Received: 11 May 2020 | Revised: 23 March 2021 | Accepted: 8 May 2021

DOI: 10.1111/boer.12290

BULLETIN OF ECONOMIC RESEARCH

ARTICLE

The effect of physical disability on group cooperation: Experimental evidence

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Abstract

Many countries have specific measures to increase the employment of people with a disability. However, there is no empirical evidence on how individuals with and without some form of physical disability interact with each other. We use the public good game to fill this gap. We find that the interaction with physically disabled individuals does not affect group cooperation nor the cooperativeness of participants without visible physical disabilities. Our results shed light on the social inclusion of people with disability in organizations.

KEYWORDS
cooperation, physical disability, public goods game, social inclusion

JEL CLASSIFICATION
C92, D79, I14

1 | INTRODUCTION

A large share of the population suffers from some form of disability. The estimated global prevalence of disability in general is 15% (World Health Organization, 2011). Data from several countries show that employment rates for people with disabilities are below that of the overall population (World Health Organization, 2011). People with disabilities might be disadvantaged in the labor market due to their lack of access to education or lower mobility, or due to the nature of the workplace or employers' perceptions of disability and disabled persons (Snyder et al., 2010). Despite the importance of understanding the psychological factors that may influence the inclusion of

persons with disabilities on the labor market, there is no empirical evidence on how the presence of persons with disabilities influences social dynamics within an organization. In effect, Max et al. (2020) is one of the rare studies of how people with and without some form of disability interact in strategic environments, such as the ultimatum game (Güth et al., 1982). However, their experiment addresses the generosity and fairness aspects of such interactions, while this paper is the first, to our knowledge, to investigate the effects of physical disabilities[1] on the individual and group cooperation of all members in a group.

The question that we address here is important for at least two reasons. The first is that knowledge of how the presence of individuals with disabilities affects group dynamics, and in particular group cooperation, may enhance the inclusion of people with disabilities on the labor market. For instance, the results from this study may correct some priors held by employers that employees may coordinate better on joint tasks if groups are homogenous, meaning that individuals with and without a disability are not mixed in the same group. Because perceptions of discomfort by nondisabled coworkers is a major barrier to the acceptance of disabled individuals into work groups (Jones & Stone, 1995), one may indeed assume that diversity breeds conflicts and makes it difficult to coordinate or cooperate. Second, this paper aims to offer causal evidence on some of the consequences of laws and regulations that increased employment for people with disabilities and thus their presence in the workplace. In the last decades, many countries implemented quotas for the employment of people with disabilities in the public and private sectors (Lalive et al., 2013; Waldschmidt & Lingnau, 2007). The existing empirical research on the effects of quotas suggests that this policy led to a significant increase in the employment of disabled workers (Lalive et al., 2013). However, the question of how the presence of disabled workers affected group cohesion within the targeted organizations remains largely unexplored.

Our aim in this paper is to fill this gap by setting up a laboratory experiment that investigates whether the presence of individuals with a conspicuous physical disability would influence group cooperation in the context of a public goods game. By manipulating the group composition during the public goods game, we create an environment that is close to real-life interactions between individuals with and without physical disabilities. Further, our design enables us to test whether the presence of physically disabled individuals influences cooperativeness of individuals without visible physical disabilities both after a brief exposure and during real cooperative interactions. This is an important feature of our experiment as the number of individuals with disabilities in large organizations is generally lower than 5% in countries under the aforementioned quotas. Hence, most employees may be exposed to individuals with disabilities in their organization but only a small number may share offices or take part in joint projects with a person with a disability.

2 | EXPERIMENTAL DESIGN

2.1 | Experimental method

To study individual and group cooperation, we used an incentivized economic game called the public goods game (Ledyard, 1995). Participants are allocated to groups of four people. Each participant is endowed with 20 tokens that s/he can either allocate to a private account or a group

[1] We focus on physical disabilities for two main reasons. First, because this is the most common type of disability. Second, as it will become clear in the next section, to answer our research question, we sought participants with disabilities that were conspicuous to others.

