Conflict in the Pool: A Field Experiment

Balafoutas, Loukas and Faravelli, Marco and Sheremeta, Roman

25 August 2021

Conflict in the Pool: A Field Experiment*

Loukas Balafoutas† **Marco Faravelli**‡ **Roman Sheremeta**§

Abstract

We conduct a field experiment on conflict in swimming pools. When all lanes are occupied, an actor joins the least crowded lane and asks one of the swimmers to move to another lane. The lane represents a contested scarce resource. We vary the actor's valuation (high and low) for the good through the message they deliver. Also, we take advantage of the natural variation in the number of swimmers to proxy for their valuation. Consistent with theoretical predictions, a swimmer's propensity to engage in conflict increases in scarcity (incentive effect) and decreases in the actor's valuation (discouragement effect). We complement the results with survey evidence.

Keywords: conflict; conflict resolution; field experiment.
JEL Codes: C72, C93, D74, D91.

* We are grateful to Ralph-Christopher Bayer, Subhasish Chowdhury, Martin Dufwenberg, Helena Fornwagner, Ben Greiner, Steffen Huck, Kai Konrad, Marie Claire Villeval, as well as seminar and conference participants at Humboldt University of Berlin, Vienna University of Economics and Business, the University of Padua, the University of Exeter, the University of Southampton, New York University Abu Dhabi, the 2019 ESA World Meeting in Vancouver, 2019 ESA European Meeting in Dijon, French Experimental Talks Workshop and RExCon21 Conference on Social Preferences and Social Norms for helpful comments and suggestions. Special thanks are due to Alex Cummins, Isobel Grummels, Lucy Heathcote, John Humphreys, Ethan Lwin and Josh McDonough for assisting in the experiment. This study has received a certificate of good standing from the Board for Ethical Questions in Science of the University of Innsbruck (Approval Number 13/2019) and from the Human Ethics Research Office at The University of Queensland (Clearance Number 2018001352). Loukas Balafoutas' research was supported by the Tyrolean Science Fund through grant number 0404/2147; Marco Faravelli's research was supported by the Australian Research Council's Discovery Projects funding scheme (DP190102629).
† University of Innsbruck, Department of Public Finance. Email: loukas.balafoutas@uibk.ac.at.
‡ University of Queensland, School of Economics. Email: m.faravelli@uq.edu.au.
§ Case Western University, Weatherhead School of Management, Department of Economics. Email: rms246@case.edu.

1. Introduction

Conflict is an unavoidable part of life. People engage in conflict when competing for scarce resources, such as physical resources, employment opportunities and promotions, mates, scarce vaccines, and so on. A vast literature in economics and other disciplines examines several aspects of conflict using theoretical and empirical methods. This literature is characterized by a strong heterogeneity in the methodological approaches used to study conflict, but an even more fundamental diverging feature is the way in which conflict is defined in theory and operationalized in empirical analysis.[1] In an effort to systematize existing work, Kimbrough et al. (2020: p. 999) – following Garfinkel and Skaperdas (2007) – define conflict *'as a situation in which agents choose inputs that are costly, both to themselves and relative to some socially efficient optimum, in pursuit of private payoffs framed as wins and losses'*. This definition is helpful in demarcating conflict from situations in which a principal (e.g., firm) seeks ways to maximize effort from agents (e.g., workers), because it precludes cases where expended efforts create positive third-party externalities.

In this paper, we present novel evidence from the field on the behavior of economic agents in a conflict environment, where competing parties can engage in conflict and the efforts they invest create no positive externalities. More specifically, we test the role of scarcity and players' valuations in determining effort invested into the conflict. Following a simple framework that resembles those commonly used for the study of contests, we predict that effort increases in scarcity (through an increase in a player's valuation of the contested resource) and decreases in the other player's valuation. A key contribution of this work is that it represents a methodological advancement in the literature on conflict by introducing a method for initiating conflict and testing theoretical predictions related to it in a field experiment. In doing so, we show how previous lab evidence generalizes to a field setting.

The experiment was conducted in a number of swimming pools in Brisbane, Australia. We staged a conflict scenario by employing four actors who, acting individually, asked swimmers in the pool to move to a different lane, so that the actors could have more space to train.[2] Hence, our actors initiated a conflict over a scarce resource, namely space in the water. In this tightly controlled environment in the field, we vary a signal on the actors' valuation for the scarce resource, by manipulating the type of justification that they deliver along with their request. In addition, we exploit the naturally occurring variation in scarcity (measured by the number of people swimming in each lane). We document the responses of swimmers to the request by our actors and whether they agreed to leave the lane or not. We also code these responses into varying degrees of

[1] On this issue, see Kimbrough and Sheremeta (2019): *'Not only do the various disciplines [economics, psychology, evolutionary biology, anthropology, political science, management] use different methods, models and kinds of data studying conflict and war, there is also surprisingly little agreement on fundamentals such as how to define conflict.'*

[2] To avoid any confusion, we will always refer to our confederates as the *actors* and to the persons they engaged with as the *swimmers*.

willingness to engage in conflict. We find that, in line with theoretical predictions, a swimmer's propensity to engage in conflict increases in scarcity (incentive effect) and diminishes in the actor's stated valuation (discouragement effect). Moreover, the propensity to engage in conflict increases in the swimmer's speed, lending more support to the finding that individuals with a higher valuation are more likely to invest resources into conflict. We complement these results with survey evidence, which helps us better understand the way that the conflict scenario is perceived by swimmers and to interpret the variables and effects of interest.

