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1 **Public attitude influences actors' visual orientation: a pilot experimental study**

2

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24 **ABSTRACT**

25 Human emotions guide verbal and non-verbal behaviour during social encounters. During public
26 performances, performers' emotions can be affected directly by an audience's attitude. The valence of the
27 emotional state (positive or negative) of a broad range of animal species is known to be associated with a body
28 and visual orientation laterality bias. Here, we evaluated the influence of an audience's attitude on professional
29 actors' head orientation and gaze direction during two theatrical performances with controlled observers' reactions
30 (Hostile vs Friendly audience). First, our speech fluency analysis confirmed that an audience's attitude influenced

31 actors' emotions. Second, we found that, whereas actors oriented more their head to the left (i.e. Right Hemisphere
32 Bias) when the audience was hostile, they gazed more straight ahead at Friendly spectators. These results are in
33 accordance with the Valence-Specific Hypothesis that proposes that processing stimuli with negative valences
34 involves the right hemisphere (i.e. left eye) more than the left hemisphere.

35

36 **KEYWORDS**

37 Emotions; Public performance; Audience effect; Laterality; Theatre.

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42 INTRODUCTION

43 Nonverbal behaviours, such as mutual gazes and proxemics, impact the regulation of social interactions
44 (Herrera et al., 2011). Directed gazes and body postures play an important role in coordinating turn-taking by
45 communicating information concerning interlocutors' intentions and emotions (Kendon, 1967; Herrera et al.,
46 2011). Body posture affects an audience's perception (Huang et al., 2011), but an audience's characteristics can
47 also influence performers' body posture (Mehrabian, 1969). Emotions and behaviours are intermingled (Feldman
48 et al., 1999; Baumeister et al., 2007). Gaze avoidance is characteristic of unfriendly encounters, while more direct
49 gazes are present during friendly interactions (Kendon, 1967). Interlocutors also tend to expose one hemiface more
50 than the other to their partner (Nicholls et al., 2002). The choice of the hemiface exposed is linked to the subject's
51 emotional state (i.e. presenting the left cheek when posing is considered to be more emotionally expressive,
52 Nicholls et al., 1999 and 2002) or to the emotional valence (aggressive/friendly) of the context of social encounters
53 (Basile et al., 2009).

54 A broad range of animal studies support the link between perceptual laterality and emotional state (Rogers et
55 al., 2013; Versace & Vallortigara, 2015; Vallortigara & Versace, 2017). The Valence-Specific Hypothesis (VSH)
56 posits that the left side of the brain is specialised for processing positive emotions and the right side for processing
57 negative emotions (Ahern & Schwartz, 1979; Davidson, 1984; Wedding & Stalans, 1985; Hook-Costigan &
58 Rogers, 1998). The predominance of the left visual field preference (i.e. suggesting a contralateral right hemisphere
59 processing) varies with the level of negative emotions during social interactions and exposures to negative stimuli
60 (nonhuman primates: Casperd & Dunbard, 1996; Baraud et al., 2009; Quaresmini et al., 2014; dogs: Quaranta et
61 al., 2007; Siniscalchi et al., 2013; horses: Larose et al., 2006; De Boyer des Roches et al., 2008; Austin & Rogers,
62 2014; birds: Vallortigara et al., 1999; cetaceans: Chanvallon et al., 2017 and honeybees: Rogers & Vallortigara,
63 2019).

64 During public performances, characteristics of the audience influence performers' emotions and
65 behaviours (Bode and Brutton, 1963; LeBlanc et al., 1997). For example, audience size, actors' emotions and
66 lateralised positioning are inter-connected, and actors tend to use their left visual field (i.e. right hemisphere) in
67 anxious and less preferred situations (Lemasson et al., 2018). The spatial disposition of an audience in a theatre
68 layout is associated with different rates of galvanic skin responses and a quadri-frontal disposition (with spectators
69 on all possible sides) increases actors' emotional scores (Lemasson et al., 2019).

70 The pleasantness, responsiveness and interest of an audience are known to affect performers' internal
71 state (MacIntyre and Thivierge, 1995; MacIntyre et al., 1997). Negative responses from an audience typically

72 increase speakers' anxiety (Bassett et al., 1973; Gardiner, 1971; Pertaub et al., 2002). In contrast, supportive
73 audiences have a positive impact on speakers' stress (Yokoyama et al., 1992; Taylor et al., 2010). We know that
74 looking at angry/happy faces triggers more/less gaze avoidance especially when the observer is feeling anxious
75 (Roelofs et al., 2010). However, to our knowledge, no study has evaluated the influence of an audience's attitude
76 on performers' behavioural laterality.

