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Fairness decisions in children and early adolescents with and without hearing loss

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Abstract

Although having universal aspects, development of a sense of fairness, a milestone in children's social development, is influenced by social and cultural forces. Yet, it scarcely has been studied in children who are at risk for their social development, let alone in deaf and hard-of-hearing (DHH) children, who have limited access to linguistic and social input. This study examined for the first time equity preferences in DHH children compared with hearing counterparts. About 179 children (8–11 years) and early adolescents (12–14 years) played four economic allocation games where they distributed coins between themselves and another child. Participants with and without hearing loss were similar in conditions that entailed non-costly prosociality or self-maximization. However, DHH participants showed weaker inequity aversion in more complex conditions: DHH children were more willing to allow other players to receive more coins than themselves, compared with hearing children and to DHH or hearing adolescents, and DHH adolescents were less willing to share resources when it was self-costly, compared with all other groups. Findings are discussed in light of the tension between norms of social comparison and norms of prosociality, and how they are reflected in developmental trajectories for inequity aversion when access to these norms is limited.

KEYWORDS
deaf/hard-of-hearing, fairness, inequity aversion, prosociality, social comparison, social development

1 | INTRODUCTION

A sense of fairness is an important determinant in human social decisions. From children's moral development and social interactions to social and political norms of resource distribution, fairness decisions impact almost every aspect of our lives (Fehr, Bernhard, & Rockenbach, 2008; Rutland & Killen, 2017; Shaw, 2016). From an evolutionary perspective, the mechanism of fairness promotes large-scale co-operation between human-beings who are genetic strangers (Fehr et al., 2008), and helps individuals avoid potential condemnation by others (Shaw, 2016). Yet, how we interpret fairness and the extent to which we act according to it, depend not only on innate maturation but also on social and cultural forces (Blake et al., 2015). In this research, we examined fairness development in deaf and hard-of-hearing children (DHH), who are considered to be at risk for less exposure to social interactions and to dominant social norms. By including DHH children in this field, we aimed to examine the theory of fairness development in the light of a broader human variety of social experiences.

Developmental research has shown that children perceive fairness in terms of equal distribution of resources between recipients. This form of fairness, so-called inequity aversion (Fehr & Schmidt, 1999), has precursors in infants already as young as 12 months old, for example, by preferring pictures of fair over unfair distributors (Geraci & Surian, 2011) or looking longer at an unfair outcome at the age of 15 months, suggesting violation of their expectations (Schmidt & Sommerville, 2011). From the age of three years onwards, there is an intensive growth in children's inequity aversion, reaching its peak around the age of eight (Blake & McAuliffe, 2011; Fehr et al., 2008). In addition, between the ages of six and eight, children develop a deeper sense of inequity aversion, because at this age they express preference for equal distributions even when they are self-costly or disadvantageous to themselves (Blake & McAulifee, 2011), or at the cost of throwing away resources (i.e., when equity is less efficient, Shaw & Olson, 2012).

When children enter adolescence, their perception of fairness becomes more complex. For example, there is a sharp increase in early adolescence in accepting inequity based on meritocracy (i.e., differences in individual achievements). This meritocratic perspective on fairness continues to increase with age during adolescence (Almås, Cappelen, Sørensenb, & Tungodden, 2010). In addition, cognitive maturation alongside social and emotional changes enable adolescents to use justifications other than fairness in their decision making, such as economic efficiency (Almas et al., 2010; Meuwese, Crone, de Rooij, & Güroğlu, 2015) or parochialism (Fehr, Glätzle-Rützler, & Sutter, 2013; Güroğlu, Van den Bos & Crone, 2014), and to incorporate the specific social context better in their social decision-making (Güroğlu, Bos, & Crone, 2014; Meuwese et al., 2015). Thus, although inequity aversion remains a strong norm after middle childhood, there is a significant decrease in equity preferences during adolescence (Fehr et al., 2013; Martinsson, Nordblom, Rützler, & Sutter, 2011; Meuwese et al., 2015).

1.1 | Fairness-related decision making and social development

Research has shown that fairness decisions are related strongly to children's and adolescents' cognitive and social development. Infants who were more sensitive to unfair distributions were more willing to share a preferred toy with a stranger (Schmidt & Sommerville, 2011). In addition, fairness decisions have been found to be associated with Theory of Mind (ToM) in pre-school children (Takagishi, Kameshima, Schug, Koizumi, & Yamagishi, 2010) and with perspective taking and cognitive empathy skills in adolescents (Güroğlu et al., 2014; Will, Crone, Van den Bos, & Güroğlu, 2013). Furthermore, fairness decisions are influenced by awareness and identification with group

norms, and identity of the recipients as in-group or out-group members (e.g., Fehr et al., 2008; Moore, 2009; Rutland & Killen, 2017). Awareness of group norms becomes more central and more complex with age, and adolescents are more aware and capable of reflecting on different levels of social norms in their fairness-related decisions (Rutland & Killen, 2017). Fairness decisions during adolescence become also more flexible and differentiated according to complex social contexts (Güroğlu et al., 2014; Overgaauw, Güroğlu, & Crone, 2012; Will, Crone, Bos, & Güroğlu, 2013). Finally, fairness development also is associated significantly with emotions related to social comparison such as envy and schadenfreude (Steinbeis & Singer, 2013), to social competition and to management of one's social reputation (Blake et al., 2015; Shaw, 2016). Thus, fairness decisions are shaped inherently by cognitive and affective aspects of social development.