To the best of our knowledge, this is the first study using experimental data from the field in order to test theoretical predictions related to conflict. One likely reason for the lack of existing studies is the difficulty in implementing such a scenario in the field. We present here a methodology that engages the experimental participants in conflict and allows us to test the effects of interest through a controlled treatment variation, without creating any risks for participants.[3] By doing so, we are able to take advantage of the benefits of field experiments in terms of ecological validity and realism (Harrison and List, 2004).

One of the most common ways to model conflict in economics is to cast the problem in terms of a contest (see Kimbrough et al., 2020) between players who compete for a scarce resource (i.e., a prize) with '*imperfectly specified and imperfectly enforced property rights*' (Garfinkel and Skaperdas, 2007: p. 652).[4] The two most popular contest models are rent-seeking models (Tullock, 1980) and all-pay auctions (first adopted by Nalebuff and Stiglitz, 1983, and described in detail by Hillman and Riley, 1989). Over time, the development of these models has provided valuable theoretical predictions for the study of strategic behavior in conflicts (see Konrad, 2009, for a review). Among these, two well-established theoretical results are worthy of attention (see Kimbrough et al., 2020, for a detailed description). First, the aggregate level of conflict increases in the size of the prize; this is known as the *incentive effect*. Second, in contests with asymmetric players, the equilibrium effort exerted by the contestant with the lowest valuation diminishes as the asymmetry increases (Baye et. Al., 1993, 1996; Baik, 1994).[5] This is called *discouragement effect*: weaker players strategically cut their losses when facing stronger players.

Lab experiments have offered support both for a positive effect of own valuation on effort (Bull et al.,1987; Van Dijk et al., 2001) as well as for the discouragement effect (Davies and Reilly, 1998; Fonseca, 2009). Beyond the lab, however, results are not as clear-cut. A different strand of the literature using empirical data from sports tournaments, generally find mixed results. While some studies find evidence in line with the incentive effect (Ehrenberg and Bognanno, 1990),

[3] This methodology has received ethical approval from two independent institutional review boards (see the acknowledgements footnote for further details).

[4] Notice, however, that contest and conflict are not synonyms. Contests can also be employed to model situations where third party externalities are present, such as sports competitions or workplace tournaments, while the lack of such externalities is an essential attribute of conflict.

[5] The problem can be either in terms of asymmetric valuations or asymmetric abilities, the two frameworks being isomorphic.

others do not (Orszag, 1994). Similarly, the discouragement effect is supported in some (Brown, 2011; Tanaka and Ishino, 2012), but refuted in others (Guryan et al., 2009; Babington et al., 2020). Two kinds of reasons help explain why these findings are inconclusive. First, empirical studies, by definition, lack the control of experiments. Second, unlike a conflict, effort in sports competitions is typically characterized by externalities (first and foremost on spectators), further complicating the matter. We contribute to the still open and important research questions on the relationship between scarcity, valuation and conflict by offering evidence from a controlled, natural field experiment.[6]

2. Experimental design

The experiment described here was conducted in six swimming pools in Brisbane, Australia, between January and February 2019. We consider this setting well suited for a study on conflict, due to a number of reasons. First, it features a scarce resource – space in the water – with naturally occurring scarcity. Second, it offers a tightly controlled environment in the field, in which certain important aspects of the environment can be objectively measured, such as the extent of scarcity and observable characteristics of the individuals under consideration (swimmers in the pool). This environment is also highly standardized, with all pools being of the same size (Olympic size, including eight 50-meter-long lanes). Third, it offers the possibility of engaging with the swimmers one-on-one, without the involvement of bystanders or other parties. Fourth, the study is conducted in Australia, a country with a long successful tradition in the swimming sport, and one in which swimming is performed by highly competitive individuals who take it very seriously. Hence, we have an environment where the scarce resource is of substantial value for the typical individual in the sample.

The interaction in our experiment includes the following elements: An actor employed by the researchers walks to the shallow end of a swimming lane, enters the lane, and waits until a swimmer stops, making sure that the swimmer is alone and no one else can overhear the conversation.[7] Then, the actor speaks to the swimmer and asks him or her to leave the lane so the actor has more space to train. This is the key feature of our design, in which our actors essentially initiate a conflict with the swimmers over a scarce resource (space in the water).

Our exogenous treatment variation consists of two different messages delivered by the actors, corresponding to two different levels of their valuation of the scarce resource. In treatment *Low Valuation*, the message is the following: *'Excuse me, I need to train for a race. Do you mind moving to a different lane?'*. In treatment *High Valuation* the message was modified to reflect an

[6] There are studies using field experiments to assess the role of tournaments as incentive mechanisms. Such studies examine performance at the workplace (Erev et al., 1993; Bandiera et al., 2013), educational attainments (e.g. Leuven et al., 2011; Herranz-Zarzoso and Sabater-Grande, 2018), salespersons motivation (e.g. Casas-Arce and Martinez-Jerez, 2009; Delfgaauw et al., 2013), or status (e.g. Kosfeld and Neckermann 2011). However, these experiments are conducted in principal-agent settings and are not directly related to conflict.

[7] In order to be inconspicuous and not attract any attention, we averaged between one and two observations per hour.

even higher valuation by the actor: '*Excuse me, there's a race tomorrow I really need to train for. Do you mind moving to a different lane?'*. In order to standardize the interactions and keep interaction protocol as tightly controlled as possible, we instructed actors to avoid engaging in additional free-form conversation with the swimmers and respond to most possible queries from the swimmers by saying *'Well, I need to train, will you leave the lane or not?'*, thus provoking a binary decision by the swimmer on whether to follow the request, or stay in the lane.[8] They were also instructed to avoid any form of escalation, and to immediately end the interaction and avoid all provocation in case a swimmer showed any sign of aggression.[9] Actors recorded the exact verbal response of the swimmer and whether they agreed to leave the lane. They also recorded certain observable characteristics of the swimmer (gender, approximate age, approximate height, perceived muscularity on a scale from 1 to 10, with higher values indicating a more muscular swimmer).