TABLE 1 Number of tokens (mean, SE) invested in the public account over the 10 rounds of the game

		Individual contributions of abled subjects	
	Group contribution	**Men ($N = 72$)**	**Women ($N = 80$)**
Baseline ($N_{group} = 10$)	36.37 ± 1.78	11.54 ± 0.54	7.29 ± 0.41
Mixed ($N_{group} = 16$)	40.90 ± 1.43	10.18 ± 0.47	8.90 ± 0.44
Nonmixed ($N_{group} = 16$)	33.75 ± 1.49	10.09 ± 0.42	6.98 ± 0.35

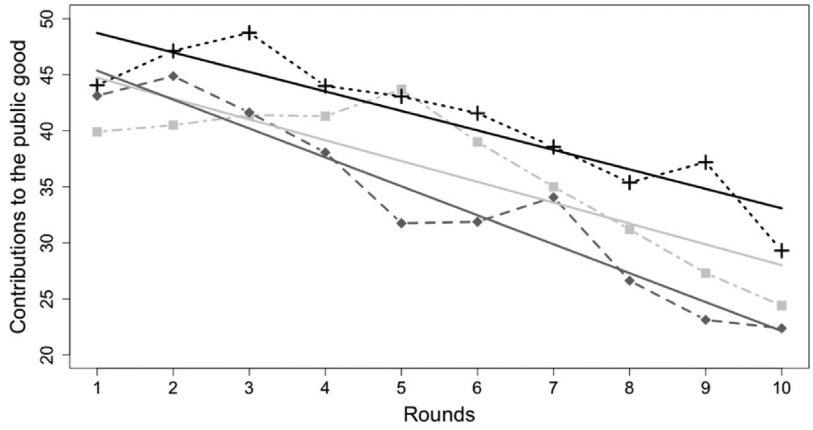

FIGURE 1 Average contributions over the 10 rounds in mixed groups (black), nonmixed groups (dark gray), and baseline groups (light gray)

Note: Predicted values are shown in solid lines. Raw data are shown in dotted line with crosses for mixed groups, dashed line with diamonds for nonmixed groups, and dash-dotted line with squares for baseline groups.

account. Each token placed in the private account yields a gain of 1 experimental currency unit (ECU; that are exchanged into euros at the end of the experiment) to the decision maker, while each token in the group account yields 0.5 ECU to each member of the group regardless of whether s/he contributed something to the group account (see the instructions in the Appendix in the Supporting Information).[2] Given the parameters of the game, the utilitarian optimum and the efficient symmetric outcome in the experiment is for all group members to contribute their entire endowments to the group account. However, it is in each individual's self-interest to contribute zero.

To study the dynamics of cooperation, the game was repeated 10 times, keeping the group composition unchanged (hence simulating real-world situations in which coworkers interact repeatedly). Participants received feedback about the total group contribution after each repetition (round). The number of rounds was common knowledge, as was the fact that participants' decisions and identity were anonymous during the game. The experiment was run on a computer

[2] The use of ECU and tokens is a standard procedure in public goods games. In general, tokens are not directly exchanged into euros. The use of ECU instead of some real currency during the experimental session facilitates the cross-country comparability of the results.

