

CAN AI AND DEMOCRACY BE RECONCILED?

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AIDAL workshop
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AI AND DEMOCRACY?



The New York Times

Elections and Disinformation Colliding Like Never Before

A wave of elections coincides with state influence operations, a surge of extremism, A.I. advances and a pullback in social media protections.

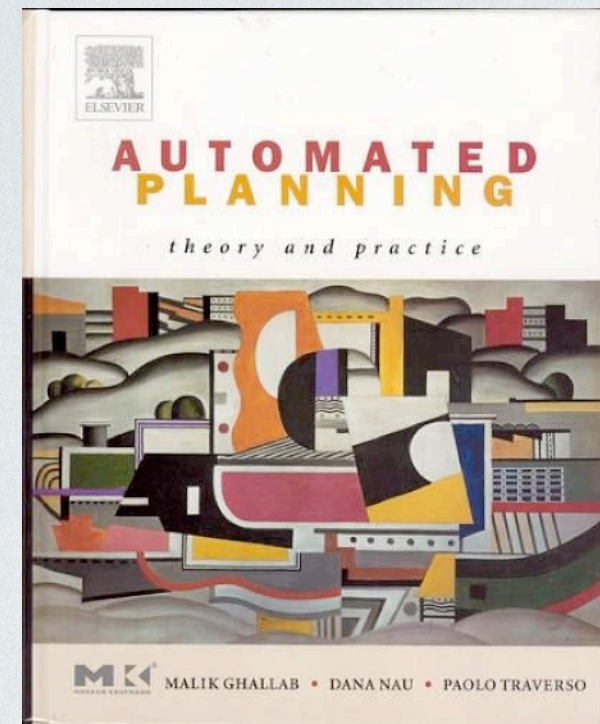


Political misinformation
with deep-fakes

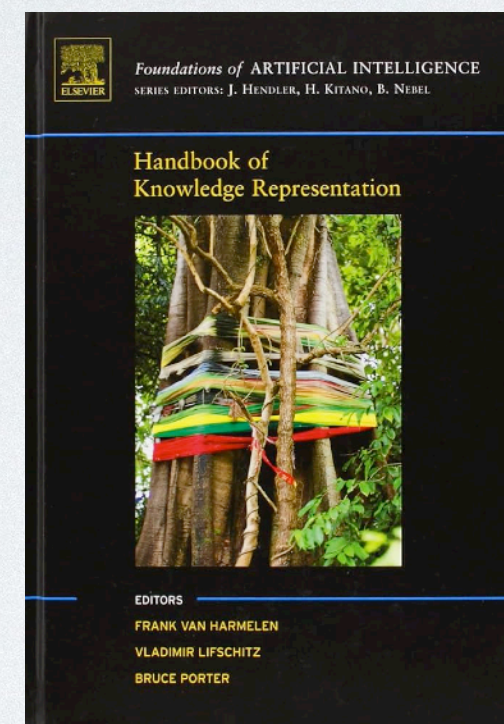
AI-based micro-targeting favouring the
spread of polarising information

IS THERE LIFE OUTSIDE OF MACHINE LEARNING?

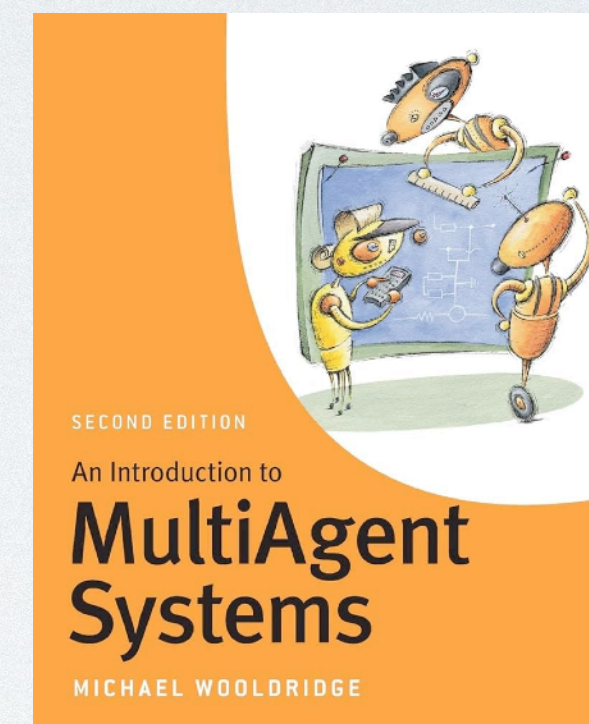
AI is a vast endeavour: from statistical learning, to logical reasoning, to robotics...