The second key dimension in which variation occurred in the experiment was the scarcity of the resource. This naturally occurring variation is measured by the number of swimmers per lane, with more swimmers corresponding to more scarcity. Data were collected only under conditions of scarcity, which in this setting means two things. First, in all collected observations, all lanes in the pool were busy with at least one swimmer. Second, the lane in which the interaction took place was always the least busy one in the pool, in the sense that all other lanes had at least as many swimmers as the selected lane.[10] This is necessary in order to ensure that leaving the lane at the actor's request imposes a cost on the swimmer in terms of the scarce resource.

We employed four actors (two male and two female), trained them before the experiment, and simulated the interactions until we were sure that they were sufficiently prepared. Data were then collected in teams of three, including two actors and one research assistant (henceforth, RA). The RA's job was to select an appropriate lane for the next observation and record the number of swimmers in each lane in the pool, as well as the speed of each swimmer in the selected lane. Then, the RA told the actor which lane to enter and which message to deliver. Hence, randomization across treatments was performed by the RA who was instructed to randomly switch between the two messages.[11] The full instructions given by the experimenters to the RAs and the actors can be found in Appendix A.

---

[8] In case the swimmer asked what kind of race the actor is referring to, actors were instructed to respond that this was a race at The University of Queensland. Indeed, each day, we conducted races among our actors, to avoid potential criticism that our messages involved deception.

[9] We note, however, that no escalation and no sign of aggression occurred in any of the 205 collected observations.

[10] We did not collect any observations in lanes with more than three swimmers, because in such situations the value of the prize (staying in the lane) is rather low in the first place.

[11] Brisbane has more than 20 public, outdoor Olympic-size pools. Based on a two-week period of observation prior to the experiment, we selected the six with the best conditions: they had to be sufficiently crowded to create conditions of scarcity, and easy for the actors and RAs to mix in the crowd and disappear after each observation. The pools all included a location (e.g., a cafe) where the RA could sit and take notes of the interaction without appearing suspicious. In this respect, we note that in no single pool or occasion did our teams arouse any suspicion or attract the attention of pool staff.

3. Conceptual framework and hypotheses

Conflict and contest models in economics commonly assume that a number of players invest costly and irreversible efforts while competing for a prize, and that their probability of winning the prize is increasing in own and decreasing in the other player's effort according to some contest success function. Kimbrough et al. (2019) classify models used to study conflict in economics into contest models, war of attrition games, Colonel Blotto games, guns versus butter games, and spatial conflict models. Without loss of generality, we rely here on a simplified version of the well-known rent-seeking contest by Tullock (1980) in order to describe the effects of interest.[12] We consider two risk-neutral players (i = 1,2) who can exert effort levels e_1, e_2, in order to win a prize of value v_1, v_2, respectively. The contest success function of player 1 takes the form $p_1 = \frac{e_1}{e_1+e_2}$, where p_1 is the probability that player 1 wins the prize (with the contest success function being analogous for player 2). This is known as a lottery contest success function. Costs of effort are linear: $c_1(e_1) = e_1$, $c_2(e_2) = e_2$. Given the above, the expected payoffs π_1 and π_2 for players 1 and 2 are equal to the respective probability of winning the prize (p) times the prize value (v) minus the cost of effort (e):

$$E(\pi_1) = \frac{e_1}{e_1+e_2} v_1 - e_1, \quad (1)$$

$$E(\pi_2) = \frac{e_2}{e_1+e_2} v_2 - e_2. \quad (2)$$

Solving the first-order conditions yields the following equilibrium efforts: $e_1^* = \frac{v_1 v_2}{(v_1+v_2)^2} v_1$; $e_2^* = \frac{v_1 v_2}{(v_1+v_2)^2} v_2$. The comparative statics reveal that own effort (e_1) is increasing in own valuation (v_1) and decreasing in the other player's valuation (v_2) as long as $v_1 < v_2$. For this reason, we have chosen messages for the actors that convey a high valuation for the resource, especially in the high valuation treatment. Moreover, survey evidence (reported in Section 4) suggests that this assumption generally holds in our setting. The preceding analysis leads us to formulate our two hypotheses.

Hypothesis 1: The probability that the swimmer leaves the lane is higher when the actor delivers a higher valuation message. This hypothesis, known as the discouragement effect, directly follows from the fact that a player's effort is decreasing in the other player's valuation, when the other player values the resource more.

[12] The particular choice of formalization that uses a rent-seeking contest is not crucial for obtaining the effects of interest. It would suffice to formulate a generic contest success function that defines a player's probability of winning as a continuous and monotonic function, increasing in own and decreasing in the opponent's effort (see Chowdury, 2021, for such a contest success function). Our objective is not to recreate a field setting that perfectly corresponds to a stylized theoretical representation of conflict; after all, theoretical models aspire to capture certain elements of the real world, while abstracting from others. The aim of the conceptual framework is to better illustrate how players' valuations can be expected to affect their behavior.

Hypothesis 2: The probability that the swimmer leaves the lane is lower when the resource is scarcer (i.e., the lanes are busier). This hypothesis captures the positive relationship between a player's own valuation and his or her effort. Seen from the perspective of the swimmer, more acute scarcity translates into a higher prize of winning the conflict and hence a higher willingness to invest effort. An alternative formulation is in terms of the well-known incentive effect, which states that the aggregate level of conflict increases in the size of the prize. Since the actor's effort is by design fixed in our setting, any change in the effort invested by the swimmer directly translates into an equivalent change in the aggregate level of conflict.

