School Choice with Consent: An Experiment*

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Abstract

Public school choice often yields student placements that are neither fair nor efficient. Kesten (2010) proposed an efficiency-adjusted deferred acceptance algorithm (EADAM) that allows students to consent to waive priorities that have no effect on their assignment. In this article, we provide first experimental evidence on the performance of EADAM. We compare EADAM with the deferred acceptance mechanism (DA) and with two variants of EADAM. In the first variant, we vary the default option: students can object – rather than consent – to the priority waiver. In the second variant, the priority waiver is enforced. We find that both efficiency and truth-telling rates are substantially higher under EADAM than under DA, even though EADAM is not strategy-proof. When the priority waiver is enforced, we observe that efficiency further increases, while truth-telling rates decrease relative to the EADAM variants where students can decide to eschew the waiver. Our results challenge the importance of strategy-proofness as a condition of truth-telling and point at a trade-off between efficiency and vulnerability to preference manipulation.

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1 Introduction

One of the most prominent mechanisms achieving a stable matching outcome is Gale and Shapley's student-proposing deferred acceptance algorithm (Gale and Shapley 1962), henceforth referred to as DA. Several school districts in the United States and other countries have adopted some version of DA, not least for its fairness virtues (Pathak and Sönmez 2013). These

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fairness virtues result from both the properties of the matching outcome that DA produces and the incentives it sets for students and their parents.

On the one hand, DA produces stable outcomes, which means that DA completely suppresses priority violations (Gale and Shapley 1962). This implies that the assignment procedure always fully respects the criteria set by lawmakers or school authorities. By the same token, stability eliminates justified envy and thus mitigates the motives for legal action against the assignment procedure or the outcome it produces.[1] On the other hand, DA is strategy-proof, which means that it is a weakly dominant strategy for students to rank schools according to their true preferences (Dubins and Freedman 1981; Roth 1982). DA thus enhances procedural fairness and creates a level playing field, as it is impossible for sophisticated students to manipulate the outcome of the assignment procedure at the expense of less sophisticated students (Pathak and Sönmez 2008).

DA, however, comes at an important cost: it is Pareto inefficient (Balinski and Sönmez 1999). The inefficiency can be potentially quite severe (Kesten 2010) and is further exacerbated when priorities involve ties (Erdil and Ergin 2008). Empirical analysis shows that such welfare loss is a serious practical concern. Abdulkadiroğlu, Pathak, and Roth (2009) show for the New York City High School match in 2006-2007 that approximately 4300 eight-graders could have been assigned to more preferred options without hurting any other students.

One intuitive way of addressing the inefficiency arising from DA is to allow students to trade the seats they have been assigned under DA once the assignment procedure is completed.[2] And indeed, several school systems allow for swaps and trades outside of the primary assignment procedure on a secondary, post-match marketplace, sometimes referred to as a *scramble* (Roth 2013; May et al. 2014).[3] Assuming transaction costs to be zero and absent any tendency to stick with the status quo (*status quo bias*) hampering the transfer of currently assigned seats, this type of post-allocation Coasian trading would indeed produce a more efficient allocation (Coase 1960).

However, such trades face two major problems. First, by trading, students would get another chance at obtaining a preferred seat. While a trade would enable the trading students to improve their assignment, it would necessarily come at the expense of other students who

1. Judicial review of public assignment procedures is a fundamental right in many jurisdictions. Under Art. 6 of the European Convention of Human Rights, for example, any public assignment decision can be attacked in court.

2. Alternatively, an efficient procedure such as the the top trading cycles (TTC) mechanism (Abdulkadiroğlu and Sönmez 2003) can be adopted at the expense of stability. However, such procedures have not been viewed as favorably as DA by practitioners. For example, a memo from the superintendent of Boston school district articulated how DA was chosen over TTC due to concerns over the way priorities are treated (Abdulkadiroğlu, Pathak, and Roth 2005). Similarly, New Orleans abandoned TTC in favor of DA one year after its adoption.

3. A prominent example for a scramble is the Pharmacy Online Residency Centralized Application Service (PhORCAS) of the American Society of Health-System Pharmacists (ASHP) Resident Matching Program. "The Post Match (also known as "The Scramble") is the last phase of the PhORCAS application cycle. Post Match is available to applicants who did not match during Phase I, Phase II, or to new applicants who decide to apply."

cannot or do not want to trade. Trades could thus violate the priorities of students not participating in the trade. In *Association OSVO v. Municipality of Amsterdam*, the Amsterdam Court of Appeal therefore held that students are not allowed to trade seats that were assigned to them under a variant of DA with multiple tie-breaking used until 2016 (de Haan et al. 2018; de Haan 2017):

> *If swapping were allowed, (...) it could lead to a student with an unfavorable lottery number [lower priority] bypassing a student with a more favorable lottery number [higher priority]. Under these conditions, equal opportunities are no longer guaranteed. (...) The admissions system then no longer meets the requirements of consistency and transparency. That would be contrary to the general interest of all students.*[4]

Second, allowing trades encourages the strategic manipulation, thus eliminating the strategy-proofness of DA. As the Amsterdam Court of Appeal noted, students could apply at popular schools and attempt to obtain a highly valued seat in order to later use it as a bargaining chip in a trade:

> *If students know that swapping is allowed after the placement is made, it would be optimal for them to place popular schools (not necessarily their own preferences) high on their preferred list. If they are then placed in one of those schools, that place can be used in a trade. (...) Even then, the system does not work cleanly, because it reduces the chances of those who register in accordance with their true preferences.*[5]

Similar concerns were raised by the Boston Public Schools (BPS) Strategic Planning Team when redesigning the Boston school admissions system in 2005.[6] These considerations tie in with the general finding that there is no mechanism that eliminates justified envy and yields a Pareto efficient matching at the same time (Roth 1982; Balinski and Sönmez 1999; Abdulkadiroğlu and Sönmez 2003).[7]

Kesten (2010) traced the source of the welfare loss under DA to certain priorities that have no effect on the assignment of the student holding the priority. He proposed an *efficiency-adjusted deferred acceptance mechanism* (EADAM) that allows students to waive such priorities,

4. Instantie Rechtbank Amsterdam, 30-06-2015, Zaaknummer C/13/588653 / KG ZA 15-718, para. 4.8.

5. Instantie Rechtbank Amsterdam, 30-06-2015, Zaaknummer C/13/588653 / KG ZA 15-718, para. 4.9.

6. A similar problem arises when Gale's top trading cycles algorithm (Shapley and Scarf 1974) is implemented once students have been assigned places under DA. Allowing a trade of priorities would not be possible without simultaneously violating the priorities of some students and thus diluting the admissions criteria (Kesten 2010). Ultimately, such a system would enable students to gain control over the admissions criteria that were initially designed in order to achieve specific policy goals (e.g. prioritizing students from walk zones, prioritizing siblings, or ensuring a diverse student body) and were therefore not intended to be at the students' disposal.

7. It is worth noting that stability is not always and necessarily superior to other allocative properties, such as efficiency. Accommodating the trade-off between stability and efficiency requires a normative decision in light of the respective social and legal context that the school admissions procedure is embedded in, and making this decision is one of the core challenges that market designers and lawmakers alike have to cope with.

thereby allowing DA to regain the lost welfare. More specifically, DA is based on iterated applications of students in the order of preference.

As further explained in Section 2, EADAM systematically "revises" the applications under DA whenever they give rise to a *rejection cycle*. Although a student's priority at a school does not play any role on her own assignment, it can make other students worse off. EADAM solicits *consent* from such students to waive their priority for such a school if a situation of this type arises. A priority waiver only takes effect if the corresponding student consents. Most importantly, incentives for consenting are not in conflict with private welfare: a student consenting to the priority waiver causes no harm to herself, but may help other students as a consequence and can thus increase the efficiency of assignments. In this sense, consenting is akin to deceased organ donation where an individual can benefit others at no own material cost.[8]

A burgeoning theoretical literature has highlighted a number of attractive properties of EADAM. One strand of literature shows that when the objective is efficiency, EADAM is the central mechanism to achieve several natural axioms of fairness such as *legality* (Ehlers and Morrill 2020), *essential stability* (Troyan, Delacrétaz, and Kloosterman 2020), *weak stability* (Tang and Zhang 2021),[9] *α-equity* (Alcalde and Romero-Medina 2017), *sticky stability* (Afacan, Aliogullari, and Barlo 2017), and *priority neutrality* (Reny 2021). Tang and Yu (2014) propose an efficient and simpler version of EADAM.[10] EADAM is the unique minimally stable among efficient mechanisms in both an ordinal sense (Kwon and Shorrer 2020; Tang and Zhang 2021) and a cardinal sense (Dogan and Ehlers 2021). The mechanism has also been advocated as a useful tool for restoring welfare losses under weak priorities (Kesten 2010), finding a strictly strong Nash equilibrium outcome of DA and the optimal von Neumann and Morgenstern stable matching in a one-to-one matching market (Bando 2014), affirmative action in school choice (Dogan 2016), organ allocation, i.e., settings with both social and private endowments (Kwon and Shorrer 2020), and under substitutable choice functions (Ehlers and Morrill 2020).

EADAM, however, is not strategy-proof. This entails that the desirable features of EADAM cannot be guaranteed unless students are truthful. On the one hand, recent studies show that strategy-proofness is not always an effective enabler of truth-telling. Experimental evidence documents a widespread prevalence of preference misrepresentation even when truth-telling is a weakly dominant strategy (see, Hakimov and Kübler 2020; Featherstone, Mayefsky, and Sullivan 2021).[11] Even under mechanisms based on DA, incentives to report preferences truth-

8. EADAM can be characterized as a specific type of *nested public goods game*. As in a public goods game, the more students consent, the better for them collectively. However, unlike in a standard public goods game, there is no conflict between private and social interest.

9. Tang and Zhang (2021) also show that EADAM is *self-constrained optimal* at each problem in the sense that its outcome Pareto dominates any other assignment that is more stable.

10. From a computational perspective, Faenza and Zhang (2020) introduce a fast algorithm and show that EADAM can be run with similar time complexity as Gale and Shapley's deferred acceptance algorithm.

11. An alternative direction to pursue to increase truth-telling rates is to consider *obviously strategy-proof* mecha-

fully do not seem to effectively mitigate attempts to game the system, neither among medical students applying under the National Resident Matching Program (Rees-Jones 2018; Rees-Jones and Skowronek 2018) nor among students applying to graduate programs in psychology in Israel (Hassidim, Romm, and Shorrer 2021). On the other hand, a series of papers argue that EADAM has nonetheless good incentive properties: it is *not obviously manipulable* under complete information (Troyan and Morrill 2020) and harder to manipulate than well-known mechanisms (Decerf and Van der Linden 2018). Moreover, truth-telling is a weakly dominant strategy under low information (Ehlers and Morrill 2020). Similar in this vein, Reny (2021) shows that truth-telling is an ordinal equilibrium and offers participants explicit advice to be truthful under EADAM. When incentives to consent are built into the mechanism design problem, within a large class of *consent-proof* mechanisms (i.e., a consenting student is never hurt by her decision), EADAM is the unique constrained efficient mechanism that is consent-proof (Dur, Gitmez, and Yılmaz 2019). Finally, EADAM is *regret-free truth-telling* (Chen and Möller 2021), a weaker incentive property than strategy-proofness introduced by Fernandez (2020).