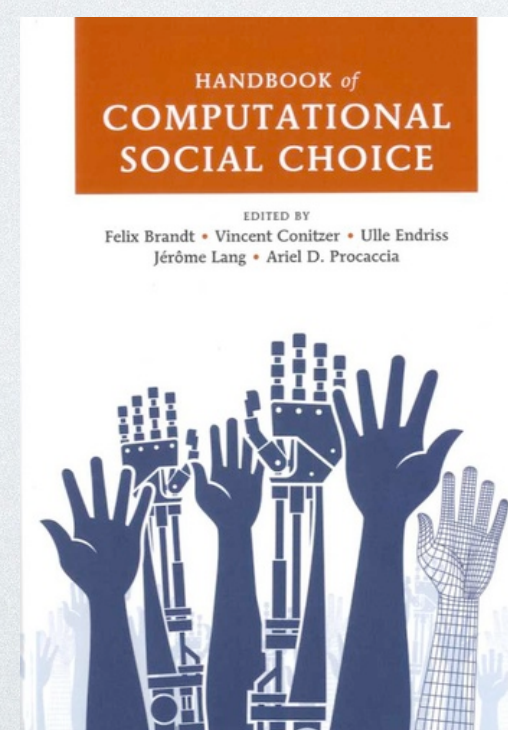
Planning



Knowledge representation



Multiagent systems
(economic paradigm)



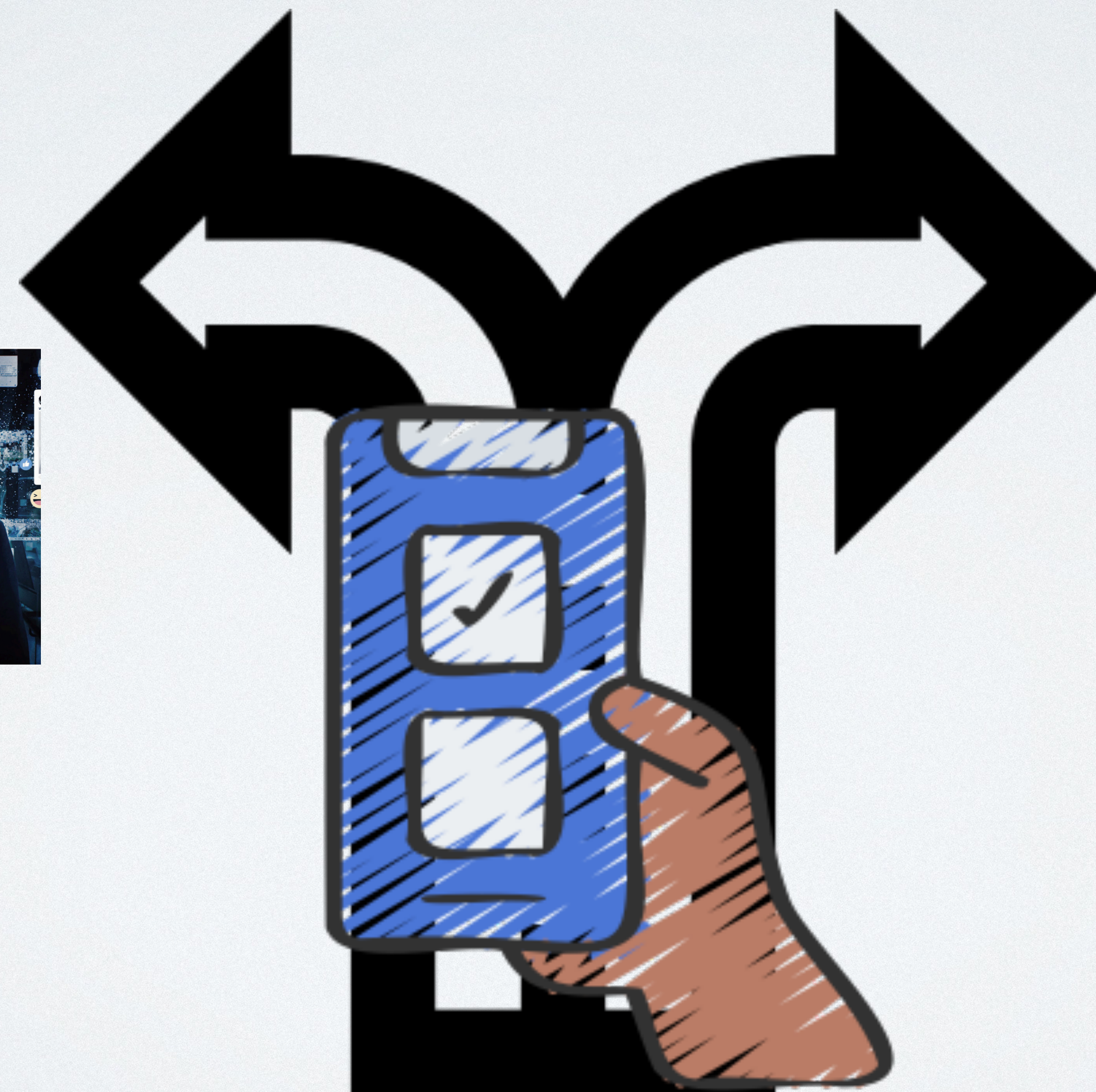
Study social choice with techniques from theoretical CS:

- computational complexity
- **algorithmic design**
- simulations and data analysis