An important part of our identification strategy is the interpretation of observed outcomes in terms of the two hypotheses. In particular, an empirical question is how to measure the effort invested by swimmers. In the experiment we observe two aspects of a swimmer's behavior: first, his or her verbal response to the request formulated by the actors; second, his or her actual decision on whether to leave the lane as requested.

The decision to leave the lane is a crude measure of effort, in the sense that it takes a binary form, but it has the advantage of being more directly and objectively quantifiable. A swimmer who agrees to leave the lane essentially avoids conflict, conceding the prize (more space in the water) by moving to a more crowded lane. By contrast, a swimmer who refuses to leave the lane engages in direct confrontation and does not concede the scarce resource. Hence, comparing the two actions (staying in the lane or leaving), staying is associated with higher effort for the swimmer. This rests on our assumption that engaging in confrontation by responding negatively to the actor is indeed a costly act, in other words that individuals are generally averse to being involved in a disagreement. We hold this to be a plausible assumption. In this respect, notice also that the swimmer does not know whether his or her refusal to leave the lane could escalate into a prolonged verbal disagreement, or even physical confrontation. The survey evidence discussed in Section 4 shows that a considerable share of swimmers would consider an escalation likely in this scenario.

The swimmer's verbal response can deliver a more nuanced picture of the swimmer's effort, especially in case of a refusal to move to a different lane. Conditional on the swimmer staying in the lane and thus engaging in confrontation, a verbal response can signal varying degrees of determination and willingness to fight for the scarce resource. For instance, it can signal a willingness to compromise by suggesting to share the lane, or promising to leave soon (see Appendix B for the full list of responses). On the other hand, some swimmers deliver an absolute, firm refusal, or even express their annoyance at the request. In order to perform the data analysis with the verbal measure, we asked two independent coders to rate the responses of all swimmers into one of four categories: 0 (swimmer left the lane); 1 (mild refusal, meaning that the swimmer refused to leave but signaled a willingness to compromise or made some kind of concession); 2 (firm refusal); 3 (firm refusal accompanied by an expression of annoyance or anger). The coders were given the exact text of the swimmer's response, along with a description of each interaction (including the information on whether the swimmer left the lane, as well as additional remarks by

the actor on non-verbal reactions by the swimmer). We then constructed the average of the two coded responses, resulting in a variable that ranges from 0 to 3 in steps of 0.5, with higher values indicating a higher invested effort.[13]

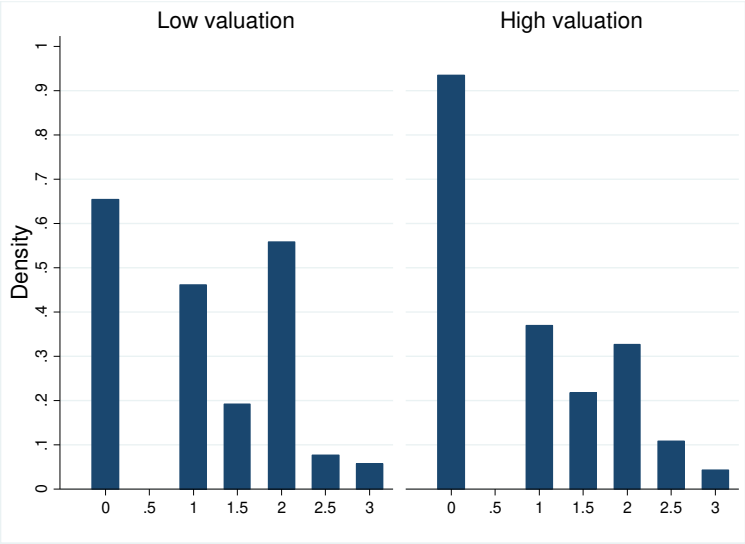
Regarding scarcity, the main measure used in the analysis is the average number of swimmers in the two lanes adjacent to the one where the interaction takes place (or in the one adjacent lane in cases when the interaction takes place at one end of the pool). We rely on this primary measure because the adjacent lanes are more readily visible to the swimmer at the time of interaction. However, we confirm the robustness of our findings by measuring scarcity in terms of the average number of swimmers per lane in the entire pool.

3. Results

Our sample consists of 205 swimmers (64% male). 104 observations were collected by male and 101 by female actors. Randomization across treatments resulted in 107 observations for the *Low Valuation* and 98 observations for the *High Valuation* treatment. On average, there were 2.0 swimmers per lane in the pool and also per adjacent lane, while the selected lane where the interactions took place had 1.4 swimmers (such that moving to a different lane always came at a cost, as already explained in the previous section). 86 out of 205 swimmers (42%) followed the actor's request and left their lane, thus avoiding conflict. Conversely, 58% of swimmers declined the request, thus engaging in the conflict situation that our actors initiated. Comparing by treatment, a clear pattern emerges, with swimmers significantly more likely to avoid conflict and leave the lane when the actor signaled a high valuation (49.0% in *High Valuation* vs. 35.5% in *Low Valuation*, p=0.05, χ^2 test). Using the non-binary measure of swimmers' effort based on the distribution of coded responses (see Figure 1) confirms that effort is lower in the high valuation treatment (0.82 in *High Valuation* vs. 1.08 in *Low Valuation*, p=0.04, Mann-Whitney U test). These results provide strong support for Hypothesis 1.