TABLE 2 Linear mixed models examining the effect of physically disabled participants on group contributions

	Dependent variable: Groups' contribution	
	(1)	(2)
Intercept	46.59***(5.53)	47.79***(5.04)
Group's type		
Mixed	3.88(7.05)	4.50(6.20)
Nonmixed	1.36(7.05)	−2.41(6.20)
Round	−1.86***(0.50)	−2.09***(0.25)
Group's type × Round		
Mixed:Round	0.12(0.64)	
Nonmixed:Round	−0.72(0.64)	
Observations	420	420
Log likelihood	−1581.21	−1583.18
Akaike Inf. Crit.	3182.42	3182.35
Bayesian Inf. Crit.	3222.82	3214.67

Note: Estimate, standard error in parentheses. For the categorical variable "group's type," the estimates are for one category compared to the baseline (reference category). (1) Full model including the interaction between round and group's type. (2) Simple model without the interaction. Post hoc analyses comparing the types of group two-by-two show that the decreasing pattern of contributions over rounds (baseline: $\beta = -1.86$, SE = 0.50, 95% CI = [−2.88,−0.84]; nonmixed groups: $\beta = -2.58$, SE = 0.40, 95% CI = [−3.39,−1.78]; mixed groups: $\beta = -1.74$, SE = 0.40, 95% CI = [−2.55,−0.93]) does not differ between groups' types (all *p*-values > 0.310). $^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.001$.

network[3]. All experimental sessions took place at the Laboratory for Experimental Anthropology (Catholic University of Lille, France) between June 2017 and October 2018.

Two sessions gathered 40 participants (57.50% males) from the student population at the Catholic University of Lille. These sessions correspond to our *baseline*. In the baseline, all subjects were individuals without visible physical disabilities. In other eight sessions, in addition to the students' population ($N = 112$, 51% males), we recruited 16 participants (50% males) with visible physical disabilities. They all suffer from multiple sclerosis and were in wheelchairs, which made their disability conspicuous to others. They were recruited in Lille from local associations as well as at the annual meeting of the national association of individuals with multiple sclerosis. At the recruitment stage, they received similar information to the student population. In each of these eight sessions, we had two participants with visible physical disability and 14 participants without. Instructions were identical to the baseline except that at the group formation stage the computer randomly allocated the two participants with visible physical disability to two different groups where the other three participants had no visible physical disability and this was common knowledge. We displayed the following message on each subject's computer screen: "There are two groups where there is one person with physical disability. In your group, there is one person with physical disability (or alternatively, in your group there is no one with physical disability)." Hence, half of the groups were what we will further refer to as mixed groups and the other half were nonmixed groups. The comparison between contribution decisions in the baseline and in the nonmixed groups will allow us to identify the effect on cooperation from a brief exposure to individuals with visible physical disability before the start of the public goods game (prior

[3] We used LE2M, the software developed by D. Dubois, to manage the experiment and collect the data.

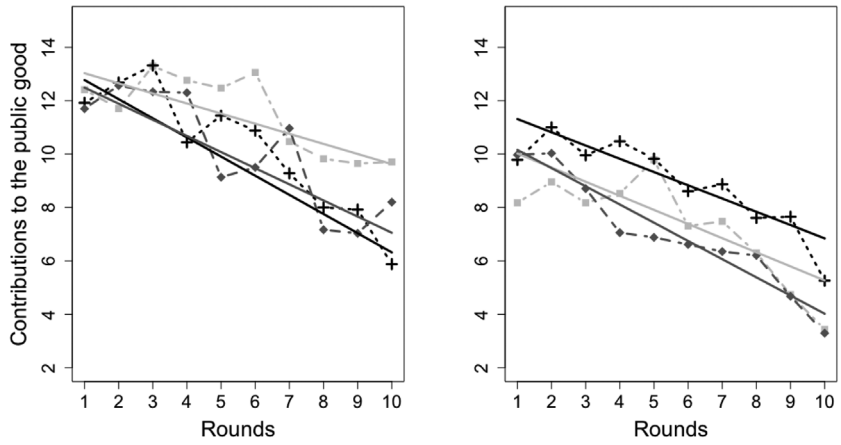

FIGURE 2 Men's (left) and women's (right) average contributions to the public account over the rounds in mixed groups (black), nonmixed groups (dark gray), and baseline groups (light gray)
Note: Predicted values are shown in solid lines. Raw data are shown in dotted line with crosses for mixed groups, dashed line with diamonds for nonmixed groups, and dash-dotted line with squares for baseline groups.

to starting the experiment, all participants waited in the same waiting room). The comparison between mixed groups and nonmixed groups will tell us whether cooperation is affected by the interaction with a physically disabled person in the group.