Where market design has been influential in practice such as school choice and auction design, the theory has been often complemented by experiments that have tested and fine-tuned the final design. As Chen and Ledyard (2010) put it, "the lab serves as a *wind-tunnel* for mechanisms". Therefore, how market participants actually respond under EADAM remains an important behavioral question before this procedure can be applied in practice. In 2019, the Flemish Ministry of Education undertook the first attempt to implement this algorithm in the school choice system in Flanders, the most populated region of Belgium.[12] According to statutory law:

> *[...] b) a student who is favorably ranked at several schools or locations is assigned to the most preferred school or location and is removed from the less preferred schools or locations; c) after the final assignment, there can be no students who have been assigned to each other's higher choice; d) after the final ranking of the unsuccessful students, there can be no students with a higher [priority] at each other's higher choice school or location.*

This provision was conjointly adopted with other rules mandating the protection of underrepresented groups, that is, typically students from vulnerable populations or socially disenfranchised families.[13] The Flemish Ministry of Education undertook several efforts to implement EADAM. Unfortunately, the legal framework turns out be inconsistent and contains

nisms that facilitate optimal choices for non-sophisticated individuals (Li 2017). However, since obvious strategy-proofness is more demanding than strategy-proofness, such a pursuit only adds new challenges to the existing incentive-efficiency-fairness trade-off: there is no obviously strategy-proof mechanism achieving stable outcomes (Ashlagi and Gonczarowski 2018).

12. Art. 253/16 of the Decree of 17 May 2019 (2019041360) amending the primary education decree of 25 February 1997, the Codex Secondary Education of 17 December 2010 and the Codification of certain provisions for education of 28 October 2016 regarding the right of enrollment.

13. See Art. 253/15 of the decree.

loopholes preventing reliable efficiency-adjustments.[14] EADAM being currently on hold, the Flemish government expects a legal reform to pursue its initial objectives.

In this article, we provide the first experimental evidence on the performance of EADAM. First, we explore how EADAM affects efficiency, stability and truth-telling rates relative to DA. Second, we use insights from behavioral economics to understand whether consent rates under EADAM, and thus efficiency, can be increased by means of a gentle nudge. Building on evidence revealing a tendency to stick with the status quo (*status quo bias*), we manipulate the default rules used to legitimize the priority waiver and compare the original variant of EADAM where students can consent to a priority waiver (*opt-in default rule*) with a variant of EADAM where consent is the default and students can object to a priority waiver (*opt-out default rule*). Regardless of how a priority waiver takes effect, students always know that their decision – consenting or not objecting – will have no effect on their assignment but may help other students. Third, we explore the effect of a variant of EADAM where the priority waiver is enforced.

Our results are intended to contribute to both the matching and the behavioral literature. Corroborating our theoretical predictions, we first find that assignments are significantly more efficient under all variants of EADAM than under DA. Second, we observe a relatively high prevalence of preference misrepresentation under DA, which is in line with existing evidence. However, and this is a startling finding, we observe that students are significantly more likely to submit truthful preference lists under EADAM than under DA. This suggest that a mechanism that is not obviously manipulable such as EADAM may generate even higher truth-telling rates than a mechanism that is (not obviously) strategy-proof. Strategy-proofness may therefore be far less important a design prerequisite for the optimal matching to emerge in school choice than the matching literature often suggests.[15] This has important implications for the protection of vulnerable populations that are most likely to be harmed when failing to strategize or strategize well, as our findings indicate that it may be possible to relax the strategy-proofness standard at no expense to unsophisticated families.

Third, when comparing the variants of EADAM, we find that enforcing priority waivers generates an increase in efficiency and a decrease in truth-telling rates. We see this as evidence of a behavioral effect that points at a hitherto rarely considered trade-off between efficiency and vulnerability to preference manipulation. Fourth, we observe that more than half of the students consent to waive priorities, both under EADAM with an option to consent (opt-in default rule) and under EADAM with consent by default (opt-out default rule). This is con-

14. For instance, some provisions allow seats in waiting list to be traded without any safeguard in place to guarantee Pareto-improvements.

15. Budish and Cantillon (2012) raise a similar point in the context of course allocation. They use theory and field data to study the draft mechanism for allocating courses at Harvard Business School. They find that although the draft is manipulable in theory, it leads to higher welfare than under its widely studied strategy-proof alternative. Unlike under EADAM, however, the draft is highly manipulable and these manipulations cause significant welfare losses.

sistent with evidence on *costless altruism* (Güth 2010; Güth, Levati, and Ploner 2012; Ferguson et al. 2019; Fan, Li, and Zhou 2020; Engel and Van Lange 2021), i.e. individual behavior that benefits others at no own material cost. However, setting consent as the default option does not increase consent rates, although our data suggest that the effect of the default rule may increase over time. At least in our matching market, we see little evidence of the power of defaults – a centerpiece in behavioral economics.

Finally, our article provides novel evidence on the possibility and limits of implementing complex algorithms. EADAM is far more complex than most mechanisms usually probed in lab experiments. Understanding how far the complexity of a mechanism can be pushed without sacrificing implementability, tractability and its fairness virtues, is key not just with a view to successful market design but also to ensure compliance with the legal rules guiding the admissions procedure. More generally, our results provide important evidence for policymakers and school authorities keen on implementing a school admissions procedure that effectively mitigates the trade-off between stability and efficiency. Moreover, since EADAM adds efficiency to DA with little disruption to its compelling stability and incentive properties, transitioning to EADAM in places that currently use DA can be viewed as a rather smooth and low-cost welfare-enhancing improvement.

The remainder of this article proceeds as follows. Section 2 illustrates EADAM through an example. Section 3 presents the experimental design and the hypotheses. Section 4 presents the results of the experiment. Section 5 concludes.

2 EADAM: A simple example

Let $I \equiv \{i_1, ..., i_n\}$ denote a finite set of students and $S \equiv \{s_1, ..., s_m\}$ denote a finite set of schools. Each student i has strict preferences over schools, denoted by P_i, and each school has strict priorities over students, denoted by $\succ_s$. We assume that each school has a finite number of available seats, q_s, where the number of students n does not exceed the number of available seats, $n \leq \sum_{s \in S} q_s$. A school choice problem is a pair $((\succ_s)_{s \in S}, (P_i)_{i \in I})$ consisting of a collection of priority orders and a preference profile.

A school choice mechanism φ is a systematic procedure designed to solve a school choice problem by producing a matching μ of students and schools.

With respect to the matching outcome, there are two core properties a mechanism can be designed to satisfy: stability and Pareto-efficiency. A matching μ that assigns a student j at a school s is stable if there is no student i who prefers school s over the school she is currently assigned to and if student i does not have higher priority than student j at school s. A matching μ is Pareto-efficient if there is no alternative matching that can improve at least one student's assignment without making any other student worse off.

With respect to the mechanism, the core property is strategy-proofness. A mechanism φ is strategy-proof if it is a dominant strategy for each student to report her preferences truthfully, that is, if no student can ever benefit from misreporting her preferences for schools.

To illustrate EADAM and the welfare gains it entails, we present a simple example provided by Kesten (2010).[16]

Let $I \equiv \{i_1, i_2, i_3\}$ and $S \equiv \{s_1, s_2, s_3\}$, where each school has a capacity of only one seat. The priorities for the schools and the preferences of the students are given as follows:

$\succ_{s_1}$	$\succ_{s_2}$	$\succ_{s_3}$
i_3	i_1	$\vdots$
i_1	i_2	
i_2	i_3	

P_{i_1}	P_{i_2}	P_{i_3}
s_1	s_1	s_2
s_2	s_2	s_1
s_3	s_3	s_3

The EADAM algorithm proceeds as follows:

Round 0: Run the DA algorithm. The steps are illustrated below. Students tentatively admitted at a school are inserted in a box.

Step	s_1	s_2	s_3
1	$\boxed{i_1}, i_2$	$\boxed{i_3}$	
2	$\boxed{i_1}$	$i_3, \boxed{i_2}$	
3	$i_1, \boxed{i_3}$	$\boxed{i_2}$	
4	$\boxed{i_3}$	$i_2, \boxed{i_1}$	
5	$\boxed{i_3}$	$\boxed{i_1}$	$\boxed{i_2}$

The matching produced by DA in Step 5 is stable but Pareto-inefficient. The efficiency losses are caused by students whom we refer to as *interrupters*. Formally, if a student i is temporarily accepted at a school s in Step t and rejected in a later Step $t^{'}$, and if at least one other student j is rejected at that school in a Step l such that $t \leq l \leq t^{'}$, student i is an *interrupter* at school s and the pair (i, s) is an *interrupting pair* of Step $t^{'}$. An interruption implies that an application at a school in Step t does not benefit the student but initiates a rejection chain that hurts other students. The interrupter causes an inefficient assignment at no gain to herself. In our example there are two interrupting pairs: (i_1, s_1) (student i_2 was rejected while student i_1 was tentatively placed at school s_1) and (i_2, s_2) (student i_3 was rejected while student i_2 was tentatively placed at school s_1). The efficiency losses caused by these interruptions can be recovered by proceeding according to the following rules:

Round 1: Find the last step of the DA algorithm run in Round 0 in which a consenting interrupter is rejected from the school for which she is an interrupter. Identify all interrupting pairs of that step, each of which contains a consenting interrupter. If there are no interrupting pairs, then stop. For each identified interrupting pair (i, s), remove school s from the preference list

16. Appendix 2 presents and explains the example we used in the experiment.

of student i without changing the relative order of the remaining schools. The preference lists of the other students remain unchanged. Rerun DA with the updated preference lists.

Round k: Find the last step of the DA algorithm run in Round $k-1$ in which a consenting interrupter is rejected from the school for which she is an interrupter. Identify all interrupting pairs of that step, each of which contains a consenting interrupter. If there are no interrupting pairs, then stop. For each identified interrupting pair (i, s), remove school s from the preference list of student i without changing the relative order of the remaining schools. The preference lists of the other students remain unchanged. Rerun DA with the updated preference lists.

End: The algorithm ends when there are no more interrupting pairs. Admissions now become final.

We first identify the last interruption and remove school s_2 from the preferences of student i_2. Then we rerun DA and obtain a Pareto-efficient matching. Every student is assigned to their top choice.

Step	s_1	s_2	s_3
1	$\boxed{i_1}, i_2$	$\boxed{i_3}$	
2	$\boxed{i_1}$	$\boxed{i_3}$	$\boxed{i_2}$

3 Experimental design

In this section, we present our experimental design and our hypotheses.