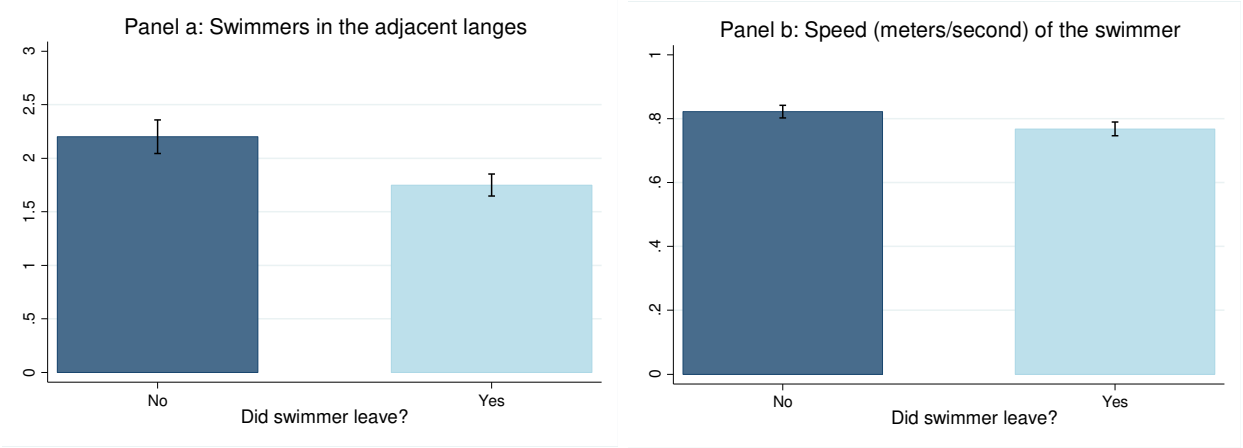
[13] The tau-equivalent reliability of the two ratings is very high, with Cronbach's alpha equal to 0.95.

Figure 1. Swimmer's coded effort, by actor's valuation



Turning to Hypothesis 2, we find that swimmers are significantly more willing to engage in conflict as scarcity increases. Comparing those swimmers who agreed to leave and those who did not (see Panel a in Figure 2), the resource is scarcer in the latter group (average number of swimmers in the adjacent lanes: 2.20 vs. 1.75, p=0.01, Mann-Whitney test). If we use the average number of swimmers in the entire pool as our measure of scarcity, the result is very similar (2.18 vs. 1.79, p=0.02, Mann-Whitney U test). Based on the non-binary measure, we find a positive relationship between coded effort and the average number of swimmers in the pool (Spearman's ρ=0.14, p=0.05). Hence, our data support Hypothesis 2 as well.

Figure 2. The incentive effect: Scarcity and swimmer's speed



We proceed to offer some additional support for the incentive effect. Our RAs measured the speed of all swimmers in the sample before the interaction with the actors, allowing us to relate their responses to how fast they are. Panel b in Figure 2 shows that those swimmers who refuse to

leave the lane are, on average, significantly faster than those who agree to leave (0.82 m/s vs. 0.77 m/s, $p<0.01$, Mann-Whitney U test). One can interpret this finding in terms of the incentive effect that we are interested in, because faster swimmers are likely to have a higher valuation for the scarce resource. This interpretation rests on the assumption that speed is positively associated with valuation. An alternative interpretation of the effect of speed could be that it is related to a sense of entitlement, if faster swimmers believe that they have more right to space in the water compared to slow swimmers, who are less likely to be obstructed during their laps by someone in front of them. Evidence from the post-experimental surveys (see Section 4 for details) clearly supports the valuation interpretation and rejects the one based on entitlement. In the question '*In general, would you say that a fast swimmer values swimming in a less crowded lane more or less compared to a slow swimmer?*', a large majority of 69% answered that a fast swimmer values the less crowded lane more than the slow swimmer (with 27% of responses supporting an equal valuation and only 4% a higher valuation by the slower swimmer). On the contrary, when we asked '*In general, would you say that a fast swimmer has more or less right to have free space compared to a slow swimmer?*', an overwhelming 93% of respondents said that both types of swimmers have the same right to free space.

Table 1 displays the results of a multivariate regression analysis with the swimmer's response as dependent variable. In the first three columns, this is a binary variable on whether the swimmer stayed in the lane and thus engaged in the conflict initiated by the actor, while in the last three columns it is the intensity of the swimmer's response, as coded by the two raters and with higher values corresponding to a stronger perceived propensity to engage in conflict.[14] The explanatory variables in the parsimonious specifications (1) and (4) include a dummy variable for the high valuation treatment, the average number of swimmers per adjacent lane as a measure of scarcity, and the swimmer's speed as measured by our RA. Additional control variables in the remaining specifications include the swimmer's perceived muscularity as rated by the actor, the swimmer's height, and the actor's and swimmer's gender (as female dummy variables).[15] The rationale for including the swimmer's height and muscularity is to control for his or her physical strength, which could become relevant in case of a physical confrontation. Although no such confrontation could ever take place given the way our actors were instructed, it is conceivable that

[14] Given the distributions of the dependent variables, estimation is based on the Probit model in the first two columns and on the Tobit model in the last two columns. The results in columns (3) and (4) are generally robust to estimation with Ordinary Least Squares instead of Tobit, although we note that the variable *High Valuation* retains its sign and magnitude but loses its significance in the random effects OLS regression, due to a large increase in its standard error.
[15] As already discussed, we have opted for the average number of swimmers per adjacent lane as the primary measure of scarcity. We replicate all regressions replacing this variable with the average number of swimmers per lane in the entire pool, and also with the difference between the number of swimmers in the adjacent lanes and the swimmer's lane. All results remain qualitatively the same.

stronger, taller swimmers feel more confident in a conflict situation. Finally, columns (3) and (6) include actor random effects.[16]