77 We tested experimentally the impact of two contrasting controlled audience attitudes (Friendly/Hostile)
78 on professional actors' spontaneous emotions and lateralised behaviour. Emotions were estimated by analysing
79 their speech as stress is known to reduce speech fluency (Buchanan et al., 2014). Lateralised behaviours were
80 evaluated by head orientations and gaze directions. We hypothesised that left-side orientations and direct gazes
81 would be fewer in the negative situation than in the positive situation.

82

83 **METHODS**

84 Since our study was only observational, with informed consents from participants, no further ethical
85 authorisations were requested according to the French law. Following the recommendations of the European
86 General Data Protection Regulation, this study was registered under the certificate #2-17049\UMR6552 by the
87 Data Protection Service.

88 - Experimental setup

89 The study was conducted during two theatrical representations by the "Fabrique Autonome des Acteurs"
90 (Moussey City, France) on August 30th and the 31st 2017. Ten professional actors, 6 women and 4 men, between
91 24 and 47 years old, took part in a play including ten monologues, lasting about 4 minutes each. During a given
92 monologue, only one actor spoke and sat on a chair placed in front of the spectators. Each actor had the leading
93 role in one monologue only while all the other actors remained on stage, sitting silently on chairs but down-stage.
94 All the monologues included a reference to animals and/or animal sciences. The ten monologues were delivered
95 their lines consecutively and in the same order during the two representations. The actors and the spectators knew
96 they were contributing to an ethological research project but were totally naive as to the scientific objectives,
97 measurements and experimental variables. They were informed only that they had to remain sitting on the offered
98 chair. Respectively 34 and 31 spectators attended the representations. The spectators differed between the two
99 representations.

100 The two representations were identical so that the only experimental variable was the spectators' attitude. Just
101 before the start of a representation, the spectators were informed that they had to contribute by being Friendly on

102 the first day (i.e. to over express all their positive feelings) and Hostile on the second day (i.e. to express their
103 positive feelings discreetly and to exaggerate all their negative feelings). Each leading actor was filmed using a
104 Sony DCR-SR35 camera, positioned centrally, behind the spectators.

105 - Selection of texts and direction of actors

106 The texts for the ten monologues were chosen based on two criteria. First, all texts talked about animals and were
107 mainly descriptive in order to be dramaturgically coherent. Second, all texts had to be emotionally “neutral” for
108 the actors, such as naturalistic descriptions (i.e. three extracts of Darwin’s “Voyage autour du monde à bord du
109 Beagle”, two extracts of Maëterlinck’s “La vie des abeilles”, one extract of Lorenz’ “L’agression”) and extracts
110 of novels (i.e. three extracts of Mac Carthy’s “La trilogie des plaines”, one extract of London’s “Construire un
111 feu”) in French. Prior work with the actors focused on some specific parts of the text (like active verbs) but never
112 concerned the characters played.

113 - Data collection

114 The videos of all the entire monologues were scored using Boris software v.6.0.5 © 2012-2018. Using
115 continuous focal sampling, we scored indicators of change in emotional state through the leading actor’s speech:
116 Mistakes (i.e. word omission, word addition, word error and word inversion, after comparing to the original text)
117 and Silent pauses (total duration and number of occurrences) (Buchana et al., 2014; Lemasson et al., 2018).
118 Durations were measured with a precision of 0.001s, and silences lasting more than 0.1s were considered a pause.
119 In addition, using instantaneous scan sampling, every 5 seconds, we measured (independently from one another)
120 head orientations and gaze directions of the leading actor. Head orientations were categorised either as “Front”
121 (i.e. facing the spectators), “Right” (i.e. right side oriented towards the spectators at an angle of more than 45°) or
122 “Left” (i.e. left side oriented towards the spectators at an angle of more than 45°). Gazes were also categorised
123 either as “Front” (i.e. directed towards the centre of the audience), the “Periphery” (i.e. directed towards the farthest
124 sides of the audience) or “Undirected” (i.e. not directed towards the audience).

125 - Data analyses

126 Given our small sample size (N = 10 actors), we only ran non-parametric statistical tests. Using Wilcoxon
127 matched pair tests, we analysed the influence of the public’s attitude on the actors’ behaviours (speech, head
128 orientation, gaze direction). We compared frequencies and durations for focal variables and percentages for scan
129 variables. To run the data analysis, we used Rstudio software v.1.0.146 © 2009-2016 (package: coin) with the
130 significance level set at 0.05.