In spite of the significant research done so far on fairness development, most studies have focused on rather homogenous samples, consisted mainly of Western Caucasian children without any mentioned disabilities. Examining a more diverse population can provide insights into the development of inequity aversion (Blake et al., 2015). Particularly, studies on children who differ in their social development can contribute to our understanding of factors influencing fairness development. There have been several studies conducted with children and adolescents with autism (Downs & Smith, 2004; Paulus & Rosal-Grifoll, 2017; Sally & Hill, 2006; Schmitz, Banerjee, Pouw, Stockmann, & Rieffe, 2015). These studies found a broad similarity between children and adolescents with and without autism in their fairness decisions, from young childhood to early adolescence. Nevertheless, there also were differences indicating that children and adolescents with autism relied less on equity norms in resource allocation. Interestingly, this happened mainly in conditions when inequity was disadvantageous for them, whereas benefiting the other recipient. Compared with control groups, 3- to 6-year-old children with autism gave more to others than to themselves (Paulus & Rosal-Grifoll, 2017); 6–15 year olds accepted more often offers which were unfair to themselves (Sally & Hill, 2006); and 9–14 year olds chose inequity more often when it was disadvantageous to themselves but benefited the other recipient and was more efficient in terms of general resource utilization (Schmitz et al., 2015). Thus, initial evidence suggests that children with autism might make decisions guided by motives other than the fairness norm in situations that involve disadvantageous inequity. This lower inequity aversion in children with autism has been suggested to stem from preference for instrumental/economic goals and from missing out on subtle social learning (Schmitz et al., 2015).

1.2 | DHH children and adolescents

Similar to autistic children and adolescents, DHH children and adolescents also are at risk for their social development, albeit due to other reasons. Hearing loss limits access to spoken communication. Most DHH children are born to hearing families and are raised in environments in which spoken language is dominant. These children of hearing or non-signing parents are at risk for hindered language, communication and socio-emotional development (Calderon & Greenberg, 2003; Hindley, 2000; Rieffe, Netten, Broekhof, & Veiga, 2015). Children with hearing loss can be defined as deaf or as hard-of-hearing, according to medical, functional, or cultural definitions, which do not necessarily overlap. For example, some children with severe hearing loss (i.e., medically deaf) use spoken language and define themselves as hard-of-hearing (Israelite, Ower, & Goldstein, 2002). Hence, in many studies, including this one, they are grouped together. At the same time, it is important to look for variables that may explain the heterogeneity within this population, such as communication mode, hearing status of parents, and educational settings. The socio-emotional outcomes reported in the following studies are based on samples in which most, if not all, of the participants grew up in hearing families, or families who used spoken language.

Particularly relevant to social development, research has shown that compared with hearing children, DHH children are slower in developing ToM abilities during early childhood (e.g., Ketelaar, Rieffe, Wiefferink, & Frijns, 2012), which still is evident also during adolescence (12 years old; Peterson, 2004). Compared with hearing counterparts, DHH children and adolescents also were found to present moral emotions to a lesser degree

(Broekhof, Kouwenberg, Oosterveld, Frijns, & Rieffe, 2017; Ketelaar, Wiefferink, Frijns, Broekhof, & Rieffe, 2015), and both DHH children and adolescents were found to present lower degrees of cognitive empathy and prosocial motivation (Netten et al., 2015). Additional areas of risk found in DHH children and adolescents, in comparison to hearing peers, were pragmatic communication skills (e.g., Most, Shina-August, & Meilijson, 2010) and social information processing skills (Torres, Saldaña, & Rodríguez-Ortiz, 2016). As the development of the sense of fairness is anchored in social understanding, prosocial motivation, and cognitive empathy, DHH children and adolescents thus may present different patterns of fairness decision-making.

DHH children and adolescents may lack access to full and rich communication (spoken or signed) not only in the family but also in other contexts, and at different developmental stages. Research in various educational settings suggests that DHH children have fewer opportunities to practice their social understanding in real-life situations, thus hindering further social learning. Many DHH children in special or regular schools experience social difficulties with peers and tend to feel lonely (e.g., Eichengreen, Hoofien, & Bachar, 2016; Nunes, Pretzlik, & Olsson, 2001; Rieffe et al., 2018; van Gent, Goedhart, Knoors, Westenberg, & Treffers, 2012; Wolters, Knoors, Cillessen, & Verhoeven, 2011; Xie, Potměšil, & Peters, 2014). In the transition to adolescence, many feel isolated from hearing peers due to negative attitudes of peers or to acoustically challenging conditions in which hearing adolescents socialize (Oliva, 2007; Punch & Hyde, 2011; Zaidman-Zait & Dotan, 2017). In addition, much of social learning takes place by overhearing conversations that are not directed at the child. However, such incidental learning of social norms is much more difficult when the child has hearing loss (Calderon & Greenberg, 2003; Hindley, 2000). Finally, adults and parents may treat DHH children and adolescents with linguistic over-protection (Calderon & Greenberg, 2003), or expect less of them in terms of autonomy and responsibility-taking (Berkowitz & Jonas, 2014), which also can affect their awareness and internalization of social norms. As fairness considerations are influenced by sociocultural norms and the ability of children to learn and implement these norms, missing out on social information due to communication, familial or social barriers may impact DHH children's fairness development.