ALGORITHM DESIGN FOR DEMOCRATIC VALUES

Repeating the recent past and present of (mostly political) elections

Invent new forms of collective decision making



IN THIS TALK

Three examples of algorithmic design for collective decision making

I - Participatory budgeting

II - Iterative voting

III - Understanding divisiveness

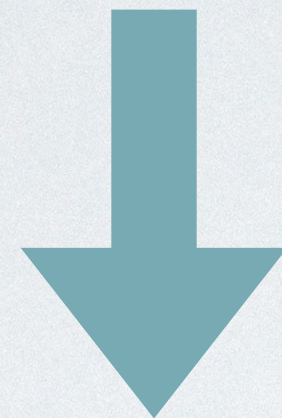
The screenshot shows the Toulouse Métropole website. At the top left is the logo "toulouse métropole". Below it is a navigation bar with "Accueil", "Agenda", "Participations en cours", and "Communes". A large purple banner features the text "Mes idées pour mon quartier ! 2023/2024" and "Proposez vos idées et choisissez les idées qui vous tiennent à coeur pour votre quartier." Below the banner is a navigation bar with "PRÉSENTATION", "TOUTES VOS IDÉES", "TOUS LES VOTES", and "RÉSULTAT DES VOTES". At the bottom, it says "8 millions d'euros pour développer des idées dans les 20 quartiers de Toulouse".

The screenshot shows the Itero website. The header includes "Itero Online iterative vote application" and "Polls Create". The main content area is titled "Which feature would you like in Itero?" and contains instructions: "Please select which feature you would like to be implemented first in Itero. If you have ideas of features that are not in the list, please don't hesitate to contact us. If you really don't know because you're just trying Itero for the first time, don't worry and vote 'I don't know.'. You'll be able to change your vote later for a real feature." Below this is a "First Round" section with the instruction "Choose one of the following alternatives:" and a list of options: "Modify a poll before it starts.", "Allow my friends to see my ballots.", "Option to restrict polls to users with a verified email address.", "Approval voting.", "Participatory budget voting.", and "I don't know." At the bottom are "Abstain" and "Vote" buttons. A sidebar on the right explains the poll process: "This is the first round of the poll. You can submit a first ballot, in which case you will become a participant of the poll. In the next rounds, you will be able to change your vote, based on the results of the previous round. The first round will end as soon as three participants have voted. It will not be possible to join the poll once the first round has ended. Then, each round will last 1 day, or until all participants have voted, whichever comes first. The poll will end after the 100th round, or after the 10th round if that happens after August 1, 2021."

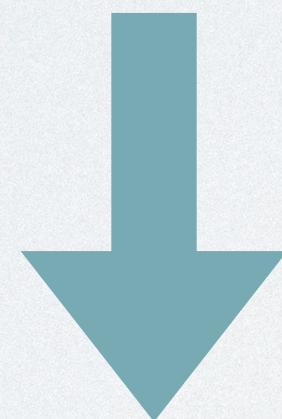
The screenshot shows the MonProgramme website. The header includes "MonProgramme" and navigation links: "PARTICIPATE", "ABOUT", "PROPOSALS", "RESULTS", "D'ACCORDLE", and language options "FR EN ES". The main content area is titled "Do you agree with these proposals?" and contains a list of proposals with "Agree" (green checkmark), "Disagree" (red X), and "blank" buttons: "Cap prices of essential products: gas, electricity, food", "Guarantee the free movement of cars in cities", "Pay a significant child allowance from the first child", "Increase paternity leave to match maternity leave", and "Nationalization of the highways".

I. PARTICIPATORY BUDGETING

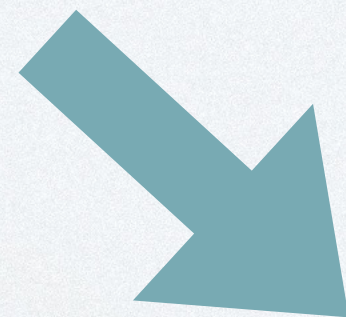
1. Citizens (usually of a municipality) propose projects for their neighbourhood



2. Municipality judges feasibility and prices the projects



3. Citizens vote for their favourite projects (usually they list 1 to 5 projects they support)



4. Winning projects are implemented

183 PROPOSITIONS

Les filtres permettent de classer les idées par territoire et par catégorie. Pensez-y !

Rechercher

ÉTAT

- Tout
- Accepté
- En cours d'évaluation
- En attente de réponse
- Rejeté

PORTÉE

- Tout
- 1 - Capitole / Arnaud Bernard / Carmes
- 2 - Amidonniers / Compans-

Classement des propositions par : Aléatoire

Résultats par page : 20

Création micro forêt rond point la ce-pière
Juillard Coralie
RETENUE La route Saint Simon depuis la sortie 27 du périphérique au boulevard de Séverac est une zone à...
Nature en ville et biodiversité
16 - Fontaine-Lestang / Arènes / Bagatelle / Papus / Tabar / Bordelongue / Mermoz / La Faourette
CRÉÉ LE 11/10/2023 ▲ 62 SUIVRE ▼ 15
VOIR LA PROPOSITION