3.1 Setup

The experiment is designed to assess the performance of EADAM relative to DA and two variants of EADAM. In the EADAM treatment, participants are asked whether they consent to waive their priorities. Interrupting pairs are only eliminated if interrupting students *consent* (active choice). In the first variant of the EADAM treatment, consent becomes the default option and participants are asked whether they object to waive their priorities. Interrupting pairs are eliminated if interrupting students *do not object* (passive choice). In the second variant of the EADAM treatment, participants are not asked to make any choice. Interrupting pairs are automatically eliminated without students being able to influence the removal of schools at which they turn out to be interrupters.

Our matching market is designed so as to obtain a sufficient number of interruptions without making the school choice problem cognitively intractable for participants. There are five schools, s_1, s_2, s_3, s_4, s_5, where each school has only one seat, and five student types, i_1, i_2, i_3, i_4, i_5.

Points	P_{i_1}	P_{i_2}	P_{i_3}	P_{i_4}	P_{i_5}
25	s_1	s_2	s_4	s_3	s_3
18	s_3	s_4	s_1	s_1	s_2
12	s_4	s_1	s_2	s_2	s_1
7	s_2	s_5	s_3	s_5	s_4
3	s_5	s_3	s_5	s_4	s_5

	$\succ_{s_1}$	$\succ_{s_2}$	$\succ_{s_3}$	$\succ_{s_4}$	$\succ_{s_5}$
1^{st}	i_2	i_4	i_3	i_4	i_1
2^{nd}	i_4	i_1	i_2	i_5	i_3
3^{rd}	i_1	i_2	i_4	i_3	i_2
4^{th}	i_5	i_3	i_5	i_2	i_5
5^{th}	i_3	i_5	i_1	i_1	i_4

The payoffs for students and the priorities of schools are presented below. Payoffs range from 25 points to 3 points, the conversion rate being 1 point = €0.25. Preferences and priorities are exogenous and heterogeneous by design: each student has different preferences for schools, and each school has different priorities over students.

Students have complete information and therefore know the payoff table, the priority table, the availability of seats, and the exact modus operandi of the respective mechanism before submitting their preference lists.

To facilitate learning and test for convergence to predicted behavior, the experiment runs over 20 periods. Each subject is assigned a student type before the first period and keeps that student type throughout the experiment. Moreover, each subject is assigned to a matching group composed of ten subjects before the first period. At the beginning of each period, each subject is randomly assigned to a different group of five students randomly drawn from the matching group. This design feature is crucial to mitigate the dependence problem resulting from the repeated interaction of students. Given that 500 subjects participated in our experiment, we are able to generate 50 matching groups.

Students submit a complete preference list for schools. Neither can students include the same school more than once nor are they allowed to truncate their preference list, as this would create further incentives to misrepresent their preferences (Calsamiglia, Haeringer, and Klijn 2010). Our four treatments are described below.

DA: Students submit their preference lists under the student-proposing version of DA. This treatment serves as our baseline.

EADAM Consent: Students submit their preference lists under EADAM. In each period, all students are offered the option to consent to waive their priorities before submitting their preference lists. If they consent, all schools at which they turn out to be interrupters are removed from their preference lists. Otherwise, no school is removed. Efficiency-adjustments are therefore only possible if interrupting students make the active choice to consent.

EADAM Object: Students submit their preference lists under a variant of EADAM. In each period, all students are offered the option to object to waive their priorities before submitting their preference lists. If they do not object, all schools at which they turn out to be interrupters are removed from their preference lists. Otherwise, no school is removed. Efficiency-adjustments are therefore only possible if interrupting students remain passive and decide not to object.

EADAM Enforced: Students submit their preference lists under a variant of EADAM. All schools at which they turn out to be interrupters are automatically removed from their preference lists. Students have no option to prevent the removal.

Given that there is no way of telling who is an interrupter and who is not prior to the admissions procedure, any decisions about whether to consent or object to a priority waiver should be made a priori. This implies that students have to decide whether to consent or object when submitting their preference lists in each period, without knowing whether their application will actually entail an interruption. Each student is told that consenting, not objecting or enforced removals of schools at which they turn out to be interrupters will never affect their assignment but may improve the assignment of other students.

Procedure The experiment was programmed using the experimental software *o-Tree* (Chen, Schonger, and Wickens 2016) and conducted online in September and October 2020. Subjects were recruited via ORSEE (Greiner 2015) from the common subject pool of the University of Bonn and the Max Planck Institute for Research on Collective Goods. We ran 9 independent sessions in total, with each session being embedded in a Zoom webinar that allowed subjects to privately ask questions to the experimenter, but kept complete anonymity among participants. Each session lasted approximately 75 minutes, with most groups finishing the experiment after 50 to 60 minutes. In order to begin with the actual experiment, subjects had to provide correct answers to a set of control questions. The experiment ended with a demographics questionnaire to control for gender, age, and subject studied. At the end of the experiment, subjects received the sum of their earnings, including a participation fee of €4. Subjects earned €11.49 on average.

3.2 Hypotheses

As discussed in Section 1 and Section 2, if at least one interrupting student consents to waive her priorities, EADAM will produce an assignment that is pareto-superior to the DA matching (Hypothesis 1). The efficiency gain increases with the number of consenting students. Due to status quo bias, we expect consent rates to be higher under EADAM Object than under EADAM Consent (Hypothesis 4). Against this background and given that priority waivers are enforced under EADAM Enforced, we expect efficiency to be higher under EADAM Enforced than under EADAM Object, and under EADAM Object than under EADAM Consent (Hypothesis 2). EADAM is expected to maintain the stability properties of DA (Hypothesis 3). Finally, because EADAM is not strategy-proof, truth-telling is expected to be higher under DA than under EADAM (Hypothesis 5).

Hypothesis 1 (Efficiency DA-EADAM)**.** *Assignments are more efficient under EADAM than under DA.*

Hypothesis 2 (Efficiency under EADAM)**.** *Assignments are more efficient under EADAM Enforced than under EADAM Object, and more efficient under EADAM Object than under EADAM Consent.*

Hypothesis 3 (Stability)**.** *The proportion of stable assignments is not significantly different under EADAM than under DA.*[17]

Hypothesis 4 (Consent)**.** *Students are more likely to consent to a waiver under EADAM Object than under EADAM Consent.*

Hypothesis 5 (Truth-telling DA-EADAM)**.** *Students are more likely to reveal their preferences truthfully under DA than under EADAM.*

4 Results

In this section, we present the results of the experiment. We begin with the effects of the mechanisms on efficiency, examining the effect of EADAM on efficiency relative to DA and observing how efficiency varies across the three variants of EADAM (4.1). We then turn to our results on stability (4.2) and truth-telling rates (4.3). Finally, we present a comparison of consent rates between EADAM Consent and EADAM Object (4.4).

4.1 Efficiency

We first compare the effect of DA and EADAM on efficiency for a binary efficiency measure coded as a dummy variable that takes value 1 if assignments are Pareto-efficient, and 0 otherwise. Using this measure, we observe high efficiency levels under EADAM Enforced (80.42%), EADAM Object (54.79%), and EADAM Consent (43.93%) but a very low proportion of efficient assignments under DA (6.04%, Figure 1). When pooling observations of all EADAM variants, we find that the fraction of efficient assignments is significantly higher under all variants of EADAM (58.88%) than under DA (6.04%, chi-square, $p < 0.001$).

In addition to non-parametric tests, we also estimate multilevel logistic regression models and multilevel linear regression models. In the former, the dependent variable is binary and takes value 1 if assignments are Pareto-efficient, and 0 otherwise. In the latter, the dependent variable is continuous and given by the number of points earned by students. Our parameter estimates are based on the following basic specification of a three-level model:

$$Y_{igt} = \beta_0 + \beta_1 EADAM_{Consent} + \beta_2 EADAM_{Object} + \beta_3 EADAM_{Enforced} + v_i + u_{ig} + \epsilon_{igt}, \quad (1)$$

17. As further explained in Section 4.2, our definition of stability under EADAM is subject to students waiving their priorities.

where β_0 denotes the constant, and *EADAM Consent*, *EADAM Object* and *EADAM Enforced* are treatment dummies taking value 1 if i participated in the treatment, and 0 otherwise. The indicator i denotes the second level of clustering that accounts for 20 observations of each subject i over time, with v_i denoting the subject-specific random effect. The indicator g denotes the third and highest level of clustering that accounts for each subject nested in a matching group, with u_{ig} capturing the group-specific random effect. ϵ_{igt} is the error term. To test the robustness of treatment effects, we include a categorical variable for student type (*Type*), a continuous variable for round (*Round*), and a dummy variable for truth-telling (*Truth-telling*) as controls in our additional specifications. Moreover, we use Wald tests to assess differences across treatments and expect to reject the null when comparing the coefficients of our treatment dummies.

Estimating a three-level mixed-effects logistic regression model for our binary efficiency measure, we observe that all variants of EADAM yield a significant increase in the rate of efficient assignments relative to DA (Table 1). The marginal efficiency increase is approximately twice as high under EADAM Enforced than under EADAM Consent. Overall, the effect of EADAM is robust to the inclusion of type, round and truth-telling as controls. These results lend clear support to Hypothesis 1.

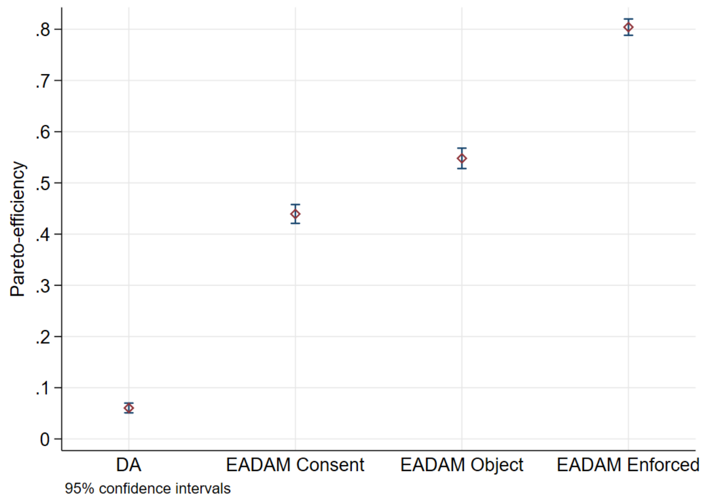

Figure 1: Pareto-efficiency

To obtain a more granular resolution of the effects on efficiency, we next estimate the effect of EADAM relative to DA for our continuous efficiency measure. These results corroborate the results obtained for our binary efficiency measure and show that all variants of EADAM yield significantly higher efficiency levels than DA (Table 2).

Result 1: Assignments are more efficient under all variants of EADAM than under DA.