As social development is embedded in many contexts across various life stages, lack of access to communication in any of these contexts may create a risk for DHH children, in spite of familial, medical, and educational differences that exist within this population. As reviewed, DHH children whose families use spoken communication and/or a poor level of signing face communication challenges starting at an early age. Moreover, also children born to fluent-signing families, on whom we lack sufficient research, have limited access to communication in settings such as gatherings of the extended family or daily interactions in the community. In addition, participating in mainstream educational settings may present additional barriers to communication, regardless of parents' communication mode. This is true also for children who are medically hard of hearing and have good oral communication skills, especially in group conversations (Xie et al., 2014). Finally, deaf children who study in special schools and have full access to signed communication with deaf peers, still may lack access to larger social circles and to the social norms of the hearing culture; or face different expectations of their social behaviour by adults in their educational, familial, or social environments (Berkowitz & Jonas, 2014). All these sub-groups therefore may present different developmental patterns of fairness decision-making.

1.3 | Current study

To explore fairness development in DHH children, we used an allocation task where children could distribute coins between themselves and another peer (Meuwese et al., 2015; Schmitz et al., 2015; see detailed description in the Method section below). We compared DHH and hearing children from two age groups: middle childhood/pre-adolescence (8–11 years old; "children") and early adolescence (12–14 years old; "adolescents"). Our goal was to examine differences in fairness-related social decision-making between hearing and DHH children across an age period when inequity aversion is expected to reach its peak, and whether any differences emerge between these two groups in the transition to adolescence.

We expected the DHH group to conform less to the equity norm due to lack of access to social learning. As there are no previous studies on fairness-related social decision-making in the DHH population, we did not have a strong hypothesis for the direction of the differences in decisions. Prior literature provides support for both directions: Inequity can be preferred in order to avoid costs to the self, as is seen in younger (hearing) children (e.g., Fehr et al., 2008); but it also can stem out of preference for other motives over self-maximization such as prosociality or efficiency, as was found for children and young adolescents with autism (e.g., Schmitz et al., 2015).

2 | METHOD

2.1 | Participants

The final sample consisted of 108 children (Mean age = 10.7 years, *SD* = 0.8), 41 with and 67 without hearing loss, and 71 early adolescents (Mean age = 13.1 years, *SD* = 0.81), 35 with and 36 without hearing loss. This study was part of a larger research project investigating socio-emotional development of children and adolescents with less access to the social environment (e.g., hearing loss, autism) and control groups (Bos, Diamantopoulou, Stockmann, Begeer, & Rieffe, 2018; Broekhof et al., 2017; Rieffe et al., 2018). We recruited participants from all over the Netherlands and the Dutch speaking part of Belgium in order to attain geographic and socioeconomic diversity. All participants had an IQ of 80 or higher, and no known learning problems. Hearing loss had to be detected prelingually (<3 years) or perilingually (3–5 years) and was defined as experiencing a loss of at least 40dB in the best ear. Sixty percent of the DHH participants were studying in regular education, where each of them was the only child with deafness in their class. The rest of the participants studied in special schools for the deaf which promoted spoken language, with or without signs. Sixty seven percent of the DHH participants used spoken language as their preferred communication mode, and the rest used sign language. All the DHH children were born to hearing parents, except for one child whose parents were both deaf. Both the DHH and the Hearing groups were matched based on age; the groups did not differ in age ($t(177) = -.91$, $p = .367$) and gender ($\chi^2(1, 179) = .02$, $p = .876$). In addition, there were no group differences for the two subtests of the Wechsler Intelligence Scale for Children-III (WISC-III); Block design ($t(161) = 1.56$, $p = .120$); and Picture arrangement ($t(161) = .64$, $p = .525$; see Table 1 for participants' characteristics).

2.2 | Procedure

Recruitment was done via hospitals, speech- and hearing centres, special schools for the deaf, and primary and secondary mainstream schools (for both the DHH and the hearing participants). The study was approved by the ethics committee of Leiden University. Written parental informed consent was obtained for all participating children. Children who were 12 years old or older also gave a written consent. Before data collection, children were ensured that all their answers would remain anonymous and that participation was voluntary. First, a battery of

TABLE 1 Participants' characteristics

		DHH	Hearing	Total
		(*n* = 76)	(*n* = 103)	(*n* = 179)
Age in years (*M*; *SD*)		11.8 (1.54)	11.1 (1.33)	11.9 (1.42)
Gender (*n* boys; girls)		36;40	50;53	86;93
Cognitive ability (*M*; *SD*)	Block design	10.01 (3.18)	10.76 (2.95)	10.42 (3.07)
	Picture arrangement	10.35 (3.14)	10.67 (3.29)	10.53 (3.22)

questionnaires was administered to the participants on a laptop. Next, participants performed the allocation task on a laptop. For DHH participants, instructions were given in sign language or in spoken language according to the child's preference, by an experimenter proficient in native sign language.