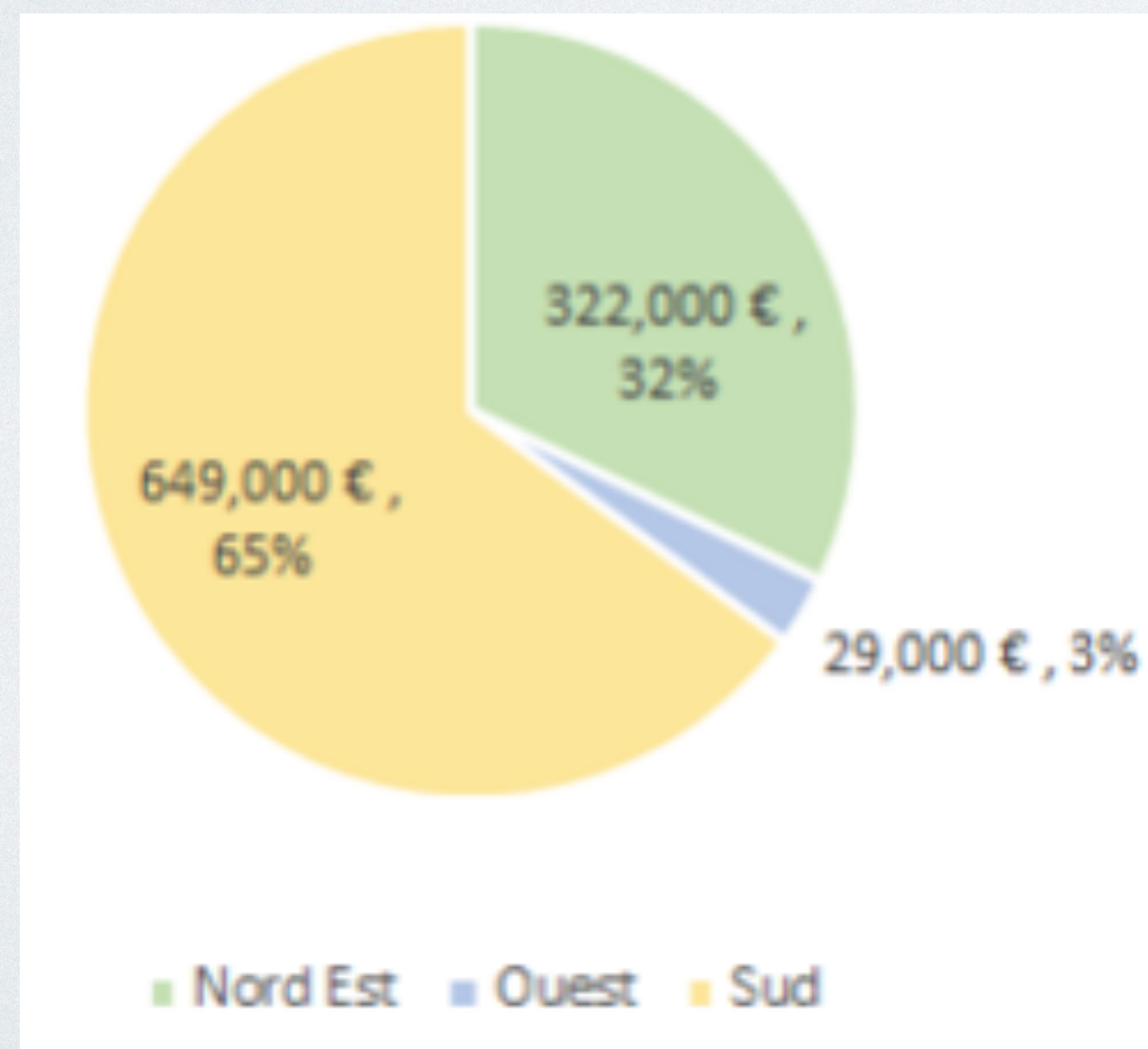
Améliorer Parc La Vache
Proposition officielle
RETENUE Cette idée a été transmise via un formulaire papier par Lalou. Rénovation des jeux, davan-tage de...
Cadre de vie
8 - Minimes / Barrière de Paris / Ponts-Jumeaux / La Vache / Raisins / Fondeyre
CRÉÉ LE 13/11/2023 ▲ 57 SUIVRE ▼ 0
VOIR LA PROPOSITION

Titre de l'idée	Montant	Total des voix
Multiplier les places de stationnement pour les vélos en hypercentre	12 000 €	590
Refaire la bande de roulement des pistes cyclables des quais de Garonne	201 000 €	334
Installation d'ombrières rue Pargaminières	150 000 €	276
Sécuriser le passage vélo entre rue de Metz et Pont Neuf	2 000 €	153
Apaiser et végétaliser la rue de la Dalbade	75 000 €	128
Fontaine à boire place Sainte-Scarbes	10 000 €	54
Revégétalisation du square Aymé Kunc	10 000 €	53
Quartier Jacobins/ Fermat limiter la circulation et la vitesse avec un marquage au sol	4 000 €	50
Danger croisement entre les rues Lafayette et du Rempart Villeneuve	1 000 €	36

GREEDY UTILITARIAN RULE

In step 3 this is the decision rule used in 99% of cities:

- Rank projects by approval rating
- Start funding from the top-voted and descend until budget is spent
- If adding a project exceeds the budget then jump to next



Unequal distribution of budget in Toulouse in 2019 and in 2022 (even if it was corrected by dividing budget in districts)

METHOD OF EQUAL SHARES

Algorithmic design research question: can we design a voting rule that has good **proportionality** properties and is **polynomial** to compute? Yes!

