically, an orange-filled circle indicates that a person is looking at this information or in the immediate vicinity. As soon as they look at one of these areas, it is marked. For example, if the person looks at the information "85" on "the other person receives", the circle fills orange for the respective time.

The observers see the decision and gaze behavior for as many seconds as the respective allocator needs for the decision. The observers will see a green-colored frame after the respective allocator has decided. After the observers have seen the information from the first allocator, the second allocator decides. Then the information from the second allocator follows in the same way.

The observers see this information in 4 rounds. First, they see the information of the first allocator and then the information of the second allocator. The allocators transmit the gaze video live in these rounds. An orange frame around the screen signals this to the allocator.



Partner choice

Having seen the information (choice or gaze video) of the two allocators in decision 1, the observers must decide whether decision 2 from the first or the second allocator should apply to them in the upcoming decision 2.

Decision 2

After decision 1, **decision 2** follows with a new randomly drawn decision situation. Here, the allocators decide without any information being passed on. Accordingly, there is no orange frame for the allocators, and the observers do not know about this decision.

For observers, this decision includes payoff from the allocator that was previously selected.

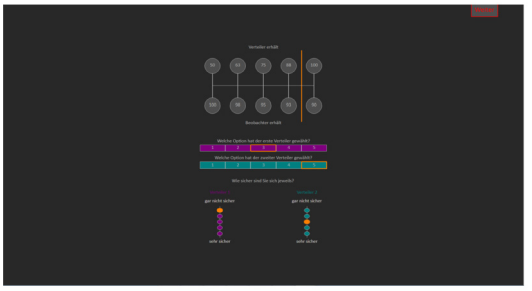
For allocators, this decision is payoff-relevant as often as they were chosen by the observers after decision 1: twice, once or not at all.

Prediction

Regardless of their partner choice, the observers in the prediction phase have to predict the **decisions of the two allocators** for the new decision situation (options 1, 2, 3, 4 or 5). In addition, the observers receive additional information about

how the whole group of participants decided in a very similar experiment in June. In this earlier experiment, there were only the decision situations and no transmission of information. An orange line divides the decisions in such a way that roughly as many June participants chose the decisions on the left side of the orange line as on the right side. For example, if the options were selected by 10%, 20%, 30%, 20% and 20% of the participants, then the orange line is after the third option; the options to the left of the orange line were chosen by 60% of the people and the options to the right of the orange line by 40% of the participants.

For these situations, the observers have to predict which of the 5 possibilities the two displayed allocators selected. In addition, the observers must also state how confident they feel about their predictions. In the made-up example below, we have indicated that an observer predicted the 3rd option for the first allocator and the 5th option for the second allocator. The observer was not at all sure about the first allocator, while the prediction for the second allocator was made with half-certainty. The information about certainty is not payout relevant.



After the prediction has been made, the observers continue using the "Next" button.

Decisions in round 9

Before round 9, the observers choose what information (CHOICE or GAZE VIDEO) is displayed in this round. After the observers have chosen, all participants learn how the observers in the group have chosen. There are 2 scenarios: either both observers choose the same information type, or the observers choose different information types. If both observers choose the same type, round 9 is equivalent to the rounds in the respective type of information. If the two observers select different types of information, the respective type is displayed to the respective observer. For the allocators, this means that one observer is shown CHOICE and the other observer is shown GAZE VIDEO.

Payout

At the end of part 2, one round will be randomly drawn and paid out. It will also be randomly determined whether the prediction for the first or the second allocator is relevant for payment. The payout consists of several parts.

Allocator: You will receive the points from the first decision, as well as the points from the second decision as often as you were elected: twice, once or not at all.

Observer: You will be assigned to one of both allocators in the first decision and will receive the respective points. In decision 2, you get the points from the option chosen by the allocator you have chosen.

Regardless of their choice of allocator, the observers receive points from their predictions. First, they get **30 points** if they have predicted the other participant's decision on the **correct side** (to the left or right of the displayed average decision). Furthermore, they get another **30 points** if they have also predicted the **correct option** (options 1, 2, 3, 4 and 5).

The points in this part of the experiment are converted again as follows: 1 point = 0.10 euro.

During Part 2, there will be a short summary of the respective section before the 1st round and before the 5th round.

Summary (observer)

In Part 2, you will first see the information of 2 different allocators in the format CHOICE or GAZE VIDEO. In each of the 4 rounds, you are in a group with different allocators. First, you will learn exactly what the decision situation will look like and you will familiarize yourself with the situation. When you have done this, you can continue using the spacebar.

In decision 1, you see the decision situation (first from the first allocator, then from the second allocator) with the additional information CHOICE or GAZE VIDEO for as long as the respective allocator needed to decide. You will receive the points from the option chosen by one of the allocators. Which allocator this is will be decided randomly.

After seeing the information from both allocators, you have to decide whose next decision should apply to you. This decision 2 is a different decision situation and you will receive the points from the option chosen by the allocator you have chosen.

Either way, you need to make predictions for both allocators about what they have chosen in decision 2 and indicate how confident you are of your prediction. The prediction can give you a total of 60 points. In the decisions you are to predict, you will see an orange line that marks the average decision of all participants from an earlier experiment (June 2017). You get 30 points if you indicate the other participant's option on the correct side (left or right of the average). You get another 30 points if you predict the exact option.