Turning to a comparison of efficiency levels between all variants of EADAM, we observe that both EADAM Enforced and EADAM Object yield higher efficiency than EADAM Consent

Table 1: Impact of EADAM on efficiency compared to DA (binary measure)

DV: Efficiency Baseline: DA	(1)	(2)	(3)	(4)
EADAM Consent	0.374***	0.374***	0.374***	0.366***
	(0.044)	(0.044)	(0.044)	(0.044)
EADAM Object	0.487***	0.487***	0.487***	0.481***
	(0.048)	(0.048)	(0.048)	(0.048)
EADAM Enforced	0.739***	0.739***	0.739***	0.737***
	(0.034)	(0.034)	(0.034)	(0.034)
Type		Yes	Yes	Yes
Round			Yes	Yes
Truth-telling				0.041***
				(0.010)
Wald test	41.86***	41.86***	41.88***	43.58***
N_I	10.000	10.000	10.000	10.000
N_G	50	50	50	50

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Three-level mixed-effects logit regression. Standard errors in parentheses. All coefficients are reported as average marginal effects. *Efficiency* is a dummy variable that takes value 1 if assignments are Pareto-efficient and 0 otherwise. N_I denotes the number of individual observations. N_G denotes the number of experimental matching groups.

Table 2: Impact of EADAM on efficiency compared to DA (continuous measure)

DV: Efficiency Baseline: DA	(1)	(2)	(3)	(4)
EADAM Consent	4.459***	4.459***	4.459***	3.929***
	(0.791)	(0.449)	(0.449)	(0.439)
EADAM Object	5.174***	5.174***	5.174***	4.697***
	(0.821)	(0.465)	(0.465)	(0.455)
EADAM Enforced	7.222***	7.222***	7.222***	6.863***
	(0.821)	(0.465)	(0.465)	(0.454)
Type		Yes	Yes	Yes
Round			Yes	Yes
Truth-telling				1.961***
				(0.161)
Wald test	12.84***	39.92***	39.92***	47.41***
N_I	10.000	10.000	10.000	10.000
N_G	50	50	50	50

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Three-level mixed-effects linear regression. Standard errors in parentheses. *Efficiency* is a continuous variable that captures the number of points earned by students. N_I denotes the number of individual observations. N_G denotes the number of experimental matching groups.

(chi-square, $p = 0.003$). These results are in line with the results obtained from a three-level mixed-effects logistic regression model (Table 3) when estimating the effect of EADAM Object relative to EADAM Consent (Column 1) and of EADAM Enforced relative to EADAM Object (Column 2) using our binary efficiency measure. On the one hand, we observe that shifting the default from opt-in under EADAM Consent to opt-out under EADAM Object yields a marginally significant efficiency increase. On the other hand, we find that enforcing priority waivers leads to significantly higher efficiency levels than nudging students with an opt-out default. These results support Hypothesis .

Table 3: Efficiency comparison between EADAM variants (binary measure)

DV: Efficiency	Object vs. Consent			Enforced vs. Object		
Baseline:	EADAM Consent (1)			EADAM Object (2)		
EADAM Object	0.113*	0.113*	0.113*			
	(0.063)	(0.063)	(0.063)			
EADAM Enforced				0.252***	0.252***	0.252***
				(0.056)	(0.056)	(0.056)
Type		Yes	Yes		Yes	Yes
Round			Yes			Yes
N_I	10.000	10.000	10.000	10.000	10.000	10.000
N_G	50	50	50	50	50	50

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Three-level mixed-effects logit regression. Standard errors in parentheses. *Efficiency* is a dummy variable that takes value 1 if assignments are Pareto-efficient and 0 otherwise. N_I denotes the number of individual observations. N_G denotes the number of experimental matching groups. Column 1: All coefficients are reported as average marginal effects at DA and EADAM Enforced = 0. Column 2: All coefficients are reported as average marginal effects at DA and EADAM Consent = 0.

To obtain a more granular estimate of efficiency, we again use our continuous efficiency measure to compare the effect of EADAM Object relative to EADAM Consent (Table 4, Column 1) and of EADAM Enforced relative to EADAM Object (Table 4, Column 2). Overall, the results we obtain from the continuous measure are in line with the results for our binary efficiency measure although the difference between EADAM Consent and EADAM Object now turns out insignificant. In sum, we find a robust efficiency-enhancing effect of EADAM Enforced compared to the other variants of EADAM.

Result 2: Assignments are more efficient under EADAM Enforced than under EADAM Consent and EADAM Object.

Table 4: Efficiency comparison between EADAM variants (continuous measure)

DV: Efficiency	Object vs. Consent			Enforced vs. Object		
Baseline:	EADAM Consent			EADAM Object		
	(1)			(2)		
EADAM Object	0.714	0.714	0.714			
	(0.791)	(0.449)	(0.449)			
EADAM Enforced				2.048**	2.048***	2.048***
				(0.821)	(0.465)	(0.465)
Type		Yes	Yes		Yes	Yes
Round			Yes			Yes
N_I	10.000	10.000	10.000	10.000	10.000	10.000
N_G	50	50	50	50	50	50

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Three-level mixed-effects linear regression. Standard errors in parentheses. *Efficiency* is a continuous variable that captures the number of points earned by students. N_I denotes the number of individual observations. N_G denotes the number of experimental matching groups.

A further analysis of efficiency – as measured by points earned – corroborates these results. The proportion of students being assigned at their first choice school is higher under EADAM Consent and EADAM Object relative to DA, and highest under EADAM Enforced (Figure 2). This coincides with a shift in the welfare distribution. While efficiency is rather normally distributed under DA (σ^2 = 45.38), it takes a slightly bimodal shape with a much higher variance under EADAM Enforced (σ^2= 82.44).[18] This shift in the distribution notwithstanding, EADAM reduces welfare inequality as measured by the Gini coefficient.[19] We find that the Gini coefficient is highest under DA (0.33) and lowest under EADAM Enforced (0.26).[20] Overall, this suggests that, EADAM not only increases efficiency but also reduces welfare inequality.

4.2 Stability

EADAM is designed to increase efficiency while maintaining the stability properties of the DA matching. To compare effects on stability, we code a stability variable that takes value 1 if the DA stable assignment or one of the three efficiency-adjusted stable assignments (see Appendix B) is achieved, and 0 otherwise. Theoretically, there should be no differences in the proportion

18. Variance is sightly lower under EADAM Object (σ^2= 80.81) and EADAM Consent (σ^2= 79.85).

19. A Gini coefficient of 0 denotes that everyone receives the same income (perfect equality), whereas a coefficient of 1 expresses that a single individual receives all the income (perfect inequality).

20. The Gini coefficient under EADAM Consent (0.33) is the same as under DA, and only slightly lower under EADAM Object (0.31)

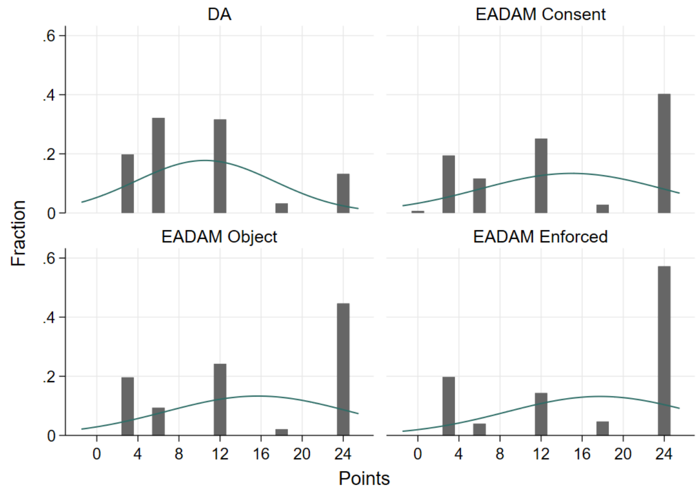

Figure 2: Distribution of points

of stable assignments between DA and all variants of EADAM. As illustrated by Figure 3, stability rates are highest under EADAM Object (81.46%) and lowest under EADAM Enforced (67.92%). Intermediate stability rates can be observed under EADAM Consent (77.14%) and DA (73.54%). When pooling observations of all EADAM variants, we observe that the fraction of stable assignments is higher under all variants of EADAM combined (75.59%) than under DA (73.54%, chi-square, $p = 0.043$).

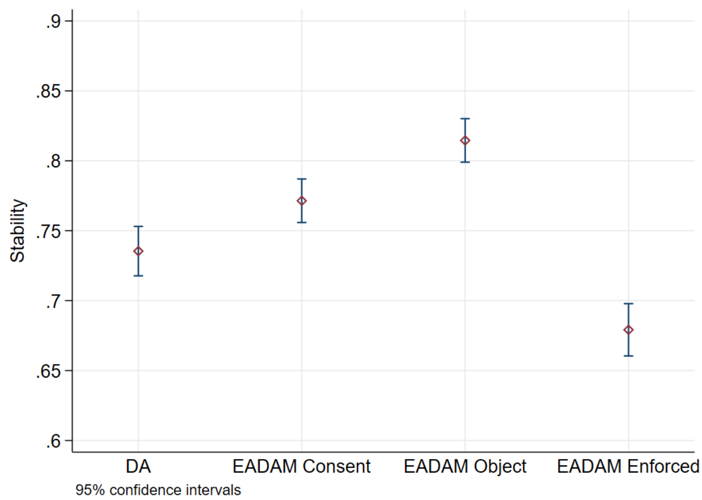

Figure 3: Stability

The results of a three-level mixed-effects logistic regression model show that this difference is mainly driven by EADAM Object (Table 5). EADAM Object produces a marginally significant increase of stable assignments compared to DA. However, this difference is no longer significant when including truth-telling as a control variable. We conclude that, in line with Hypothesis 3, stability rates are not significantly different under EADAM and DA.

Table 5: Impact of EADAM on stability compared to DA

DV: Stability Baseline: DA	(1)	(2)	(3)	(4)
EADAM Consent	0.045	0.045	0.044	0.013
	(0.044)	(0.044)	(0.044)	(0.042)
EADAM Object	0.076*	0.076*	0.076*	0.049
	(0.044)	(0.044)	(0.044)	(0.042)
EADAM Enforced	-0.045	-0.045	-0.045	-0.067
	(0.050)	(0.050)	(0.050)	(0.048)
Type		Yes	Yes	Yes
Round			Yes	Yes
Truth-telling				0.114***
				(0.011)
Wald test	7.38**	7.38**	7.39**	6.91**
N_I	10.000	10.000	10.000	10.000
N_G	50	50	50	50

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Three-level mixed-effects logit regression. Standard errors in parentheses. All coefficients are reported as average marginal effects. *Stability* is a dummy variable that takes value 1 if assignments are stable and 0 otherwise. N_I denotes the number of individual observations. N_G denotes the number of experimental matching groups.

Result 3: The proportions of stable assignments under DA and under EADAM are not significantly different.

When analyzing the difference between all variants of EADAM, we find that EADAM Enforced induces a significantly lower proportion of stable assignments than both other variants of EADAM (Table 6). This difference is slightly larger for the comparison between EADAM Enforced and EADAM Object than for the comparison between EADAM Enforced and EADAM Consent (Figure 3).