2.3 | Measures

2.3.1 | Cognitive ability

Because DHH children do not have full access to spoken language, or learn it as secondary to sign-language, non-verbal tests for cognitive ability are considered more valid in assessment of this population, compared with verbal tests (Whitaker & Thomas-Presswood, 2017). We used the two non-verbal subtests of the Dutch version of WISC-III (WISC-III^{NL}), Block Design and Picture Arrangement (de Kort et al., 2002; Wechsler, 1991). For the Block Design subtest children had to copy geometric designs with either four or nine plastic cubes. For the Picture Arrangement subtest, children had to arrange cartoons in a specific sequence in order to make logical stories.

2.3.2 | Resource allocation task

Fairness-related social decision-making was assessed using a computerized allocation task, based on Fehr et al. (2008) and expanded to four conditions (Meuwese et al., 2015; Schmitz et al., 2015). During the task, children were asked to divide coins among themselves and another child based on choosing one of the two pre-set distributions of coins. They were told that they would be playing each trial with another same-gender and same-age peer who would remain anonymous. Children were told that their decisions would determine not only the amount of money that they would receive at the end of the experiment but also the amount of money that their partners would receive. In each of the four conditions of the task, one option was an equal distribution of coins where each player would obtain one coin. The conditions differed on the alternative coin distributions, which were always unequal. These four conditions are illustrated in Figure 1. In the "Giving" condition, the alternative to equity was one coin for the self and no coins for the other. Equity here is not costly and is more efficient (i.e., resulting in larger amount of total coins). The "Sharing" condition presents an alternative of two coins for the self and no coins for the other. Equity here is thus self-costly and involves giving away one of the coins to the other. In the "Envy" condition, the alternative is one coin for the self and two coins for the other. Here equity option is costly for the other and is less efficient, as it yields fewer coins to be distributed. In other words, the alternative distribution, which is generous for the other, is disadvantageous for the self. Finally, the "Humility" condition presents the alternative of two coins for the self and one for the other. Here the equity distribution is again costly and less efficient, whereas the alternative is advantageous for the self.

After the experimenter explained the task, the child conducted four practice trials to ensure the child's comprehension of the task. Following the practice trials, the experimenter sat down at the other side of the table. It was clear to the child that the experimenter could not observe the responses. A total of 16 trials (four per condition) were randomly presented on a laptop screen. The coins were presented visually instead of numerically, making it easier for the child to understand and to respond more quickly. All trials started with a fixation cross for one second, followed by the presentation of the two offers. The coins at the top of the screen were to be given to the other and the coins at the bottom to the self, as shown in Figure 1. Participants had five seconds to click on the option they wanted using a computer mouse. The position of the equity distribution (i.e., placed on the right or left side of the screen) was counterbalanced. Equity choices were coded as 1; the alternative choice was coded as 0. The participants were told that the computer would calculate the amount of money they and the other players would acquire based on few randomly chosen trials. After the experiment, participants were told that they had won one Euro, which they received.