Table 1. Regression analysis on swimmers' behavior

	Binary variable (stay in lane)			Coded response (effort)		
	(1)	(2)	(3)	(4)	(5)	(6)
High Valuation	-0.42**	-0.42**	-0.41**	-0.47**	-0.44**	-0.42*
	(0.18)	(0.19)	(0.19)	(0.22)	(0.22)	(0.22)
Swimmers per adjacent lane	0.33***	0.33***	0.35***	0.26**	0.24**	0.24**
	(0.10)	(0.10)	(0.11)	(0.10)	(0.10)	(0.10)
Swimmer's speed	1.60***	1.62**	1.64**	1.37*	1.57**	1.50*
	(0.62)	(0.67)	(0.69)	(0.74)	(0.79)	(0.79)
Swimmer's muscularity		-0.01	-0.03		-0.03	-0.03
		(0.06)	(0.06)		(0.06)	(0.06)
Swimmer's height		-0.24	0.12		-0.04	-0.26
		(1.54)	(1.59)		(1.79)	(1.78)
Female actor		-0.10	-0.05		-0.04	-0.05
		(0.19)	(0.48)		(0.22)	(0.30)
Female swimmer		0.02	0.06		0.23	0.24
		(0.28)	(0.29)		(0.33)	(0.33)
Actor random effects	No	No	Yes	No	No	Yes
Number of observations	205	205	205	196	196	196

Notes: In columns 1-3 the estimation method is the Probit model and the dependent variable is a dummy equal to 1 if the swimmer refused to leave the lane at the actor's request, and 0 otherwise. In columns 4-6 the estimation method is the Tobit model and the dependent variable is the swimmer's response as coded by the two raters. This variable is left-censored at 0 and right-censored at 3, with higher values indicating a higher effort invested into conflict. The number of observations is slightly lower in columns 4-6 because the coders did not assign a value to the response of those swimmers who stayed in the lane but did not verbally respond to the actor's request. *Swimmer's speed* is the number of meters covered per second, such that higher values indicate faster speed; *Swimmer's muscularity* is based on the ratings of the actors and ranges from 1 to 10, with higher values indicating higher perceived muscularity. *Swimmer's height* is measured in meters. Standard errors in parentheses. *, **, *** denotes statistical significance at the 10%, 5%, 1% level, respectively.

In line with the non-parametric analysis, Table 1 regressions offer support for Hypotheses 1 and 2. With regard to Hypothesis 1, the *High Valuation* treatment leads to significantly less frequent and less intense refusals to leave the lane in every specification. With respect to Hypothesis 2, we find that swimmers are more likely to refuse to leave their lane when the pool is

[16] A Hausman specification test does not reject the null hypothesis that the random effects estimator is consistent, hence we present random and not fixed effects regressions.

busier (with more swimmers per lane) and therefore the resource is more scarce. Moreover, faster swimmers are on average less likely to heed the actor's request. As we have already argued, we view this as additional evidence in support of the incentive effect, which implies that effort increases in own valuation.

The regression analysis also allows us to assess the potential role of a number of observable characteristics – included as control variables – on the propensity of swimmers to invest effort into the enacted conflict scenario. As it turns out, the only significant predictors of behavior are the ones linked to our key hypotheses, with all additional variables being very small in magnitude and insignificant. These variables include the swimmer's height and perceived muscularity (as proxies for his or her physical strength), as well as the gender of both the actor and the swimmer. The addition of actor random effects in (3) and (6) has no notable impact on any of the coefficients of interest either.[17]

4. Interpreting the results: Post-experimental surveys

Four months after completion of our experiment, in June 2019, our research assistants conducted an ex post survey in the same six swimming pools. The sample size for the surveys was N=201. The purpose of these surveys is to help us interpret the results of the experiment and better understand the motivation behind swimmers' responses, as well as the way in which they perceive the experimental setting. The full surveys, including the distribution of responses, are shown in Appendix C.

One of the survey questions (question 3 in Appendix C) presented respondents with a hypothetical scenario, which was identical to the interaction that we staged during the actual experiment. Specifically, we asked respondents to tell us if they would be willing to move to a different lane if they found themselves in the position of the swimmer. Here we had two different versions of the survey, one corresponding to the actor's message in the *Low Valuation* and one to the message in the *High Valuation* treatment (each respondent was randomly assigned to one message only). The stated rates of willingness to leave the lane at the actor's request were 69% in *Low Valuation*, and 80% in *High Valuation*. Hence, survey respondents generally overstate their propensity to comply with the actor's request[18], but – in line with Hypothesis 1 and the results of the actual experiment – they report a higher hypothetical willingness to avoid conflict and switch lane when receiving the high valuation message (p=0.08, Mann-Whitney U test).

[17] The results are robust to the inclusion of time and day fixed effects. Moreover, we have the information on the speed provision in some lanes (slow, medium, or fast). This information is not included in the regressions, since less than half of the observations (84 out of 205) were collected in lanes with such a provision. We note, however, that neither the binary nor the coded measure of swimmer effort varies by speed provision (p=0.15, p=0.69, respectively; χ^2 tests).
[18] It is well known among social scientists that non-incentivized survey responses are subject to social desirability bias, i.e., respondents tend to conceal preferences that are considered socially undesirable (Maccoby and Maccoby, 1954; Edwards, 1957).