Table 6: Stability comparison between EADAM variants

	Object vs. Consent				Enforced vs. Object			
DV: Stability								
Baseline:	EADAM Consent				EADAM Object			
	(1)				(2)			
EADAM Object	0.032	0.032	0.032	0.036				
	(0.040)	(0.040)	(0.040)	(0.039)				
EADAM Enforced					-0.121***	-0.121***	-0.121***	-0.116**
					(0.046)	(0.046)	(0.046)	(0.045)
Type		Yes	Yes	Yes		Yes	Yes	Yes
Round			Yes	Yes			Yes	Yes
Truth-telling				0.108***				0.107***
				(0.012)				(0.012)
N_I	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000
N_G	50	50	50	50	50	50	50	50

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Three-level mixed-effects logit regression. Standard errors in parentheses. *Stability* is a dummy variable that takes value 1 if assignments are stable and 0 otherwise. N_I denotes the number of individual observations. N_G denotes the number of experimental matching groups. Column 1: All coefficients are reported as average marginal effects at DA and EADAM Enforced = 0. Column 2: All coefficients are reported as average marginal effects at DA and EADAM Consent = 0.

Result 4: Assignments are less stable under EADAM Enforced than under EADAM Consent and EADAM Object.

This result suggests that EADAM Enforced reintroduces the very trade-off between stability and efficiency it is designed to mitigate in the first place. This can be explained as the result of a behavioral backfiring effect, i.e. the fact that EADAM Enforced curtails students' right to choose and induces them to manipulate their preferences more often than under the other variants of EADAM, as further discussed in the subsection below.

4.3 Truth-telling

We begin with a comparison of truth-telling rates under DA and EADAM. While theory predicts higher truth-telling rates under DA (Hypothesis 5), we observe the opposite effect: truth-telling rates are significantly higher under all variants of EADAM (67.03%) than under DA (43.88%, chi-square, $p < 0.001$). These results are in line with the results of a multilevel mixed-effects logistic regression models estimating the effect of EADAM on truth-telling relative to DA (Table 7).

Table 7: Impact of EADAM on truth-telling compared to DA

DV: Truth-telling Baseline: DA	(1)	(2)	(3)
EADAM Consent	0.253***	0.246***	0.246***
	(0.039)	(0.033)	(0.033)
EADAM Object	0.246***	0.235***	0.235***
	(0.040)	(0.034)	(0.034)
EADAM Enforced	0.183***	0.177***	0.177***
	(0.041)	(0.035)	(0.035)
Type		Yes	Yes
Round			Yes
Wald test	5.19*	5.45*	5.46*
N_I	10.000	10.000	10.000
N_G	50	50	50

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$
Three-level mixed-effects logit regression. Standard errors in parentheses. All coefficients are reported as average marginal effects. *Truth-telling* is a dummy variable that takes value 1 if students report their preferences truthfully and 0 otherwise. N_I denotes the number of individual observations. N_G denotes the number of experimental matching groups.

Result 5: Truth-telling rates are higher under all variants of EADAM than under DA.

This is a remarkable result. Although not being strategy-proof, EADAM delivers higher truth-telling rates than DA, a mechanism often hailed for its strategy-proofness virtues. While previous evidence shows that truth-telling rates strongly vary across strategy-proof mechanisms such as DA and TTC (Hakimov and Kübler 2020), our results suggest that strategy-proofness may offer much less protection against manipulation attempts than theory suggests.

While our design does not enable us to identify the specific behavioral driver of the effect of EADAM on truth-telling, we offer three potential explanations. First, students may have understood that misrepresenting their preferences under a mechanism that is designed to increase their welfare may actually hamper their chances of being admitted at their preferred school. Being aware of the benefits generated by the efficiency-adjustment under EADAM, they may have trusted the algorithm to produce the best outcomes when refraining from manipulation. Second, students may perceive a complex mechanism like EADAM as requiring much more sophisticated manipulation strategies than a simpler mechanism like DA. Unsure about what they should do under a complicated mechanism, they may just default to truthful reporting (Troyan and Morrill 2020). Third, students may be driven by reputation concerns and may have a preference for truth-telling and being seen as honest, especially when the mechanism is hard to game but relies on truth-telling to produce optimal results (Abeler, Nosenzo, and Raymond 2019; Featherstone, Mayefsky, and Sullivan 2021).

A comparison between the variants of EADAM sheds light on a behavioral pattern that is in conflict with theoretical predictions. According to theory, truth-telling rates should not differ between the variants of EADAM. However, we observe the highest truth-telling rates under EADAM Consent (70.93%), slightly lower truth-telling rates under EADAM Object (68.17%), and the lowest truth-telling rates under EADAM Enforced (62.20%, chi-square, $p = 0.004$). A closer comparison of EADAM Object relative to EADAM Consent (Table 8, Column 1) and of EADAM Enforced relative to EADAM Object (Table 8, Column 2) confirms that EADAM Enforced has a negative impact on truth-telling. While we do not find a significant difference in truth-telling rates when comparing EADAM Object and EADAM Consent, we observe a marginally significant reduction in truth-telling rates under EADAM Enforced compared to EADAM Consent and EADAM Object.

Result 6: Truth-telling rates are lower under EADAM Enforced than under EADAM Consent and EADAM Object.

This effect is plausibly driven by one of the following behavioral effects. On the one hand, by eliminating the option to consent to or object to the priority waiver, EADAM Enforced reduces the degrees of freedom that students have when applying to schools. Constraining students' choice set may have triggered the perception that the only way of influencing the outcome is through the preference list. On the other hand, students' ranking behavior may have been driven by reactance, i.e. a state of motivational arousal emerging when people experience a threat to their behavioral freedoms or a limitation to the set of choice options from which they can pick. In sum, these results suggest that less obtrusive matching mechanisms may produce higher truth-telling rates without necessarily having to rely on strategy-proofness.

Finally, we analyze how truth-telling rates vary across periods. As Figure 5 shows, truth-telling rates start high in all treatments (although slightly lower under EADAM Enforced) and

Table 8: Truth-telling comparison between EADAM variants

DV: Truth-telling	Object – Consent			Enforced – Object		
Baseline:	EADAM Consent			EADAM Object		
	(1)			(2)		
EADAM Object	-0.007	-0.011	-0.011			
	(0.031)	(0.030)	(0.030)			
EADAM Enforced				-0.063*	-0.058*	-0.058*
				(0.035)	(0.033)	(0.033)
Type		Yes	Yes		Yes	Yes
Round			Yes			Yes
N_I	10.000	10.000	10.000	10.000	10.000	10.000
N_G	50	50	50	50	50	50

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$
Three-level mixed-effects logit regression. Standard errors in parentheses. *Truth-telling* is a dummy variable that takes value 1 if students report their preferences truthfully and 0 otherwise. N_I denotes the number of individual observations. N_G denotes the number of experimental matching groups. Column 1: All coefficients are reported as average marginal effects at DA and EADAM Enforced = 0. Column 2: All coefficients are reported as average marginal effects at DA and EADAM Consent = 0.

later decrease. Under DA, truth-telling rates drop more after the first few periods, but increase again in the last few periods. One plausible reason is that it may feel natural for participants to start off by ranking schools truthfully, truth-telling being a "behavioral default" of sorts. After a few periods, however, they may want to see what happens if they try something else.[21]

Our results on truth-telling have important implications for the protection of vulnerable families and students that are most likely to be harmed when failing to strategize or strategize well under manipulable mechanisms. While the literature has offered formal support of strategy-proofness as a condition to level the playing field (Pathak and Sönmez 2008), our findings suggest that the strategy-proofness standard can be relaxed at no expense to unsophisticated families. In fact, a mechanism that is not obviously strategy-proof in the sense proposed by Troyan and Morrill (2020) may do just as well or even decrease attempts to game the system.

4.4 Consent

EADAM Object is designed as a behavioral intervention – a nudge – to increase consent rates. Corroborating our behavioral predictions (Hypothesis 4), a non-parametric test reveals that

21. Chen and Kesten (2019) find a slow decline in truth-telling rates over time under DA in a 6-school environment, but a more stable pattern in a 4-school environment.

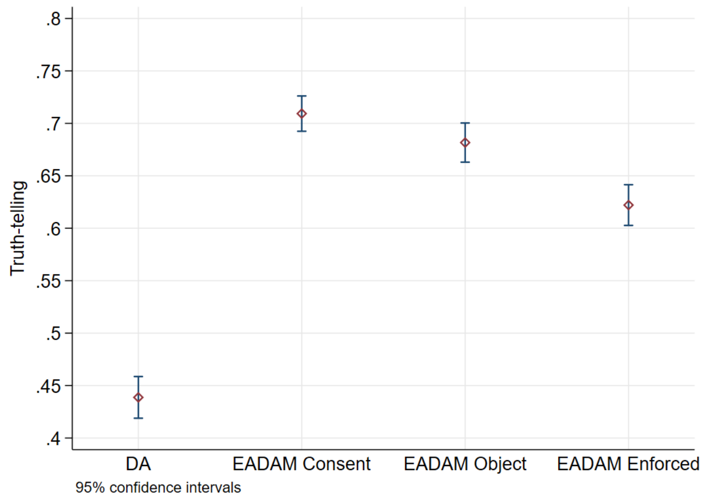

Figure 4: Truth-telling

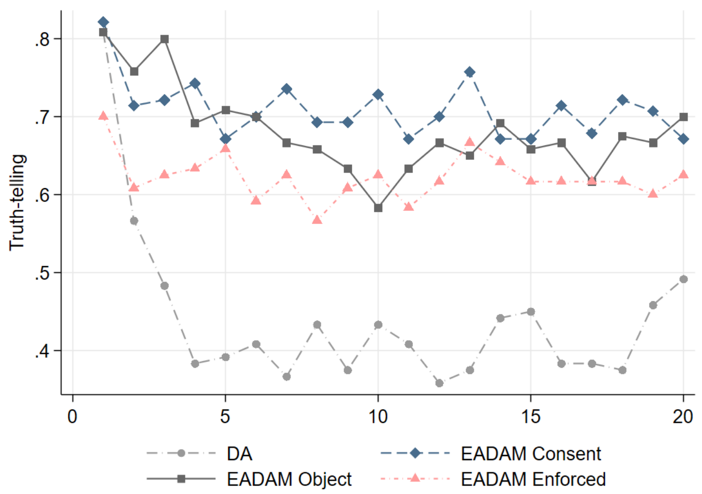

Figure 5: Truth-telling by period

consent rates are significantly higher under EADAM Object (55.29%) than under EADAM Consent (52.00%, chi-square, $p = 0.018$). However, this difference is relatively small (Figure 8, Appendix A). In line with this observation, the estimates of a multilevel mixed-effects logistic regression model show that the difference in consent rates is not robust (Table 9).