131

132 **RESULTS**

133 **1 - Influence of the audience's attitude on the actors' speech**

134 Speech analyses revealed that a Hostile public was associated with longer silence durations ($V = 6$ and $p =$
135 0.03) and a greater number of silences (Wilcoxon test: $V = 5$ and $p = 0.04$) than a Friendly public (Fig. 1). However,
136 the public's attitude had no effect on the number of mistakes made by the actors during their monologues (Median
137 number of mistakes for each representation = 3.5, Wilcoxon test: $V = 17$ and $p = 0.67$).

138

139 FIGURE 1 ABOUT HERE

140

141 **2 - Influence of the audience's attitude on the actors' positions and gazes**

142 We found that the public's attitude influenced orientation of actors' head. Indeed, actors' head was directed
143 more to the Left when the public was Hostile than when it was Friendly ($V = 6$ and $p = 0.027$, Fig 2). However,
144 the public's attitude did not influence other head orientations (Front: $V = 40$ and $p = 0.23$; Right: $V = 24$ and $p =$
145 0.77 ; Fig 2).

146

147 FIGURE 2 ABOUT HERE

148

149 These results also showed that gaze direction was influenced by the public's attitude. When the public was
150 Friendly, actors gazed more towards the centre of the audience ($V = 53$ and $p = 0.006$, Fig. 3), and less towards
151 the periphery of the audience ($V = 0$ and $p = 0.002$, Fig. 3) than when acting in front of a hostile audience. However,
152 the audience's attitude did not influence the time spent with undirected gazes ($V = 29$ and $p = 0.92$).

153

154 FIGURE 3 ABOUT HERE

155

156 **DISCUSSION**

157 In line with our predictions, our data showed that actors presented spontaneously more often their left-
158 hemiface to the public when the audience expressed a hostile rather than a friendly attitude. A hostile audience
159 impaired actors' speech fluency. However, right-side orientations did not increase with a friendly public.
160 Nevertheless, the actors gazed more at the public when the audience was friendly but more to the periphery when
161 it was hostile.

162 Gaze avoidance is strongly related to emotional state and is a way for people to decrease their stress
163 (Larsen & Shackelford, 1996). A vast majority of reports indicate that a higher percentage of eye contact between
164 communicators is typically associated with more positive attitudes between the communicators (Mehrabian, 1969).
165 People make significantly more eye contacts with liked addressees than with disliked addressees (Mehrabian,
166 1969). Perceiving direct/averted gazes activates the approach/avoidance motivational brain systems thus
167 influencing the outcome of an interaction (Hietanen et al., 2008). The lack of responsiveness and pleasantness of
168 hostile observers certainly affected actors' emotional states and motivation to engage in long-lasting exchanges.
169 Binocular gazes by horses towards positive stimuli have been observed (de Boyer des Roches et al., 2018),
170 suggesting flexibility in hemispheric specialisation for processing positive emotions.

171 The increase of left-hemiface (i.e. right brain hemisphere control) exposure in the hostile audience
172 situation is consistent with the Valence Specific Hypothesis (e.g. Hook-Costigan & Rogers, 1998). Indeed, acting
173 in front of a non-responsive audience certainly created an unpleasant atmosphere and thus a bias in favour of a
174 right-hemisphere processing of negative emotions. Alternatively, this may have been a way actors spontaneously
175 and unconsciously adapted to the situation by favouring the exposure of their left hemiface, which typically
176 expresses emotions more intensively (Asthana & Mandal, 1998), possibly in order to increase the chances of
177 eliciting more positive responses from the audience. Previous authors showed that, when photographers ask people
178 to portray a variety of emotions, they present more often the left side of their face (Nicholls et al., 1999). Portraits
179 of left side posers received higher emotional expressive rates (Nicholls. et al., 2002). Finally, actors may have been
180 more surprised and hence more attentive towards the hostile public, and this may also be reflected by their longer
181 silences that would trigger a right-hemisphere bias (Hausberger et al., 2019).

182 Although this study would deserve replication with larger sample sizes and repeated trials in order to
183 make these conclusions more solid, it brings new findings that consolidate an earlier study showing that left-
184 hemiface exposure of actors increased in more anxiety-provoking theatrical situations (i.e. larger public)
185 (Lemasson et al., 2018). It confirms the possibility to run social human laterality studies in naturalistic contexts.