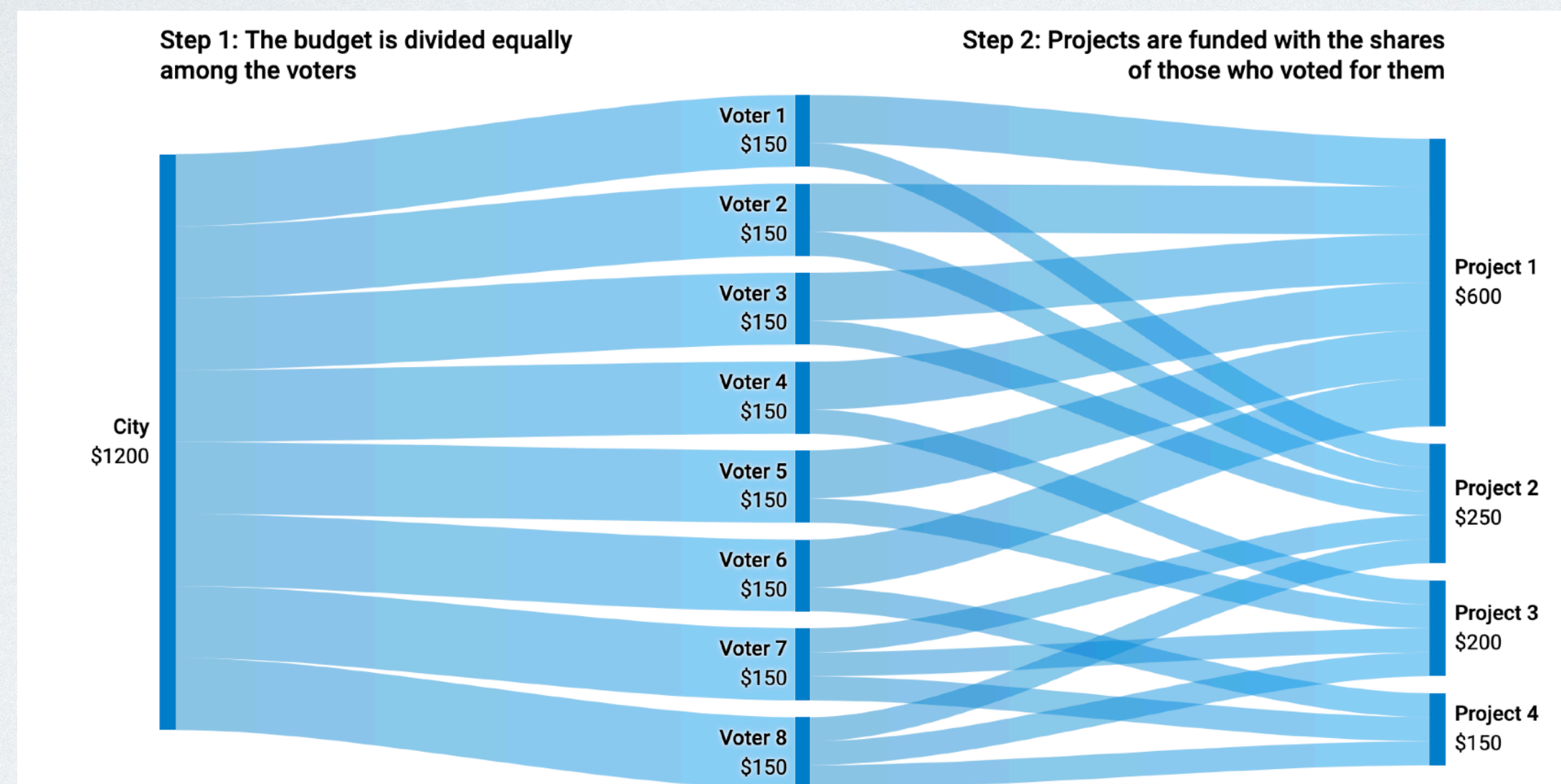