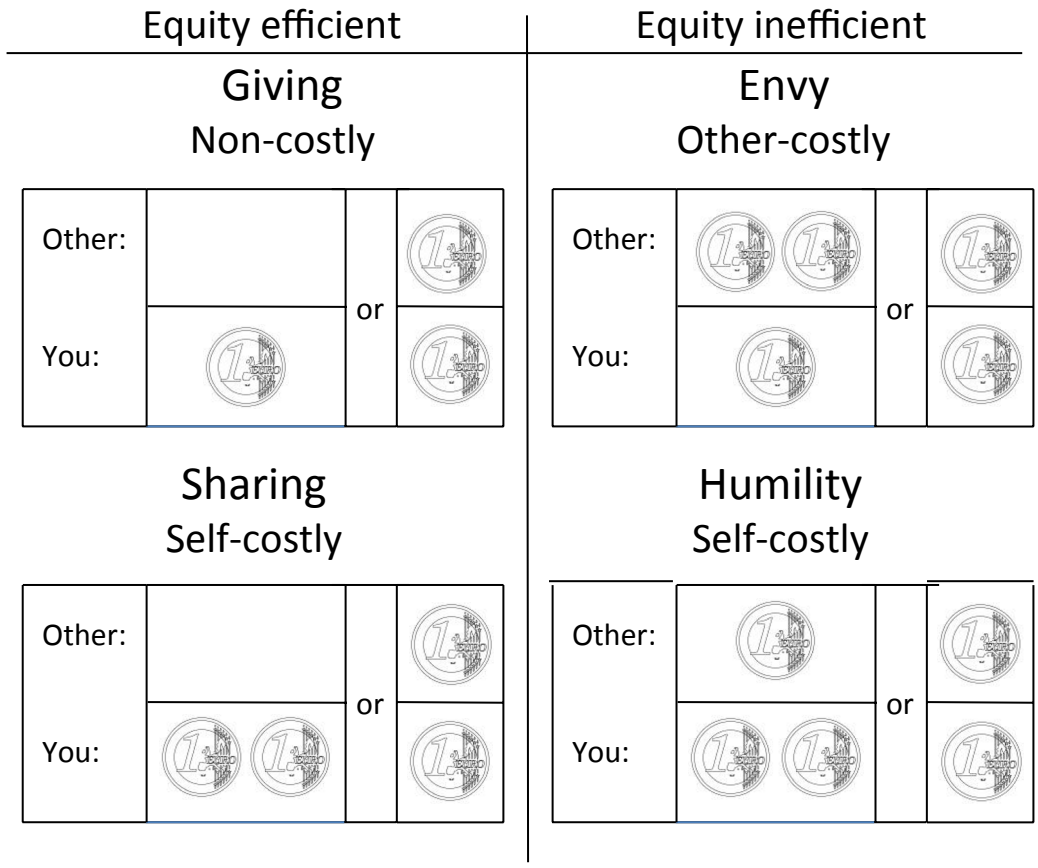

FIGURE 1 Four different conditions of the allocation game

3 | RESULTS

Out of 179 children, 159 responded to all 16 trials of the allocation task. All participants responded to 14 or more trials. Each child had at least two responses per condition. Mean scores were calculated per condition, indicating the percentage of equity choices in each condition. For statistical analyses, we used the Statistical Package for the Social Sciences (SPSS version 20.0). A power analysis test with G*Power 3 (Faul, Erdfelder, Lang, & Buchner, 2007) indicated that for a mixed-design ANOVA, with power set to 1- β = .80 at α (two-tailed) = .05, our sample size of N = 179 was adequate to detect medium effect sizes (f = .25/η_p^2 = .06; Cohen, 1988).

To examine differences in equity choices between the DHH and the Hearing groups in the four allocation conditions, a 2 (Group: DHH, Hearing) × 2 (Age: children, adolescents) × 4 (Equity condition: giving, sharing, envy, humility) mixed-design ANOVA was performed. Group and Age were the between-subjects variables and Equity condition was the within-subject variable. Categories for age were based on the median. We also tested for gender differences, but these effects were not present. For sake of brevity, gender outcomes were not reported. Table 2 summarizes the mean scores for each of the four conditions for the whole sample, as well as the mean scores per condition for each group (DHH, Hearing) at different age levels. The ANOVA analysis revealed a main effect for Equity condition (F(3, 175) = 16.34, p < .001, η_p^2 = .09), which was qualified by a 3-way Group*Age*Equity interaction (F(3, 175) = 9.51, p < .001, η_p^2 = .05). Post hoc paired t tests showed that the total sample scored higher in the non-costly (Giving) and other-costly (Envy) conditions compared with the self-costly conditions Sharing

TABLE 2 Means (*SD*) for equity choices per condition, group and age levels

		Allocation condition			
		Efficient		Inefficient	
		Non-costly	Self-costly	Other-costly	Self-costly
Age (yrs)	Group	"Giving"	"Sharing"	"Envy"	"Humility"
Children (8–11)	DHH (*n* = 41)	.78 (.30)	.65 (.35)	.56**(.41)	.50 (.41)
	Hearing (*n* = 67)	.69 (.36)	.57 (.40)	.76 (.32)	.53 (.40)
Adolescents (12–14)	DHH (*n* = 35)	.74 (.35)	.55 (.44)	.83 (.28)	.59 (.41)
	Hearing (*n* = 36)	.81 (.32)	.81**(.25)	.73 (.35)	.60 (.38)
Total sample††	*N* = 179	.74 (.34)	.63 (.38)	.72 (.35)	.55 (.40)

**p(two-tailed) < .01 Significance level is indicated for conditions which are significantly different from all other conditions at the same column.
††The following Mean differences of the total sample are significant at p(two-tailed)< .01: .74/.72> .63> .55.

($t(178) = 4.58$, $p < .001$; $t(178) = 2.68$, $p = .008$, respectively) and Humility ($t(178) = 6.02$, $p < .001$; $t(178) = 5.82$, $p < .001$, respectively); and that the Humility condition was scored lower, also when compared with the Sharing condition ($t(178) = 3.30$, $p = .001$).

To examine interaction effects for each of the four allocation conditions, we conducted four separate post hoc ANOVA's, with Group and Age as between-subjects variables, and Equity condition as the dependent variable. We applied Bonferroni corrections, defining alpha level as *p (two-tailed)* < .0125. We found no effects of group or age in the Giving and the Humility conditions, but we found Age*Group interactions for Envy ($F(1, 178) = 8.76$, $p = .004$, $\eta_p^2 = .05$) and Sharing ($F(1, 178) = 7.79$, $p = .006$, $\eta_p^2 = .04$). Post hoc *t* tests showed that in the Envy condition, DHH children scored lower than the other three groups (hearing children and adolescents, and DHH adolescents). In the Sharing condition, hearing adolescents scored higher compared with the other three groups (hearing children, and DHH children and adolescents). Mean scores for each allocation condition, indicated by group and age, are presented in Table 2 and Figure 2.