186

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305

306

307 **FIGURE CAPTIONS**

308 **Fig.1** Actors' silences in relation to the public's attitude (Friendly or Hostile). Left: Total duration; right: number
309 of occurrences. Wilcoxon tests: * $p < 0.05$.

310

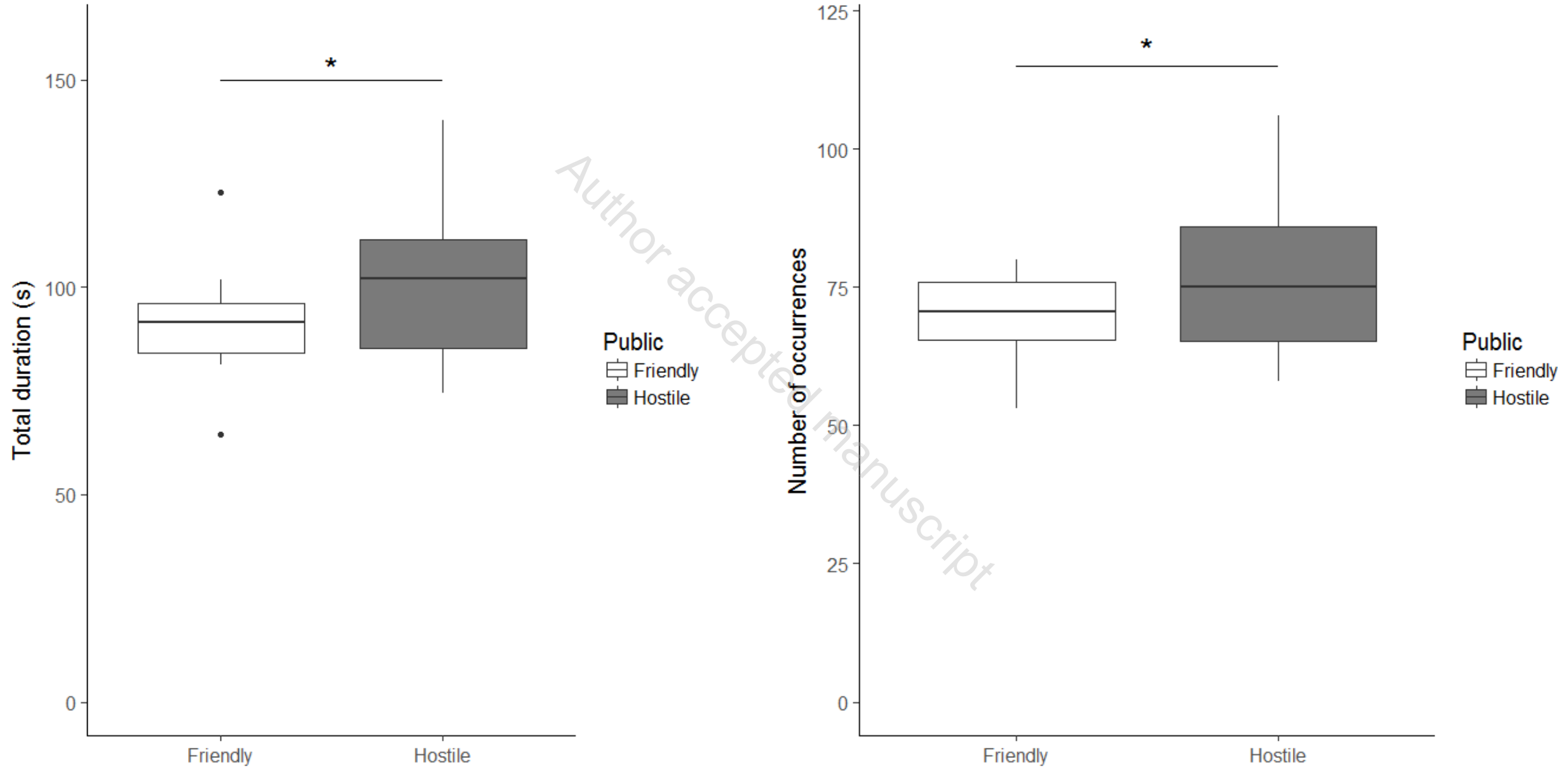
311 **Fig.2** Head orientation to the public's attitude. Times (in percent) spent by the actor in each orientation. Wilcoxon
312 tests: * $p < 0.05$.

313

314 **Fig.3** Eyes orientation in relation to the public's attitude. Times (in percent) spent by the actor in each orientation.
315 Wilcoxon tests: ** $p < 0.01$.