Participants earned on average 14.64€ (SD = 2.57€) for 1 h of participation.

2.2 | Statistical analyses

2.2.1 | The effect of physically disabled participants on group contributions

First, we investigated whether the game conditions influence group cooperation. We used a non-parametric Kruskal–Wallis test[4] on average ranks to examine whether average contributions across the 10 rounds differ between the three types of groups (baseline groups, nonmixed groups, and mixed groups). We also used a linear mixed model to examine whether the dynamics of the groups' contributions differ between the game conditions over time. The dependent variable was the group's contribution to the public account in a given round. The explanatory variables were the group's type and its interaction with the variable "round." We also included a random intercept for each group's ID to account for the repeated measures across rounds, and, following Brauer and Curtin (2018) we included random slopes for round by group. Because our variable "group's type" includes three types of group, we also run post hoc analyses to compare the dynamics of contributions between the group's type two-by-two.

[4] Statistical analyses were performed using the R statistical software (R Core Team, 2017). For the linear mixed models, we used the *lmer* function of the *lme4* package. For the post-hoc analyses, we used the function *emtrends* from the *emmeans* package. The significance threshold was set to 5%.

TABLE 3 Linear mixed models examining whether group's type influences the pattern of individual contributions of participants without visible physical disabilities across rounds

	Dependent variable:			
	Individual's contribution of nondisabled participants in a given round			
	Men		**Women**	
	(1)	**(2)**	**(3)**	**(4)**
Intercept	13.44***(1.94)	14.51***(1.69)	10.56***(1.73)	10.92***(1.56)
Group's type				
Mixed	0.16 (2.49)	−1.64(2.01)	1.28(2.35)	1.48(1.98)
Nonmixed	−0.31 (2.41)	−1.46(1.97)	0.28(2.21)	−0.71(1.88)
Round	−0.39*(0.23)	−0.61***(0.11)	−0.53***(0.14)	−0.58***(0.07)
Group's type × Round				
Mixed:Round	−0.36 (0.30)		0.03 (0.20)	
Nonmixed:Round	−0.23 (0.29)		−0.15(0.18)	
Observations	720	720	800	800
Log likelihood	−2273.64	−2273.51	−2347.31	−2346.28
Akaike Inf. Crit.	4573.28	4569.01	4720.61	4714.55
Bayesian Inf. Crit.	4632.81	4619.38	4781.51	4766.08

Note: Estimate, standard error in parentheses. For the categorical variable "group's type," the estimates are for one category compared to the baseline (reference category). (1) & (3) Full model including the interaction between round and group's type. (2) & (4) Simple model without the interaction. Post hoc analyses comparing the types of group two-by-two show that the decreasing pattern of contributions over rounds (men: baseline: $\beta = -0.39$, SE = 0.24, 95% CI = [−0.88, 0.10]; mixed groups: $\beta = -0.75$, SE = 0.19, 95% CI = [−1.14, −0.35]; nonmixed groups: $\beta = -0.62$, SE = 0.18, 95% CI = [−0.99,−0.26]; women: baseline: $\beta = -0.53$, SE = 0.14, 95% CI = [−0.83, −0.23]; mixed groups: $\beta = -0.50$, SE = 0.14, 95% CI = [−0.78, −0.21]; nonmixed groups: $\beta = -0.68$, SE = 0.12, 95% CI = [−0.92, −0.44]) do not differ between groups' type among men or women contributions (all p-values > 0.480). $^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.001$.