A discussion is due with respect to our findings in support of Hypothesis 1. Why is it the case that swimmers are more likely to avoid conflict and concede the scarce resource to high valuation – as compared to low valuation – actors? Based on the simple theoretical framework of Section 3, the answer is that a player facing an opponent with a higher valuation anticipates a low winning probability, and therefore will strategically reduce own effort in order to keep effort costs low, i.e., the discouragement effect. However, an alternative interpretation of our findings is that the high valuation message prompts more pro-social behavior by swimmers, who are more willing to give up part of the scarce resource in order to help someone who values it more than they do. This would imply that the effect we observe between the two treatments is not mainly due to the perception of one's counterpart as someone who is willing to invest resources into a conflict, but due to social preferences. Indeed, it is straightforward to show that if swimmers exhibit altruism they are more likely to react to a high valuation message by decreasing their equilibrium effort compared to a low valuation message. Assume the following utility functions for players 1 and 2, respectively: $u_1 = E(\pi_1) + \alpha_1 E(\pi_2)$, $u_2 = E(\pi_2) + \alpha_2 E(\pi_1)$, where $E(\pi_1)$ and $E(\pi_2)$ are defined as in Equations (1) and (2), and $\alpha_1, \alpha_2 \in (0,1)$ reflect the players' degree of altruism. With no loss of generality, call the swimmer player 1 and the actor player 2. It is easy to show that, in equilibrium, player 1 chooses effort $e_1^* = \frac{(v_1 - \alpha_1 v_2)^2 (v_2 - \alpha_2 v_1)}{(v_1 + v_2 - \alpha_1 v_2 - \alpha_2 v_1)^2}$. A quick inspection shows that $\frac{\partial e_1^*}{\partial v_2} < 0$ whenever $v_1 < \frac{(1+\alpha_1)}{(1+\alpha_2)} v_2$. Fixing, for simplicity, $\alpha_2 = 0$, we can see that if the swimmer is altruistic, the negative relationship between the opponent's valuation and own effort is more frequently observed than in the purely self-interested model. The reason is that $\frac{\partial e_1^*}{\partial v_2}$ is now negative under a large range of parameters even when the swimmer values the lane more than the actor. Moreover, we can show that $\frac{\partial^2 e_1^*}{\partial v_2 \partial \alpha_1} < 0$, which implies a stronger discouragement effect the more altruistic the swimmer is.

Question 4 in the survey asked respondents to state their reasons for complying with the actor's request in the hypothetical scenario, with multiple answers being allowed. The responses to this question, shown in Appendix C, are illuminating. The two most common reasons given for leaving the lane refer to the fact that the other person needs the lane more (67%), and to a desire to help people (55%). The fact that two-thirds of respondents say that the hypothetical actor needs the lane more than they do provides direct support for the assumption $v_1 < v_2$, which is necessary for the discouragement effect to apply, as described in Section 3. Moreover, a substantial number of people state that they would leave the lane in order to avoid conflict (29% for the first and the fourth option). At the same time, the fact that more than half of respondents mention helping people as a reason for moving lanes indicates that social preferences do matter in this setting. It must be noted, however, that an explanation of our data based on social preferences would require the third response in question 4 ('I like to help people') to be given more frequently in the high valuation version of the survey. As it turns out, the share of respondents who would leave the lane in order

to help the actor is actually much *lower* in the *High Valuation* (49%) than in the *Low Valuation* (63%) treatment. Hence, while caution requires us to remain open to both mechanisms, we interpret the survey evidence as showing that the results regarding the actor's valuation are more likely to be driven by considerations along the lines of the discouragement effect, and less by pro-social motives on part of the swimmers.

On a more general note, standing down in a conflict and giving up something out of altruistic (or, more generally, other-regarding) motivations is often observationally equivalent. Our view is that the extent to which altruistic or conflict-related motivations are the main driver of behaviour largely depends on context. For instance, the observation that asking can increase giving in dictator games (Andreoni and Rao, 2011; Bruttel and Stolley, 2020) could in principle be viewed through the lens of conflict, where the recipient initiates an argument over a scarce resource (money); nevertheless, context leads researchers to attribute giving in a dictator game with communication primarily to altruism. In our experiment, we argue that swimmers largely perceive the situation as a conflictual one. To begin with, we have staged a scenario in which swimmers face an unexpected and direct request from a stranger in a face-to-face interaction. Hence, contrary to lab settings, one is forced to actually interact with a demanding stranger who is challenging one's claim to a resource, without any assurance that this claim is artificially made possible within a controlled interaction protocol (such as an experiment). Second, as already mentioned above, a considerable number of respondents in question 4 say that they would leave the lane in order to avoid 'confrontation', or wasting time 'arguing with people'. We believe that verbal confrontation is unpleasant for most people, and often associated with a substantial amount of effort and costs for individuals. In addition, some swimmers may believe that the interaction with the actor could even escalate into physical confrontation. Indeed, responses to question 7 reveal that a considerable share of respondents (37%) find it 'possible' or 'quite likely' that the situation described to them could escalate into physical conflict if they did not agree to move to a different lane. Hence, overall, we believe that we have been able to create a situation that captures a number of essential aspects of conflict in this field setting, and is largely perceived as such by individuals.

5. Concluding remarks

We presented new evidence from a natural field experiment on conflict. We studied a situation where economic agents compete over a scarce resource by expending irreversible effort with no third party externalities. We analyzed the role of scarcity and valuations in determining the effort that players choose to invest in conflict. We tested two well-known predictions from the literature on conflict, the incentive and the discouragement effect, reporting evidence in support of both. In addition, we presented survey results supporting in different ways our findings, as well as corroborating that the interaction we staged in our experiment is, indeed, perceived as conflictual by the population from which our sample is taken.

To the best of our knowledge, ours is the first natural field experiment on conflict. The most likely reason for this lacuna in the literature is that the design of a controlled, natural field experiment on this topic undoubtedly presents significant challenges. First and foremost, the selection of a tightly controlled, easily replicable environment, where agents naturally and artlessly may happen to enter into conflict over a scarce resource; where scarcity, valuations, and effort are measurable; where third party externalities are absent; and where a conflict can be initiated inconspicuously, without creating any risk for the participants, and equally unostentatiously observed for study. An important contribution of our study is that it provides a methodological advancement that can add to the economist's toolkit for studying interactions in the field, for which we possess solely laboratory evidence so far.