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Fig.1 Actors' silences in relation to the public's attitude (Friendly or Hostile). Left: Total duration; right: number of occurrences. Wilcoxon tests: * $p < 0.05$.



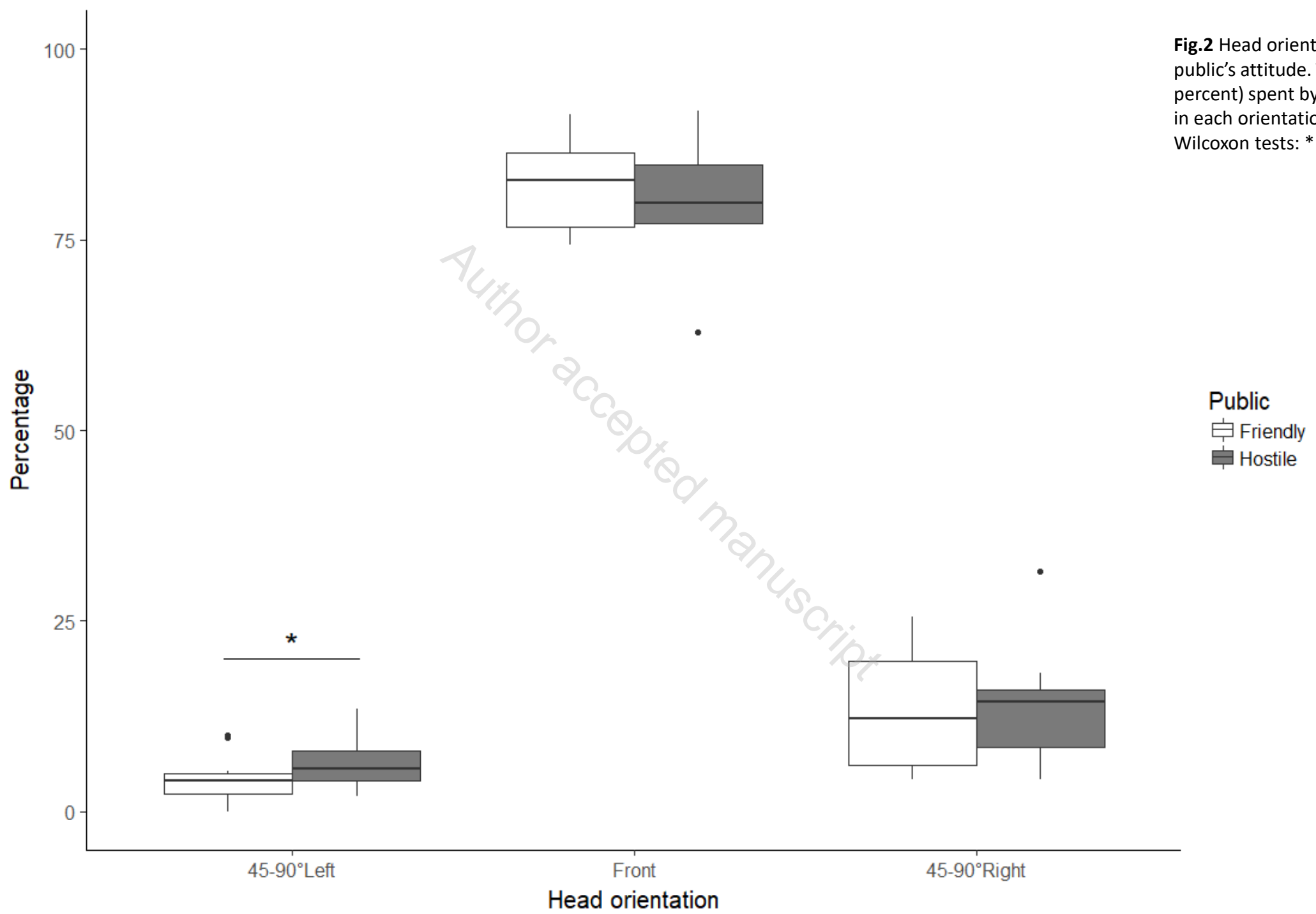


Fig.2 Head orientation to the public's attitude. Times (in percent) spent by the actor in each orientation. Wilcoxon tests: * $p < 0.05$.

Fig.3 Eyes orientation in relation to the public's attitude. Times (in percent) spent by the actor in each orientation. Wilcoxon tests: ** $p < 0.01$.