2.2.2 | The effect of the presence of physically disabled participants on the contributions of individuals without visible physical disabilities

Second, we investigated whether and how game conditions influence individual contributions to the public account of participants without visible physical disabilities. As it has been shown that perceived discomfort associated with working with disabled individuals is higher for men than for women (Jones & Stone, 1995), we investigated the effect of the presence of physically disabled participants on individual contributions of participants without visible physical disabilities by separating the analyses by sex. We used a nonparametric Kruskal–Wallis test on average ranks to examine whether the group average contributions among each sex differ between the three types of groups (i.e., baseline, mixed groups, nonmixed groups). Then, we used linear mixed models to investigate whether group's type influences the pattern of individual

contributions of participants without visible physical disabilities across rounds. Analyses were performed separately for men and women. The dependent variable was the individual contribution of participants without visible physical disabilities to the public account in a given round. The explanatory variables were the group's type and its interaction with the variable "round." Finally, we included a random intercept for each participant's ID nested in each group's ID to account for the individual's repeated measures and their nonindependence within groups and we further include random slopes for round by participant (Brauer & Curtin, 2018). We also run post hoc analyses to compare the dynamics of contributions between the group's type two-by-two.

3 | RESULTS

3.1 | The effect of physically disabled participants on group contributions

A Kruskal–Wallis test indicates that physically disabled participants do not influence group cooperation: the average contributions to the public account across the 10 rounds do not differ among the three types of groups (p-value = 0.460, see Table 1 for descriptive statistics).

The linear mixed model[5] shows that the dynamics of groups' contributions over time significantly decrease across the 10 rounds of the game for the three types of groups (Figure 1, Table 2), as it is classically observed in standard public goods games (Chaudhuri, 2011). Post hoc analyses comparing the types of groups two-by-two show that the decreasing pattern of contributions does not significantly differ between group types (all p-values > 0.310).

3.2 | The effect of the presence of physically disabled participants on the contributions of individuals without visible physical disabilities

A Kruskal–Wallis test indicates that the presence of physically disabled participants have no influence on physically non-disabled men's (p-value = 0.780) nor women's (p-value = 0.640) average contributions to the public account (see Table 1 for descriptive statistics). Regarding the dynamics of contributions over time, linear mixed models[6] show that men's (columns 1 and 2) and women's (columns 3 and 4) contributions decreased across rounds for all types of groups (Figure 2, Table 3) and post hoc analyses comparing the types of groups two-by-two show that the decreasing pattern of contributions does not significantly differ between group types among men or women (all p-values > 0.480).

[5] A panel Tobit model shows similar results. Specifically, group's contribution does not significantly differ between group types.

[6] Panel Tobit models show similar results. Specifically, individual contributions do not significantly differ between group types among men or women participants without visible physical disabilities.

4 | CONCLUSION

Many countries have specific measures, for example, quotas, aiming to increase employment opportunities for people with disabilities. These measures are important because they promote human dignity and social inclusion. However, to achieve social inclusion, one needs to understand how individuals without disabilities react to the presence of someone with some form of disability. This paper studies the behavioral reactions of individuals without a disability when they are exposed to or/and interact with someone with a disability in the context of a social dilemma game. Our results indicate that both a brief exposure to and a real interaction with physically disabled individuals do not significantly affect the contributions to the public good of participants without visible physical disabilities.

Our paper contributes to the broad literature on whether heterogeneity (diversity) in communities helps or hurts cooperation. A long literature at the intersection of economics and psychology has tended to emphasize the cost of diversity, focusing on ethnic diversity. If members of different groups do not like each other, diversity breeds conflicts and makes it difficult to agree on public good provision (Bertrand & Duflo, 2017). Our data suggest that there is no cost of diversity when it comes to mixing individuals with and without a disability.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

How to cite this article: Tognetti A, Doat D, Dubois D, Romaniuc R. The effect of physical disability on group cooperation: Experimental evidence. *Bull Econ Res*. 2021;1–9. https://doi.org/10.1111/boer.12290