***Summary* (*allocator*)**

In Part 2, you will make 2 decisions in each round. Furthermore, your information is viewed by two different observers in the format CHOICE (green screen frame) or GAZE VIDEO (orange screen frame). In each of the 4 rounds, you will transfer this information and you will play each round with a different allocator and different observers. Chance will determine whether you or the other allocator will decide first.

In decision 1, the observers see the decision situation (first from the first allocator, then from the second allocator) with the additional information CHOICE or GAZE VIDEO for as long as you or the other allocator needed to decide. Your decision is relevant for your payout, as well as for one of the assigned observers.

After the first decision, the observers can choose whether your decision or the decision of the other allocator should apply in decision 2.

After the observers have decided, you make decision 2. This decision is a new situation. No information is transmitted here. You will receive the selected points as follows: If both observers have chosen you, you will receive the selected points twice. If one observer has chosen you, you will receive the selected points once. If no observer has chosen you, you will not receive any points from this decision.

So, you get the points from decision 1, and you get the points from decision 2 (without transmission) either double, once or not at all.

Printed instructions 2 end here

Please wait until all participants have read the instructions. The first type of information transfer follows. [...] The second type of information transfer follows. [...]

You are an allocator and transmit this information. [or] You are an observer and see this information transmitted from the allocators.

In the next 4 rounds, the information type CHOICE [or] GAZE VIDEO applies. You will now see 3 examples of CHOICE [or] GAZE VIDEO from a previous experiment. Press the "w" button to continue to the examples.

[...] Please press the spacebar to continue. Then the second example follows. [...] Please press the spacebar to continue. Then the third example follows. [...] Please press the spacebar to continue.

Please click the "w" button to get to the summary for part 2.

Summary (observer) [or] Summary (allocator) [with the same text as in the printed instructions above] [...] Now rounds [x] to [x + 3] follow. In these 4 rounds, you will see the information as CHOICE [or] GAZE VIDEO.

Please wait until the experiment continues. An experimenter will come to you. [or] Please wait until the people are done with the eye-tracker calibration.

[*Round 9*]

You now have to decide if you want to see the information as CHOICE or GAZE VIDEO in the next round. [...]

[or] The observers have both chosen CHOICE. Accordingly, only CHOICE is transmitted. [or] The observers have both chosen GAZE VIDEO. Accordingly, only GAZE VIDEO is transmitted. [or] One observer opted for GAZE VIDEO and one observer opted for CHOICE. Accordingly, one CHOICE and one GAZE VIDEO is transmitted. Please press the spacebar to continue.

As a reminder, you are an allocator. The observer sees the screen exactly as you see it. Accordingly, their points will be displayed on Observer obtains. Round [x] now follows. The information is transmitted as CHOICE and has a green screen frame. [or] The information is transmitted as a GAZE VIDEO and has an orange screen frame.

[or] As a reminder, you are an observer. The allocator saw the screen exactly as you see it now. Round [x] now follows. You will now see the information CHOICE [or] GAZE VIDEO (re-live) from both allocators. Please press the spacebar to continue. [...]

Now decision 2 from round [x] follows. NO information will be disclosed. As a reminder: You will receive the selected points as often as you have just been chosen. [or] You will receive the selected points from the person just chosen and for

your prediction from one of the allocators. Whether your prediction for the first or second allocator counts will be randomly drawn at the end. Please press the spacebar to continue.

You have completed round [x]. Round [x + 1] now follows. The information is transmitted in the same format (CHOICE [or] GAZE VIDEO). [or] The information changes format. [or] In the next round, the observers choose the type of information.

You are done with the experiment now. There are a few questions left. Please press the spacebar to continue.

[*Questionnaire*]

This experiment is also about the types of visualizations of gaze directions. Since this is the first experiment with gaze video, there are a few more questions left. Please click OK to continue.

Gaze video

Do you have comments on the visualization of the GAZE VIDEO? (For example: Was it understandable, was the time sufficient, were the colors too bright?...) You can answer the question in keywords. [...] Please click OK to continue.

Comparison

How well did you understand the information you saw? CHOICE: [...] GAZE VIDEO: [...]

How well could you tell from the information shown what the other person chose in the shown situation? CHOICE: [...] GAZE VIDEO: [...]

How well did the information help you predict what the other person would do in a different situation? CHOICE: [...] GAZE VIDEO: [...]

Which of the two (CHOICE or GAZE VIDEO) information types did you find more informative? [...]

Do you have any further comments or suggestions for improvement? (You can answer in keywords) [...] Please click OK to continue.

Announcement*: We will now roll dice to determine all decisions or decisive rounds. Throw 1 determines which decision from Part 1 is paid out, throw 2 determines whether an odd or an even number corresponds to your decision* (*you can see this on the screen*)*. Throw 3 determines which round from Part 2 is paid out; throw 4 determines, for the observers, which allocator's prediction counts in this round.*

[*Random draws for payout*]

Drawn situation from Part 1 (1-26): [...] Number determining who makes the decision in Part 1 (1-6): [...] Drawn information number from Part 2 (1-9): [...] Drawn allocator from Part 2 (1-2): [...]

Your income

Part 1: Your decision is relevant. [or] The decision of the other group member is relevant. The following situation was drawn: [...] You receive: [...] The other group member receives: [...]

Part 2: In part 2, the following round was drawn: [...] From the first decision, you receive: [...] Therefore, from the second decision in this round, you receive: [...] In the whole experiment, 1 point equals: [...] In addition, you will receive: [...] In total, you will receive: [...]

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