To examine differences between the DHH and the Hearing groups in patterns of equity choices across different ages, we computed linear correlations between age and equity choices in each allocation condition per group (DHH, Hearing). After Bonferroni corrections, the DHH group showed an increase with age in equity choices in the Envy condition ($r(74) = .42$, $p < .001$); and the Hearing group showed an increase with age in the Sharing condition ($r(101) = .37$, $p < .001$). We used Fisher's *r* to *Z* transformations to compare the strength of the correlations between the groups. The results showed that the groups differed for the Envy ($Z = -3.15$, $p < .001$), and Sharing ($Z = 2.42$, $p = .004$) conditions, but not for the other conditions. In sum, these outcomes support the age differences found when using the analyses of variance. The correlation coefficients per allocation condition and group are presented in Table 3.

Within the DHH group, we also examined potential confounders which may be associated with allocation choices. We checked interactions between allocation choices, school type (special or regular school) and mode of communication (signed or spoken language). No significant results were found for these analyses.

4 | DISCUSSION

A sense of fairness is an important milestone in children's interpersonal, social, and moral development (Fehr et al., 2008; Güroğlu et al., 2014; Steinbeis & Singer, 2013), yet it scarcely has been studied in children who have less access to the social world. This study examined for the first time fairness-related social decision-making in DHH

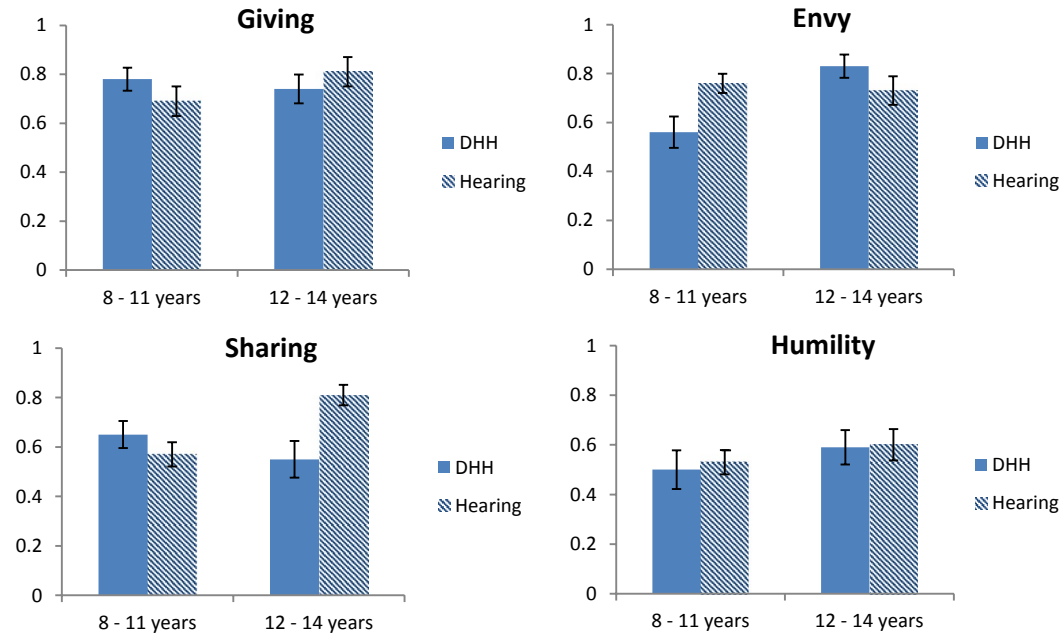

FIGURE 2 Means (*SE*) for equity choices per condition, group and age levels

TABLE 3 Pearson correlations for equity choices with age per condition and group

		Allocation condition			
Group		**Giving**	**Sharing**	**Envy**	**Humility**
DHH *n* = 76	Age	.08	.02	.42***	.22
Hearing *n* = 103	Age	.26	.37***	−.04	.09

Note: Correlations differ significantly between the DHH and the Hearing groups at the Sharing ($p < .01$) and at the Envy ($p < .001$) conditions.
***$p < .001$.

children and young adolescents, compared with hearing counterparts. We found no differences between DHH and hearing participants in equity preferences when the equity option was efficient, prosocial and not self-costly (i.e., "Giving"), or when the inequity alternative was not costly for the other although maximizing gains for the self (i.e., "Humility"). However, in two other conditions we found differences which were qualified by interactions between hearing level and age. When inequity was efficient and not costly but led to higher gains for the other player (i.e., "Envy"), DHH children preferred inequity more often compared with all hearing participants and DHH adolescents. Finally, hearing adolescents displayed a stronger equity preference when equity was costly to the self but prosocial (i.e., "Sharing"), compared with DHH participants and hearing children. We discuss these findings in light of the similarities and differences found between the DHH and Hearing groups.

4.1 | Similarities between the DHH and hearing participants

Participants displayed a preference for equity in the Giving condition about three quarters of the times, regardless of hearing level and age. These relatively high rates are not surprising, given that this condition assesses "the most

basic form of prosociality", where prosocial choices follow the equity norm and are not costly (Fehr et al., 2013). Comparison with other studies should be done with caution due to differences in the procedure, recipients' type, and sort of incentives (Steinbeis & Singer, 2013). Nevertheless, although some studies found an increase in preference for prosocial equity after the age of eight (Fehr et al., 2013; Steinbeis & Singer, 2013), other studies found no change with age (Güroğlu et al., 2014), or already high levels at the age of eight, causing a ceiling effect (80% at Fehr et al., 2008; close to 90% at Meuwese et al., 2015), similar to the results of the current study.