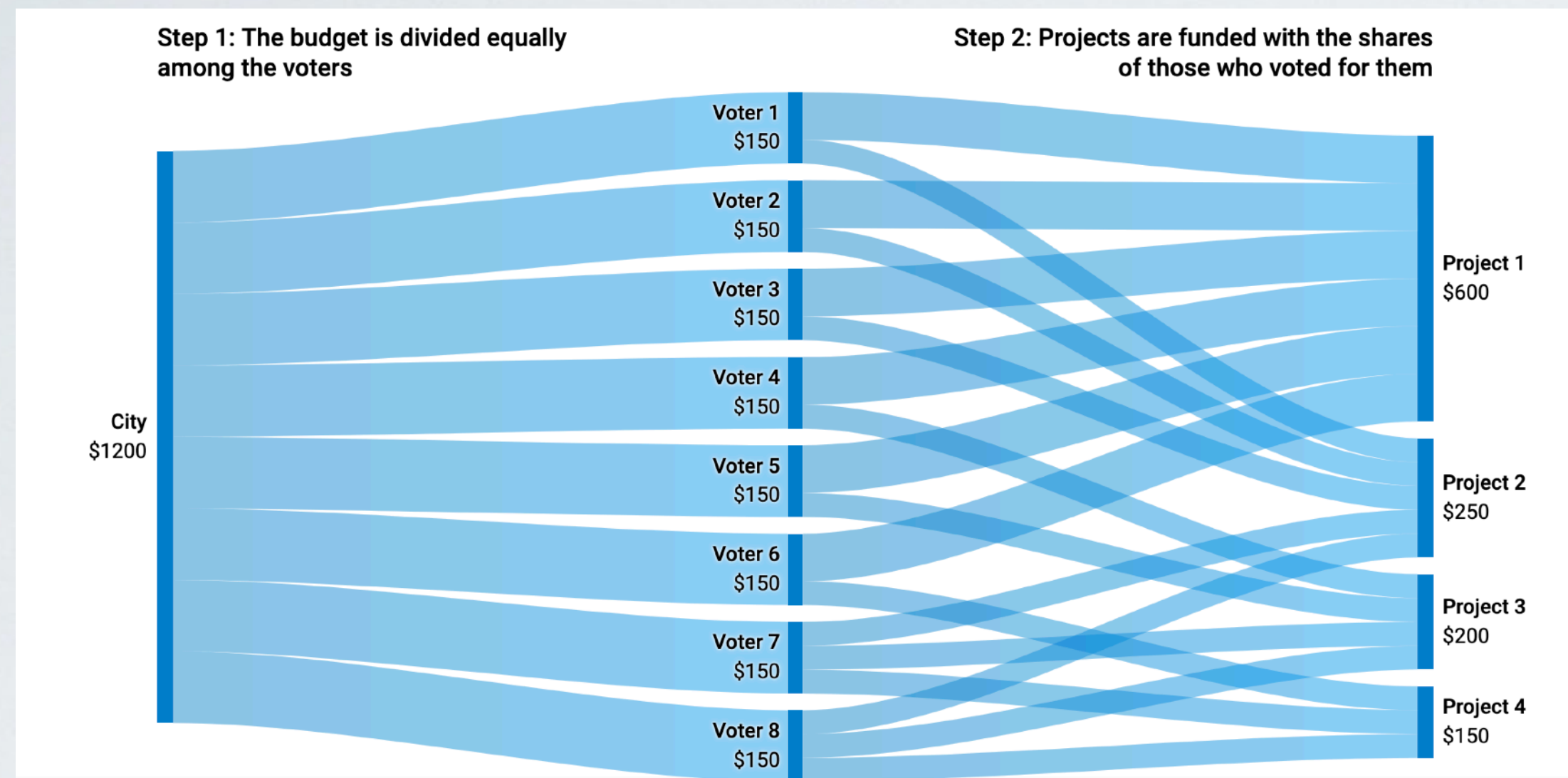