Result 7: Consent rates under EADAM Consent and under EADAM Object are not significantly different.

On closer inspection of the dynamics of consent, we observe that under EADAM Consent consent rates start very high but experience a steep drop in the first nine periods (Figure 6). The average difference in consent rates between EADAM Object (53.58%) and EADAM Consent (51.80%) is small. In the last ten periods, consent rates follow a more stable pattern. Despite some variation across periods, consent rates remain consistently higher under EADAM Object

Table 9: Comparison of consent rates between EADAM Consent and EADAM Object

DV: Consent Baseline: EADAM Consent	(1)	(2)	(3)
EADAM Object	0.036	0.035	0.035
	(10.928)	(0.041)	(0.041)
Type		Yes	Yes
Round			Yes
N_I	5.200	5.200	5.200
N_G	26	26	26

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$
Three-level mixed-effects logit regression. Standard errors in parentheses. All coefficients are reported as average marginal effects. *Consent* is a dummy variable that takes value 1 if students consented or did not object and 0 otherwise. N_I denotes the number of individual observations. N_G denotes the number of experimental matching groups.

(57.00%) than under EADAM Consent (52.21%). This suggests that the effect of the default rule might increase over time.

This tendency may be the result of two different behavioral channels. On the one hand, status quo bias may become stronger over time, as students become weary of ranking the same schools over and over again. On the other hand, this pattern may be driven by a learning effect and a concern for efficiency, as students may understand the positive impact of consent on aggregate welfare over time. Despite this tendency, we do not find robust evidence of a default effect on consent rates.

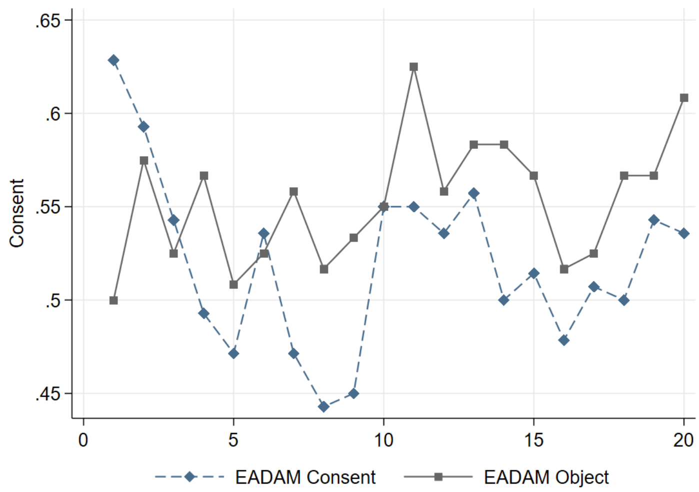

Figure 6: Consent by period

5 Conclusion

One of the core challenges in the study and implementation of matching mechanisms is to accommodate the trade-off between stability and efficiency. In this article, we offer first experimental evidence of the performance of an efficiency-enhancing stable mechanism: the efficiency-adjusted deferred acceptance mechanism (EADAM) introduced by Kesten (2010). The magnitude of the efficiency increases that EADAM generates crucially depends on whether priorities that only entail a tentative admission but do not have an impact on the final placement under DA can be removed from the students' preference lists. We study three variants of EADAM to achieve such a removal: in the first, students can consent to a priority waiver (opt-in default rule); in the second, students can object to a priority waiver (opt-out default rule); in the third, the removal of schools from students' preference lists is enforced.

Maximizing placements at preferred schools and abiding by the admissions criteria at the same time is challenging, but our results highlight that it can be done not just in theory but also in practice. We show that efficiency levels are substantially higher under EADAM than under DA. When enforcing the removal of schools from students' preference lists, the marginal efficiency increase is approximately twice as high compared to the variant of EADAM where students are offered an opt-in default rule.

Achieving one property such as efficiency usually comes at the cost of other properties. Our study highlights the need to reconsider these costs through a more behavioral lens. While enforcement increases efficiency, it also comes at a cost: when students cannot dodge the waiver, the likelihood of preference manipulation is significantly higher than under the variants of EADAM where the removal is optional. This points to a hitherto rarely considered trade-off between efficiency and vulnerability to preference manipulation. Guaranteeing sufficient degrees of freedom may come at a small cost for efficiency but may well serve students' autonomy and help level the playing field.

Our results also contribute to a refined understanding of some of the core behavioral assumptions in behavioral economics and market design. While behavioral theory predicts higher consent rates under the opt-out default rule than under the opt-in default rule, we observe no difference in our data. More importantly, however, we show that increasing the efficiency of stable assignments is feasible, but doing so without a strategy-proof mechanism does not seem to harm. Quite surprisingly, we find that students are even much more truthful under EADAM than under DA. For the purposes of practical market design, implementing a mechanism that is not obviously manipulable may thus be more important than aiming for strategy-proofness. This insight is of particular importance to vulnerable populations, because it suggests that loopholes opening opportunities to game the system need not always penalize socially disenfranchised families who are unsophisticated about the procedure or have fewer access to strategic advice than affluent households.

References

Abdulkadiroğlu, Atila, Parag A. Pathak, and Alvin E. Roth. 2005. "The Boston Public School Match." *American Economic Review* 95 (2): 368–371.

———. 2009. "Strategy-proofness versus Efficiency in Matching with Indifferences: Redesigning the NYC High School Match." *American Economic Review* 99 (5): 1954–78.

Abdulkadiroğlu, Atila, and Tayfun Sönmez. 2003. "School Choice: A Mechanism Design Approach." *American Economic Review* 93 (3): 729–747.

Abeler, Johannes, Daniele Nosenzo, and Collin Raymond. 2019. "Preferences for Truth-Telling." *Econometrica* 87 (4): 1115–1153.

Afacan, MO, ZH Aliogullari, and M Barlo. 2017. "Sticky matching in school choice." *Economic Theory* 64:509–538.

Alcalde, Jose, and Antonio Romero-Medina. 2017. "Fair student placement." *Theory and Decision* 83:293–307.

Ashlagi, Itai, and Yannai A Gonczarowski. 2018. "Stable matching mechanisms are not obviously strategy-proof." *Journal of Economic Theory* 177:405–425.

Balinski, Michel, and Tayfun Sönmez. 1999. "A Tale of Two Mechanisms: Student Placement." *Journal of Economic Theory* 84:73–94.

Bando, Keisuke. 2014. "On the existence of a strictly strong Nash equilibrium under the student-optimal deferred acceptance algorithm." *Games and Economic Behavior* 87:269–287.

Budish, Eric, and Estelle Cantillon. 2012. "The Multi-unit Assignment Problem: Theory and Evidence from Course Allocation at Harvard." *American Economic Review* 102 (5): 2237–2271.

Calsamiglia, Caterina, Guillaume Haeringer, and Flip Klijn. 2010. "Constrained School Choice: An Experimental Study." *American Economic Review* 100 (4): 1860–1874.

Chen, Daniel L., Martin Schonger, and Chris Wickens. 2016. "oTree – An open-source platform for laboratory, online and field experiments." *Journal of Behavioral and Experimental Finance* 9:88–97.

Chen, Yan, and Onur Kesten. 2019. "Chinese college admissions and school choice reforms: An experimental study." *Games and Economic Behavior* 115:83–100.

Chen, Yan, and John O. Ledyard. 2010. "Behavioural and Experimental Economics. The New Palgrave Economics Collection." Chap. Mechanism design experiments, edited by Steven N. Durlauf and Lawrence E. Blume, 191–205. Palgrave Macmillan, London.

Chen, Yiqiu, and Markus Möller. 2021. "Regret-Free Truth-telling in School Choice with Consent." *Working Paper,* 1–38.

Coase, Ronald H. 1960. "The Problem of Social Cost." *Journal of Law & Economics* 3:1–44.

de Haan, Monique, Pieter A. Gautier, Hessel Oosterbeek, and Bas Van der Klaauw. 2018. "The performance of school assignment mechanisms in practice." *Working Paper,* 1–35.

de Haan, Ronald. 2017. "Why a Dutch court stopped high school students from swapping schools." *Medium: Social Choice (Aug 18, 2017),* https://medium.com/social-choice/why-a-dutch-court-stopped-high-school-students-from-exchanging-schools-1315303a48b6.

Decerf, Benoit, and Martin Van der Linden. 2018. "Manipulability in school choice." *Working Paper,* 1–42.

Dogan, Battal. 2016. "Responsive affirmative action in school choice." *Journal of Economic Theory* 165:69–105.

Dogan, Battal, and Lars Ehlers. 2021. "Minimally unstable improvements over deferred acceptance." *Theoretical Economics, forthcoming.*

Dubins, Lester E., and David A. Freedman. 1981. "Machiavelli and the Gale-Shapley algorithm." *American Mathematical Monthly* 88 (7): 485–494.

Dur, Umut, A Arda Gitmez, and Özgür Yılmaz. 2019. "School choice under partial fairness." *Theoretical Economics* 14 (4): 1309–1346.

Ehlers, Lars, and Thayer Morrill. 2020. "(Il)legal assignments in school choice." *Review of Economic Studies* 87:1837–1875.

Engel, Christoph, and Paul A. M. Van Lange. 2021. "Social mindfulness is normative when costs are low, but rapidly declines with increases in costs." *Judgment & Decision Making* 16 (2): 290–322.

Erdil, Aytek, and Haluk Ergin. 2008. "What's the Matter with Tie-Breaking? Improving Efficiency in School Choice." *American Economic Review* 98 (3): 669–689.

Faenza, Yuri, and Xuan Zhang. 2020. "Legal Assignments and fast EADAM with consent via classical theory of stable matchings." *arXiv:1809.08506v2 [cs.DS] 6 Aug 2020,* 1–36.

Fan, Zhi, Keqiang Li, and Ya Zhou. 2020. "What Motivates Costless Altruism? Evidence from Laboratory Experiments." *Theoretical Economics Letters* 10:273–280.

Featherstone, Clayton R., Eric Mayefsky, and Colin D. Sullivan. 2021. "Learning to Manipulate: Out-of-Equilibrium Truth-Telling in Matching Markets." *Working Paper,* 1–44.

Ferguson, Eamonn, Kun Zhao, Ronan E. O'Carroll, and Luke D. Smillie. 2019. "Costless and Costly Prosociality: Correspondence among Personality Traits, Economic Preferences and Real-World Prosociality." *Social Psychological and Personality Science* 10 (4): 461–471.

Fernandez, Marcelo Ariel. 2020. "Deferred Acceptance and Regret-Free Truth-Telling." *Working Paper,* 1–39.

Gale, David, and Lloyd S. Shapley. 1962. "College admissions and the stability of marriage." *The American Mathematical Monthly* 69 (1): 9–15.

Greiner, Ben. 2015. "Subject pool recruitment procedures: organizing experiments with ORSEE." *Journal of the Economic Science Association* 1 (1): 114–125.