References

Andreoni, J., & Rao, J. M. (2011). The power of asking: How communication affects selfishness, empathy, and altruism. *Journal of Public Economics*, 95(7-8), 513-520.

Babington, Michael, Sebastian J. Goerg, and Carl Kitchens. "Do tournaments with superstars encourage or discourage competition?." *Journal of Sports Economics* 21.1 (2020): 44-63.

Baik, Kyung Hwan. "Effort levels in contests with two asymmetric players." *Southern Economic Journal* (1994): 367-378.

Bandiera, Oriana, Iwan Barankay, and Imran Rasul. "Team incentives: Evidence from a firm level experiment." *Journal of the European Economic Association* 11.5 (2013): 1079-1114.

Baye, Michael R., Dan Kovenock, and Casper G. De Vries. "Rigging the lobbying process: an application of the all-pay auction." *The American Economic Review* 83.1 (1993): 289-294.

Baye, Michael R., Dan Kovenock, and Casper G. De Vries. "The all-pay auction with complete information." *Economic Theory* 8.2 (1996): 291-305.

Brown, Jennifer. "Quitters never win: The (adverse) incentive effects of competing with superstars." *Journal of Political Economy* 119.5 (2011): 982-1013.

Bruttel, L., & Stolley, F. (2020). Getting a yes. An experiment on the power of asking. *Journal of Behavioral and Experimental Economics*, 86, 101550.

Bull, Clive, Andrew Schotter, and Keith Weigelt. "Tournaments and piece rates: An experimental study." *Journal of political Economy* 95.1 (1987): 1-33.

Casas-Arce, Pablo, and F. Asis Martinez-Jerez. "Relative performance compensation, contests, and dynamic incentives." *Management Science* 55.8 (2009): 1306-1320.

Chowdhury, S. M. (2021). The Economics of Identity and Conflict. In *Oxford Research Encyclopedia of Economics and Finance*.

Davis, Douglas D., and Robert J. Reilly. "Do too many cooks always spoil the stew? An experimental analysis of rent-seeking and the role of a strategic buyer." *Public Choice* 95.1 (1998): 89-115.

Delfgaauw, Josse, Robert Dur, Joeri Sol, and Willem Verbeke. "Tournament incentives in the field: Gender differences in the workplace." *Journal of Labor Economics* 31, no. 2 (2013): 305-326.

Edwards, Allen L. "The social desirability variable in personality assessment and research." Dryden Press, Fort Worth, TX, US (1957).

Ehrenberg, Ronald G., and Michael L. Bognanno. "Do tournaments have incentive effects?." *Journal of Political Economy* 98.6 (1990): 1307-1324.

Erev, Ido, Gary Bornstein, and Rachely Galili. "Constructive intergroup competition as a solution to the free rider problem: A field experiment." *Journal of Experimental Social Psychology* 29.6 (1993): 463-478.

Fonseca, Miguel A. "An experimental investigation of asymmetric contests." *International Journal of Industrial Organization* 27.5 (2009): 582-591

Garfinkel, Michelle R., and Stergios Skaperdas. "Economics of conflict: An overview." *Handbook of Defense Economics* 2 (2007): 649-709.

Guryan, Jonathan, Kory Kroft, and Matthew J. Notowidigdo. "Peer effects in the workplace: Evidence from random groupings in professional golf tournaments." *American Economic Journal: Applied Economics* 1.4 (2009): 34-68.

Harrison, Glenn W., and John A. List. "Field experiments." *Journal of Economic Literature* 42.4 (2004): 1009-1055.

Herranz-Zarzoso, Noemí, and Gerardo Sabater-Grande. "Monetary incentives and self-chosen goals in academic performance: An experimental study." *International Review of Economics Education* 27 (2018): 34-44.

Hillman, Arye L., and John G. Riley. "Politically contestable rents and transfers." *Economics & Politics* 1.1 (1989): 17-39.

Kimbrough, Erik O., and Roman M. Sheremeta. "Theories of conflict and war." *Journal of Economic Behavior & Organization* 159 (2019): 384-387.

Kimbrough, Erik O., Kevin Laughren, and Roman Sheremeta. "War and conflict in economics: Theories, applications, and recent trends." *Journal of Economic Behavior & Organization*178 (2020): 998-1013.

Konrad, Kai A. "Strategy and dynamics in contests." *OUP Catalogue* (2009).

Kosfeld, Michael, and Susanne Neckermann. "Getting more work for nothing? Symbolic awards and worker performance." *American Economic Journal: Microeconomics* 3.3 (2011): 86-99.

Leuven, Edwin, and Hessel Oosterbeek. "Overeducation and mismatch in the labor market." *Handbook of the Economics of Education* 4 (2011): 283-326.

Maccoby, Eleanor E., and Nathan Maccoby. "The interview: A tool of social science." *Handbook of Social Psychology* 1.1 (1954): 449-487.

Nalebuff, Barry J., and Joseph E. Stiglitz. "Prizes and incentives: towards a general theory of compensation and competition." *The Bell Journal of Economics* (1983): 21-43.

Orszag, Jonathan M. "A new look at incentive effects and golf tournaments." *Economics Letters* 46.1 (1994): 77-88.

Tanaka, Ryuichi, and Kazutoshi Ishino. "Testing the incentive effects in tournaments with a superstar." *Journal of the Japanese and International Economies* 26.3 (2012): 393-404.

Tullock, Gordon. “Efficient rent-seeking” In: Buchanan, J.M, Tollison, R.D., Tullock, G. (Eds.), Towards a Theory of the Rent-Seeking Society. Texas A&M University Press (1980).

Van Dijk, Frans, Joep Sonnemans, and Frans Van Winden. "Incentive systems in a real effort experiment." *European Economic Review* 45.2 (2001): 187-214.