Figure from equalshares.net

Designed by COMSOC researchers in 2021, now implemented in 3 cities (in Switzerland and Poland), bringing data and new theoretical problems to crunch!

VOTERS DO NOT UNDERSTAND FORMULAS

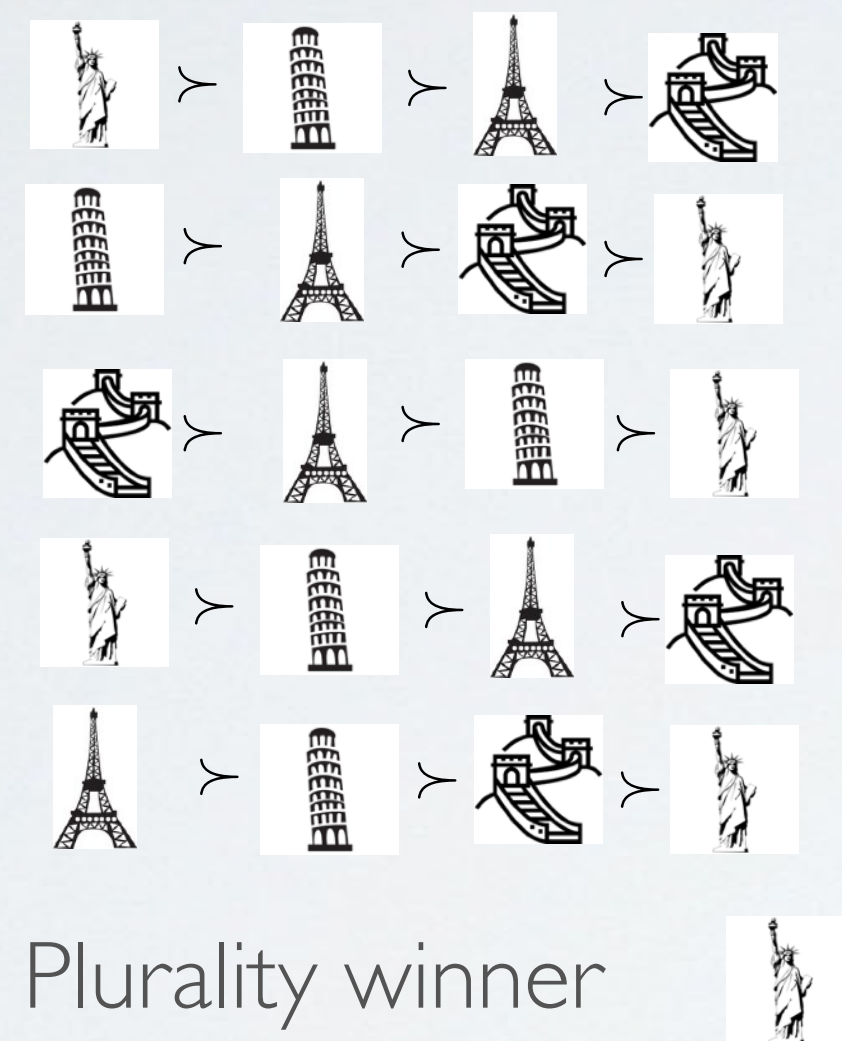


A usual comment we get from outsiders or actors in the administrative/political apparatus when showing pictures like the previous one (so voters are dumb?)

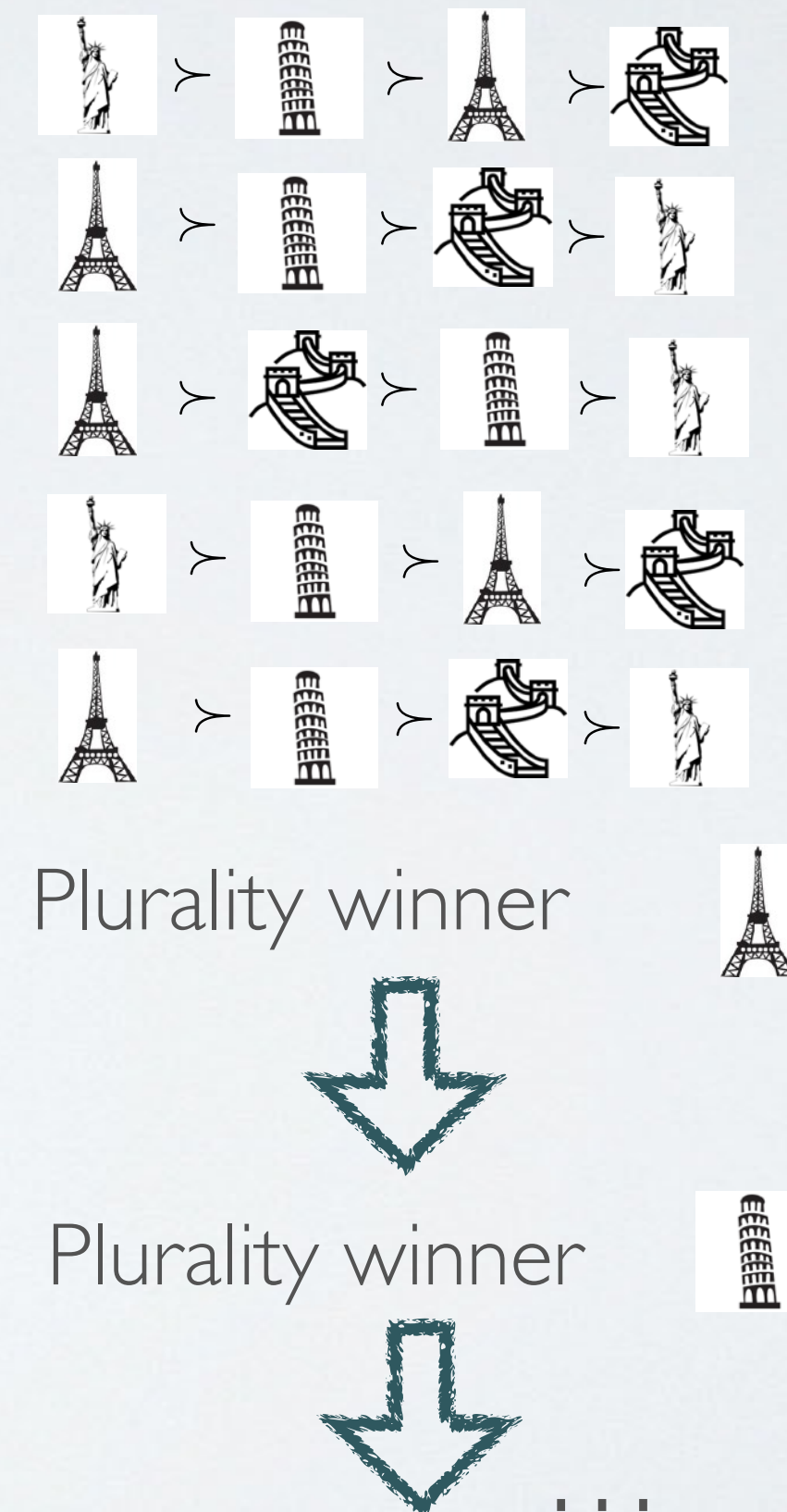
Algorithmic design research question: What is a collective decision process that uses a simple well-known rule but leads to better results?

2. ITERATIVE VOTING

Exploit vote changes in repeated elections to improve the quality of the outcome



Each voter see the plurality score of candidates and **respond** to this information



For game-theorists in the room: simple model is a best-response dynamic on a voting game, but no good theoretical model exist of concurrent manipulation in games.