Güth, Werner. 2010. "The Generosity Game and Calibration of Inequity Aversion." *Journal of Socio-Economics* 39 (2): 155–157.

Güth, Werner, Maria Vittoria Levati, and Matteo Ploner. 2012. "An Experimental Study of the Generosity Game." *Theory and Decision* 72:51–63.

Hakimov, Rustamdjan, and Dorothea Kübler. 2020. "Experiments on centralized school choice and collegeadmissions: a survey." *Experimental Economics.*

Hassidim, Avinatan, Assaf Romm, and Ran I. Shorrer. 2021. "The Limits of Incentives in Economic Matching Procedures." *Management Science* 67 (2): 951–963.

Kesten, Onur. 2010. "School choice with consent." *Quarterly Journal of Economics* 125 (3): 1297–1348.

Kwon, Hyukjun, and Ran I. Shorrer. 2020. "Justified-envy-minimal efficient mechanisms for priority-based matching." *Working Paper,* 1–39.

Li, Shengwu. 2017. "Obviously Strategy-Proof Mechanisms." *American Economic Review* 107 (11): 3257–3287.

May, J. Russell, Juliana Chan, Patrick D. Fuller, Karalea Jasiak, Marcie Lepkowsky, and Holly Phillips. 2014. "Residency scramble: Program directors' experiences with the Pharmacy Online Residency Centralized Application Service." *American Journal of Health-System Pharmacy* 71, no. 7 (April): 587–591. ISSN: 1079-2082.

Pathak, Parag A., and Tayfun Sönmez. 2008. "Leveling the Playing Field: Sincere and Sophisticated Players in the Boston Mechanism." *American Economic Review* 98 (4): 1636–1652.

———. 2013. "School admissions reform in Chicago and England: Comparing mechanisms by their vulnerability to manipulation." *American Economic Review* 103 (1): 80–106.

Rees-Jones, Alex. 2018. "Suboptimal behavior in strategy-proof mechanisms: Evidence from the residency match." Special Issue in Honor of Lloyd Shapley: Seven Topics in Game Theory, *Games and Economic Behavior* 108:317–330.

Rees-Jones, Alex, and Samuel Skowronek. 2018. "An experimental investigation of preference misrepresentation in the residency match." *Proceedings of the National Academy of Sciences* 115 (45): 11471–11476.

Reny, Philip J. 2021. "Efficient Matching in the School Choice Problem." *Working Paper,* 1–41.

Roth, Alvin E. 1982. "The Economics of Matching: Stability and Incentives." *Mathematics of Operations Research* 7:617–628.

———. 2013. "The Handbook of Market Design." Chap. What Have We Learned from Market Design?, edited by Nir Vulkan, Alvin E. Roth, and Zvika Neeman, 7–50. Oxford University Press.

Shapley, Lloyd, and Herbert Scarf. 1974. "On cores and indivisibility." *Journal of Mathematical Economics* 1 (1): 23–37.

Tang, Qianfeng, and Jingsheng Yu. 2014. "A new perspective on Kesten's school choice with consent idea." *Journal of Economic Theory* 154:543–561.

Tang, Qianfeng, and Yongchao Zhang. 2021. "Boston versus deferred acceptance in an interim setting: An experimental investigation." *Economic Theory* 71:533–552.

Troyan, Peter, David Delacrétaz, and Andrew Kloosterman. 2020. "Essentially stable matchings." *Games and Economic Behavior* 120:370–390.

Troyan, Peter, and Thayer Morrill. 2020. "Obvious manipulations." *Journal of Economic Theory* 185:1–26.

Appendix

A Additional Results

In this subsection, we present an overview of additional results.

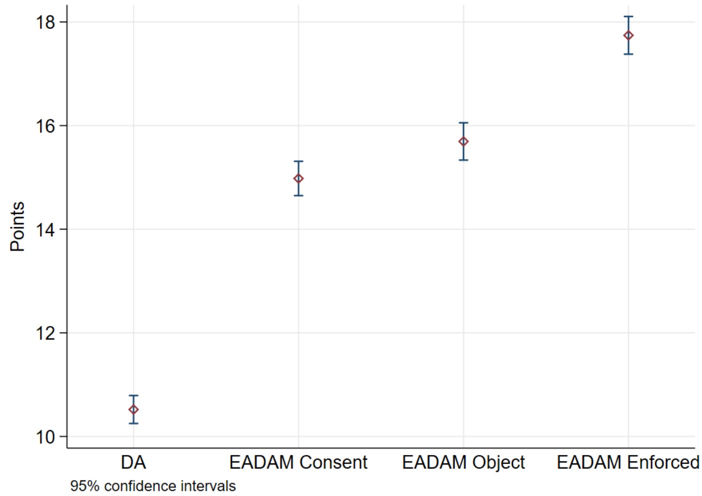

Figure 7: Points

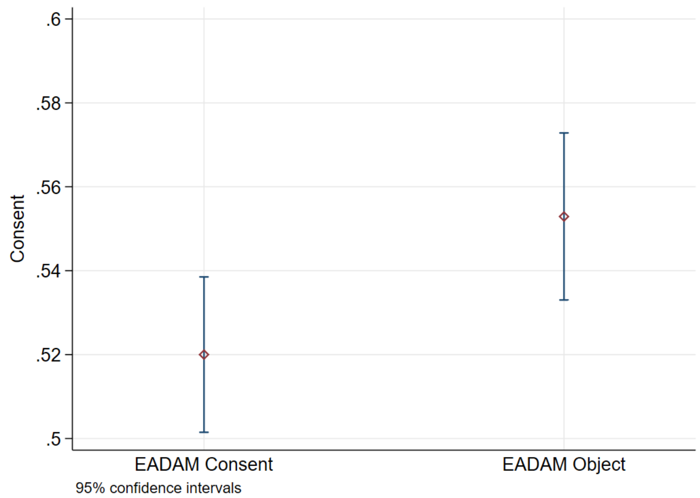

Figure 8: Consent

B Example Used in the Experiment

Consider a set of five students $I \equiv \{i_1, i_2, i_3, i_4, i_5\}$ and a set of five schools $S \equiv \{s_1, s_2, s_3, s_4, s_5\}$, where each school has a capacity of only one seat. Each student has strict preferences over schools, denoted by P_i, and each school has strict priorities over students, denoted by $\succ_s$. Preferences and priorities are given as follows:

$\succ_{s_1}$	$\succ_{s_2}$	$\succ_{s_3}$	$\succ_{s_4}$	$\succ_{s_5}$
i_2	i_4	i_3	i_4	i_1
i_4	i_1	i_2	i_5	i_3
i_1	i_2	i_4	i_3	i_2
i_5	i_3	i_5	i_2	i_5
i_3	i_5	i_1	i_1	i_4

P_{i_1}	P_{i_2}	P_{i_3}	P_{i_4}	P_{i_5}
s_1	s_2	s_4	s_3	s_3
s_3	s_4	s_1	s_1	s_2
s_4	s_1	s_2	s_2	s_1
s_2	s_5	s_3	s_5	s_4
s_5	s_3	s_5	s_4	s_5

As described in Section 2, Round 0 of the EADAM algorithm involves running the DA algorithm. The steps are illustrated below.

Step	s_1	s_2	s_3	s_4	s_5
1	i_1	i_2	$\boxed{i_4}, i_5$	i_3	
2	i_1	$\boxed{i_2}, i_5$	i_4	i_3	
3	$\boxed{i_1}, i_5$	i_2	i_4	i_3	
4	i_1	i_2	i_4	$\boxed{i_5}, i_3$	
5	$\boxed{i_1}, i_3$	i_2	i_4	i_5	
6	i_1	$\boxed{i_2}, i_3$	i_4	i_5	
7	i_1	i_2	$\boxed{i_3}, i_4$	i_5	
8	$\boxed{i_4}, i_1$	i_2	i_3	i_5	
9	i_4	i_2	$\boxed{i_3}, i_1$	i_5	
10	i_4	i_2	i_3	$\boxed{i_5}, i_1$	
11	i_4	$\boxed{i_1}, i_2$	i_3	i_5	
12	i_4	i_1	i_3	$\boxed{i_5}, i_2$	
13	$\boxed{i_2}, i_4$	i_1	i_3	i_5	
14	i_2	$\boxed{i_4}, i_1$	i_3	i_5	
15	i_2	i_4	i_3	i_5	i_1

The matching produced by DA in Step 15 is stable but Pareto-inefficient. No student is assigned to her top choice. Two students (i_2, i_4) are assigned to their third choice, two students (i_3, i_5) to their fourth choice, one student (i_1) is assigned to her last choice.

These efficiency losses are caused by students whom we refer to as *interrupters*. For the sake of clarity, interrupters are highlighted in blue. In this school choice problem, DA generates five interruptions: (i_4, s_3), (i_2, s_2), (i_1, s_1), (i_4, s_1), (i_1, s_2). The efficiency losses caused by these interruptions can be recovered by applying EADAM.

In Round 1 of the EADAM algorithm, we first identify the last interruption: (i_1, s_2). If i_1 consents, schools s_2 and s_1 are removed from her preference list. Re-running DA produces a Pareto-efficient matching, as illustrated below. Three students (i_2, i_3, i_4) are assigned to their top choice, one student (i_5) is assigned to her third choice, one student to her last choice (i_1).

Step	s_1	s_2	s_3	s_4	s_5
1		i_2	$\boxed{i_4}, i_1, i_5$	i_3	
2		$\boxed{i_2}, i_5$	i_4	$\boxed{i_3}, i_1$	
3	i_5	i_2	i_4	i_3	i_1

If i_1 does not consent, we identify the next interruption: (i_4, s_1). If i_4 consents, schools s_1 and s_3 are removed from her preference list. Re-running DA produces a Pareto-superior matching, as shown below. Two students (i_3, i_5) are assigned to their top choice, two students (i_2, i_4) to their third choice, one student (i_1) is assigned to her last choice.

Step	s_1	s_2	s_3	s_4	s_5
1	i_1	$\boxed{i_4}, i_2$	i_5	i_3	
2	i_1	i_4	i_5	$\boxed{i_3}, i_2$	
3	$\boxed{i_2}, i_1$	i_4	i_5	i_3	
4	i_2	i_4	$\boxed{i_5}, i_1$	i_3	
5	i_2	i_4	i_5	$\boxed{i_3}, i_1$	
6	i_2	$\boxed{i_4}, i_1$	i_5	i_3	
7	i_2	i_4	i_5	i_3	i_1

If neither i_1 nor i_4 consents, we identify the next interruption: (i_2, s_2). If i_2 consents, schools s_2 is removed from her preference list. Re-running DA produces a Pareto-inefficient matching that is equivalent to the DA matching. No student is assigned to her top choice.