The relatively low rates (about half the time in all participants) of equity preference in the Humility condition found in our study also are not surprising, given that the alternative to equity in this condition entails maximizing self-gain without any cost to the other player. The rates for equity preference in the current study were very similar to rates reported previously for 8-year-old children (Blake & McAuliffe, 2011; Meuwese et al., 2015). Adolescents' rates were reported previously to be stable in girls and decreasing with age in boys of 8–18 years (Meuwese et al., 2015). In our study we found stability across the ages of 8 to 14.

Taken together with previous literature, our findings suggest that the Giving and Humility conditions are insensitive to developmental changes across the age range of 8–14 years. In addition, it seems that in these relatively "easy" non-costly conditions, DHH children and adolescents do not differ from hearing counterparts in terms of their fairness-related decision-making. These findings resemble findings from studies on children with autism, which also showed broad similarities between children with and without autism (Downs & Smith, 2004; Paulus & Rosal-Grifoll, 2017; Sally & Hill, 2006; Schmitz et al., 2015). In the case of DHH children and adolescents, we can conclude that any differences that may exist in social development in this group do not find their way to fairness-related decisions when prosociality or self-maximization are not costly for the self or the other. More generally, the findings question the sensitivity of these non-costly conditions to individual differences in social development, especially during middle childhood and early adolescence.

4.2 | Differences between the participants: Interactions between age and group

In the Envy condition, most of our participants presented high rates of equity choices (about 70%–80%), similar to most previous studies conducted with this age range (7–14 years; Fehr et al., 2008; Güroğlu et al., 2014; Meuwese et al., 2015; Steinbeis & Singer, 2013). Strikingly, it was only the DHH children who less frequently made equity choices (56%), a pattern which resembles previous findings in children with autism, from young children to adolescents (Paulus & Rosal-Grifoll, 2017; Sally & Hill, 2006; Schmitz et al., 2015). The Envy condition is different from the other conditions in that the equity distribution is not prosocial. Rather, distributing resources equally might stem from the wish to prevent the other player from receiving more than oneself and thereby signal that one will not tolerate being exploited (Blake et al., 2015; Shaw, 2016).

Blake and colleagues (2015), in a different design conducted with 4–15 years old, found that rejection of such disadvantageous inequity offers develops earlier in children from Western countries (e.g., 4–6 years old in the United States and Canada, compared with 10 years old in Mexico). The authors suggested, based on research on cultural differences in child-rearing (Keller et al., 2006), that children from Western societies are more encouraged by their parents for autonomy, independence, and competition, thereby starting earlier to be concerned with social comparisons and management of their social reputation (Blake et al., 2015). In contrast, the DHH children in our study, and perhaps also children with autism who displayed similar patterns, may be less influenced by norms of social competition. Although this explanation needs further validation, the findings suggest that children who are less involved in the nuances of social interactions, especially in group settings, and are perhaps also less encouraged for independent management of their social reputations, may be less envious and focused on social comparisons, thereby preferring prosocial and efficient motives over fairness. It is important to note, however, that the effect size was small and present only for the children's group. We found no difference between DHH adolescents and hearing children and adolescents, suggesting that by early adolescence this gap in equity preference representing envy already seems to be closed. Nevertheless, our findings suggest that being envious,

that is, avoiding resource distributions that are not necessarily self-costly but only disadvantageous to the self, is associated with access to the social world. Following Blake and colleagues' (2015) suggestion that this type of non prosocial equity preference is influenced by Western cultural context, we suggest that it will not necessarily be displayed by children who, due to less exposure to social norms and interactions, may grow up as cultural outsiders within their own society.

In contrast to the Envy condition, equity preference in the Sharing condition is self-costly, whereas maximizing self-gain results in explicit harm for the other. As such, compared with all other conditions, the Sharing condition measures a stronger and more explicit sense of prosocial inequity aversion. Prior studies reported low rates of equity choices in this condition in children and adolescents, ranging from 10%–50% in 7–18 years old (Fehr et al., 2008, 2013; Güroğlu et al., 2014; Steinbeis & Singer, 2013), to 60%–70% in 8–18 years old in Meuwese et al. (2015). These rates bear similarity to the preference rates found in hearing children and all DHH participants in the current study (around 60%), and are lower than the preference rates in the hearing adolescent group (81%). Previous findings for early adolescents are mixed, with one study reporting stable equity levels across the ages 8–17 (Fehr et al., 2013), one reporting a decrease in equity preferences across ages 8–18 in boys only (Meuwese et al., 2015), and one reporting an increase from eight to 13 years, with the highest frequency being 30% (Steinbeis & Singer, 2013). As the hearing adolescents in our study presented an exceptionally strong equity preference, inferences about DHH adolescents in comparison to them should be done with caution.

Despite this point of caution, and as comparison with other designs has limitations as well (Steinbeis & Singer, 2013), it is worthwhile to note that preference for costly equity in the Sharing condition remained at childhood levels in DHH adolescents. The small effect size suggests that they do not differ to a large extent from hearing counterparts, and it is yet unknown whether this gap closes, or alternatively widens, during late adolescence. Two complementary explanations are suggested for the current findings. It is possible that DHH adolescents lag behind because of less exposure to social interactions and social norms, thereby slowing down their maturation process in this aspect. As sharing levels were found to differentiate only in the transition to adolescence, it might have to do with social interactions becoming more verbal during this period, thereby more difficult to overhear. In addition, much social interaction and learning happen at this age in acoustically challenging conditions (e.g., group gatherings, background music, dark venues), making it more difficult for DHH adolescents to participate (Punch & Hyde, 2011; Zaidman-Zait & Dotan, 2017). Lack of exposure to social interactions may inhibit in DHH adolescents' further development of cognitive empathy and prosocial motivation (Netten et al., 2015), or other aspects associated with prosocial fairness-related decision-making during adolescence (Güroğlu et al., 2014; Will et al., 2013). Conforming to social norms, moral reasoning and moral functioning also are achieved by adult teaching and supervision (Smetana, 1999). Some examples include parents setting high maturity demands, discussing moral issues with their children; and/or explaining social rules and offering reasons for people's behaviour (Berkowitz & Grych, 1998; Smetana, 1999). DHH adolescents, who have less access to such daily conversations, also might be less expected by their educators and caregivers to mature in their autonomy and moral decisions, due to overprotection and underestimation of their capabilities. Particularly deaf children in non-signing families may face isolation and low expectations (Berkowitz & Jonas, 2014).

A different explanation for DHH adolescents' lower level of sharing may have to do with social difficulties and loneliness experienced by this group (e.g., Punch & Hyde, 2011; Rieffe et al., 2018), and to feelings of alienation, that is,belonging neither to the Deaf nor to the Hearing world, which may stem especially in hard-of-hearing adolescents (Israelite et al., 2002). Previous research has found that children and adolescents were less willing to share with recipients when these were not considered as friends or as belonging to their own group (Fehr et al., 2013; Güroğlu et al., 2014; Moore, 2009). Perhaps DHH adolescents who feel more alienated may perceive recipients as "out-group" members more than usual; especially if they assume the other anonymous recipients to be hearing peers (see also our discussion in the next section). Feelings of social alienation also may account for DHH adolescents' lower levels of generosity compared with DHH children in the Envy condition. For future research, it would be interesting to see if this pattern changes when children are told that the recipient also is DHH.

Either way, these findings suggest that sharing or preference for self-costly equity, which is considered to be the strongest form of prosocial decision making, is influenced by factors that relate to children's and adolescents' social-communicational development, such as the extent of exposure to complex social learning or opportunities for experiencing social interactions.

The results of the current study raise concerns for DHH adolescents' social development and also call for further attention to the role of social norms when promoting their social skills. These findings also might apply more generally to children who, due to various reasons, have less access to the social world. At the same time, the findings from the Envy condition highlight the role of Western cultural norms for social comparisons and suggest that sometimes being an outsider may promote more prosocial moral decisions.

4.3 | Limitations and suggestions for future research

Due to the cross-sectional design of this study, it is difficult to rule out potential confounders that may give alternative explanations to the differences found between children and young adolescents (although school type and communication mode were negated as confounders for the DHH group). Future longitudinal designs can provide more accurate understanding of the developmental course of fairness decision making in various groups.

As this is the first study to examine differences between DHH and hearing groups in fairness-related social decision-making, and considering the small effect sizes found, it is necessary to replicate our findings in future research. Future designs also will benefit from extending the age range of participants to investigate whether the gaps found in this study between DHH and hearing populations close, remain or even widen during and beyond late adolescence.

Further specifications of DHH subsamples, such as the level of access to parents' communication during childhood, also are needed in order to enhance our understanding of the role of communication, and social and cultural factors in fairness development. It would be interesting to examine whether deaf signing children who were born to deaf signing parents (and therefore should not be delayed in their language and communication development) present different patterns compared with the children in our study, whose parents were mostly hearing, and whether these differences also depend on whether the child is immersed in hearing or in signing-Deaf communities.

The allocation task procedure would benefit from further sensitizing it to the variety of participants' social identities. The instructions given in the task refer to “anonymous” recepients. However, what may pass unnoticeably as a “blank” default always implies certain meanings as to the imagined identity of that generic anonymous child. For children who belong to minority groups, this may imply a profile of a child from the dominant culture, especially if the experimenter is identified as belonging to the dominant culture as well. As fairness decisions are influenced by the identity of the recipient (e.g., in-group/out-group; friend/non-friend divisions; Fehr et al., 2013; Güroğlu et al., 2014; Moore, 2009), future research would benefit from investigating the impact of recipient profiles in case of children from minority groups, such as ethnic minorities or children with disabilities.

Through a comparison between DHH children and adolescents with compatible cognitive abilities, this study uniquely examined the role of access to the social world in social decision-making. The findings call for further exploration of the mechanism by which social access is associated with social decision-making. Future research would benefit from examining directly the paths through which factors such as cognitive empathy, the degree of exposure to social learning in various contexts, or one's sense of social identity and belonging to the dominant culture, may account for individual differences in fairness development, in all sorts of populations.

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CONFLICT OF INTEREST

The authors have no conflict of interest to declare on.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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