Step	s_1	s_2	s_3	s_4	s_5
1	i_1		$\boxed{i_4}, i_5$	$\boxed{i_3}, i_2$	
2	$\boxed{i_2}, i_1$	i_5	i_4	i_3	
3	i_2	i_5	$\boxed{i_4}, i_1$	i_3	
4	i_2	i_5	i_4	$\boxed{i_3}, i_1$	
5	i_2	$\boxed{i_1}, i_5$	i_4	i_3	
6	$\boxed{i_2}, i_5$	i_1	i_4	i_3	
7	i_2	i_1	i_4	$\boxed{i_5}, i_3$	
8	$\boxed{i_2}, i_3$	i_1	i_4	i_5	
9	i_2	$\boxed{i_1}, i_3$	i_4	i_5	
10	i_2	i_1	$\boxed{i_3}, i_4$	i_5	
11	$\boxed{i_2}, i_4$	i_1	i_3	i_5	
12	i_2	$\boxed{i_4}, i_1$	i_3	i_5	
13	i_2	i_4	i_3	i_5	i_1

C Instructions

The following instructions are for EADAM Consent.

INTRODUCTION

In this study, we simulate a procedure to assign students to schools.

Please give this study your full attention. You will have a limited amount of time to complete the study. If you are inactive for long and time runs out, you will be unable to continue the study and will only be paid **€4.00** for your participation.

Your earnings are given in points. At the end of the study, you will be paid based on the following exchange rate:

1 point = €0.25.

Your earnings depend on your decisions and those made by other participants. In addition, you will be paid **€4.00** for your participation. No other participant will be informed about your payment.

Note: As you can see on top of this screen, these instructions are organized in different tabs (Introduction, Procedure, Example, Practice Questions). You can switch back and forth between these tabs. All tabs (except the tab with the Practice Questions) will be accessible any time during the entire experiment.

PROCEDURE

Rounds and groups. The experiment consists of 2 rounds. At the beginning of each round, you will be randomly matched with four other people in this session to form a group of five. All members of your group will assume the role of students applying for a school.

Types. Each group contains one of each of the five different student types: Student 1, Student 2, Student 3, Student 4 and Student 5. Student types are randomly assigned at the beginning of the experiment and remain the same throughout the experiment.

Schools and seats. For each group of participants, five schools are available: A, B, C, D, and E. Each school has one seat. Each seat is assigned to one student.

Ranking decision. In each round, you will be asked to rank the schools to indicate your preferences on a list (preference list). Note that you need to rank all five schools in order to indicate your preferences.

Earnings. Your earnings in each round depend on the school you are assigned to at the end of each round. Your assignment to a school depends on your type, your choices, and the choices made by the other four students in your group.

There will be 2 rounds. At the end, two of these rounds will be chosen randomly (with all rounds being equally likely to be chosen). Your total earnings will equal the sum of your earnings in these two randomly chosen rounds, plus €4.00 for your participation in the experiment. At the end of the experiment, you will be informed about the rounds chosen, your earnings in those rounds, and the total earnings.

For each student, each school is associated with a different number of points. You can think of this number of points as reflecting how desirable a school is to a student in terms of location and quality of education. The earnings for each of the five student types are outlined in the following table.

	Student 1	**Student 2**	**Student 3**	**Student 4**	**Student 5**
25 points	A	B	D	C	C
18 points	C	D	A	A	B
12 points	D	A	B	B	A
7 points	B	E	C	E	D
3 points	E	C	E	D	E

Note: You do not have to memorize this table. We will show you this table again in each round before you make your decision.

School priorities. Each school ranks each of the five student types in a different way. You can think of each school's ranking (priority list) as being based on how far each of the students live from the school. The priority lists for each of the five schools are outlined in the following table.

	School A	**School B**	**School C**	**School D**	**School E**
First priority	Student 2	Student 4	Student 3	Student 4	Student 1
Second priority	Student 4	Student 1	Student 2	Student 5	Student 3
Third priority	Student 1	Student 2	Student 4	Student 3	Student 2
Fourth priority	Student 5	Student 3	Student 5	Student 2	Student 5
Fifth priority	Student 3	Student 5	Student 1	Student 1	Student 4

Temporary and final admissions. In this procedure, we distinguish between temporary and final admissions. As illustrated below and in the example (**see next tab**), in some parts of the procedure the admission of a student is temporary.

In case of a **temporary** admission, the following three cases can occur:

1) The temporary admission of a student at a school becomes final at the end of the procedure.

2) The temporary admission of a student at a school differs from her final admission and **does not prevent** any other student from being admitted there.

3) The temporary admission of a student at a school differs from her final admission and **prevents** other students from being admitted there.

We refer to the student in case 3) as a **blocking student**.

Depending on the preference list you and others submit, you might turn out to be a blocking student at one or more schools.

Consent. In each round, we will ask you to decide whether you consent to waive your priority at a school in the event that you are identified as a blocking student there.

If you consent, the respective school(s) will be removed from your preference list without changing the relative ranking of the remaining schools on the list.

Note: Consenting to waive your priorities will never change your final admission but may improve other students' final admissions. We illustrate that in the example (see next tab).

Admissions procedure. After all participants have submitted their preference lists, the computer will assign each student in each group to a school. At the end of each round, each student will be informed about everybody's assignment. Note that your assignment in each round is not affected by your assignments in the previous rounds.

The assignment is generated according to the following procedure:

Part 1

Step 1

- For each student, an application is sent to the school that she ranked first on her preference list (see paragraph on ranking decision).
- If a school receives only one application, the student is temporarily admitted. If a school receives more than one application, the student with the highest priority is temporarily admitted and the remaining students are rejected.

Step 2

- For each student who was rejected in the previous step, an application is sent to the school that she ranked second on her preference list.
- Each school that receives new applications considers the student it admitted in the previous step together with the new applicants. Among these, the student with the highest priority is temporarily admitted and the remaining students are rejected.

Following steps

- The procedure continues according to the same rules.

End of Part 1

- The procedure in Part 1 ends when no student is rejected, that is, each student is assigned a seat at a school.

Part 2

Step 1

- The computer looks for the last step of the procedure in Part 1 in which a student has become a blocking student.
- If a student is a blocking student at a school and has consented to waive her priorities, the computer will remove the respective school(s) from the student's preference list and rerun the procedure described in Part 1.
- If no student is a blocking student, the procedure ends and the final admission is the same as in the last step of Part 1.

Step 2

- If the procedure has not ended, the procedure described in the previous step is repeated.

Final Step

- The procedure ends when there is no step in which a student becomes a blocking student.

Note: Until the final step, admissions are **temporary**: a student admitted at one step may be rejected in a later step.

EXAMPLE

We will go through a simple example to illustrate how the allocation procedure works. In this example, there are four students (1, 2, 3 and 4) and four schools (A, B, C and D). Each school has one seat. Students submit the following preference lists:

	Student 1	**Student 2**	**Student 3**	**Student 4**
10 points	A	A	A	C
6 points	D	B	B	A
3 points	B	C	C	B
1 point	C	D	D	D

The priority list of each of the four schools is the following:

	School A	**School B**	**School C**	**School D**
First priority	Student 4	Student 2	Student 3	Student 1
Second priority	Student 1	Student 3	Student 4	Student 4
Third priority	Student 2	Student 1	Student 2	Student 3
Fourth priority	Student 3	Student 4	Student 1	Student 2

Note: At any step, any student temporarily admitted at a school is shown in a box.

Part 1

Step 1 For each student, an application is sent to the school that she ranked first. That is, students 1, 2 and 3 apply to school A, and student 4 applies to school C. Thus, school A receives three applications. It temporarily admits the applicant with the highest priority (student 1) and rejects students 2 and 3. School C temporarily admits student 4.

	School A	**School B**	**School C**	**School D**
Step 1	[1], 2, 3		[4]	

Step 2 Both student 2 and student 3 have been rejected by school A in Step 1 and thus apply to the school that they ranked second (school B). School B receives two applications. It temporarily admits student 2 and rejects student 3, as student 2 has a higher priority at school B than student 3. (For student 1 and student 4, there is no change at this step.)

	School A	**School B**	**School C**	**School D**
Step 2	[1]	[2], 3	[4]	

Step 3 Student 3 has been rejected by school B in Step 2 and thus applies to the school that she ranked third (school C). Now school C receives two applications. It temporarily admits student 3 and rejects student 4, as student 3 has a higher priority at school C than student 4. (For student 1 and student 2, there is no change at this step.)

	School A	**School B**	**School C**	**School D**
Step 3	[1]	[2]	4, [3]	

Step 4 Student 4 has been rejected by school C in Step 3 and thus applies to the school that she ranked second (school A). Now school A receives two applications. It temporarily admits student 4 and rejects student 1, as student 4 has a higher priority at school A than student 1. (For student 2 and student 3, there is no change at this step.)

	School A	**School B**	**School C**	**School D**
Step 4	1, [4]	[2]	[3]	

Step 5 Student 1 has been rejected by school A in Step 4 and thus applies to the school that she ranked second (school D). Now no student is rejected. The procedure in Part 1 ends.

	School A	**School B**	**School C**	**School D**
Step 5	[4]	[2]	[3]	[1]

Part 2

We now look for blocking students in Part 1. In the example presented above, student 1 is a blocking student. In Step 1, her application has prevented students 2 and 3 from being admitted at school A. However, being temporarily admitted at school A does not benefit student 1, as she is assigned to school D in the last step (Step 5).

If student 1 **does not consent** to waive her priority, the admissions in the last step of Part 1 (Step 5) become final and Part 2 ends with no change.

If student 1 **consents** to waive her priority, school A is removed from her preference list. Her preference list is adjusted as follows:

	Student 1	**Student 2**	**Student 3**	**Student 4**
10 points		A	A	C
6 points	D	B	B	A
3 points	B	C	C	B
1 point	C	D	D	D

Now we repeat the admissions procedure described in Part 1.

Step 1 Each student applies to the school that she ranked first on her (adjusted) preference list. That is, student 1 applies to school D, students 2 and 3 apply to school A, and student 4 applies to school C. School A receives two applications. It temporarily admits student 2 and rejects student 3, as student 2 has a higher priority than student 3 at school A.

	School A	**School B**	**School C**	**School D**
Step 1	[2], 3		[4]	[1]

Step 2 Student 3 has been rejected by school A in Step 1 and thus applies to the school that she ranked second (school B). No student is rejected. The admission is final. There is no step in which a student becomes a blocking student.

	School A	**School B**	**School C**	**School D**
Step 2	[2]	[3]	[4]	[1]

Note: The final admission of student 1 has not changed (she is still admitted at school D), but the admissions of the other three students have improved.

PRACTICE QUESTIONS

1. How many participants are there in your group in each round?

2. Do participants in your group remain the same in each round?

3. If you are admitted at School A, how many points do you earn?

4. Do you keep your student type in each round?

5. Does each school have the same priorities over students?

6. If you are admitted at a school, can another student be simultaneously be admitted at the same school?

7. Is the admission final at the end of each step?

8. If a school does not reject you at any of the steps, does this mean that you are finally admitted at that school?

9. Is your final admission affected by whether you consent to waive your priorities?