EXISTING RESULTS

Convergence

Does the process end?
 (see Meir, *Iterative Voting, Trends in COMSOC*)

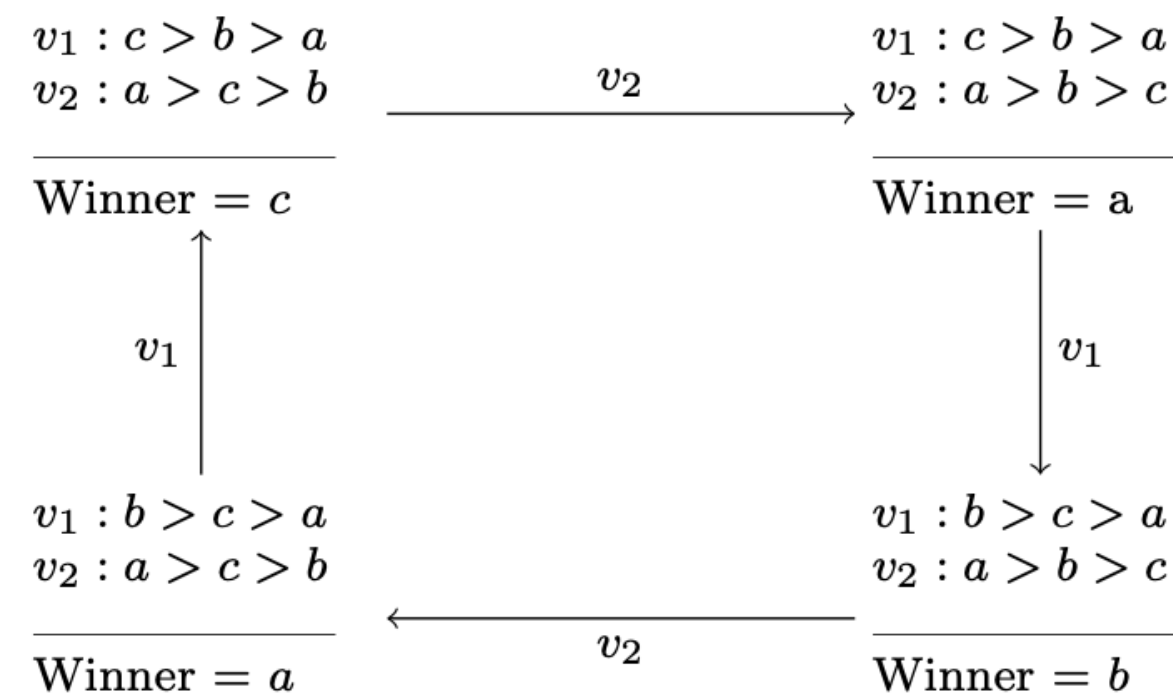


Fig. 1 Copeland does not converge with best response manipulation.

Quality of the winner

Is the winner better after iterations? Social welfare and Condorcet efficiency increase?
 (Reijngoud and Endriss, 2012, and Grandi, Loreggia, Rossi, Venable, Walsh, 2013, Kavner and Xia 2021, 2024)

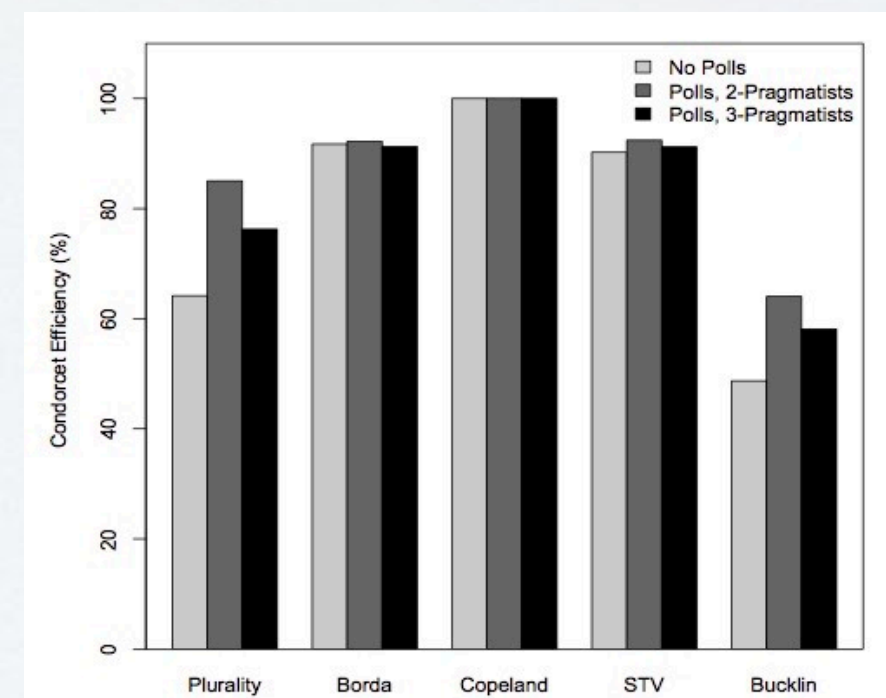
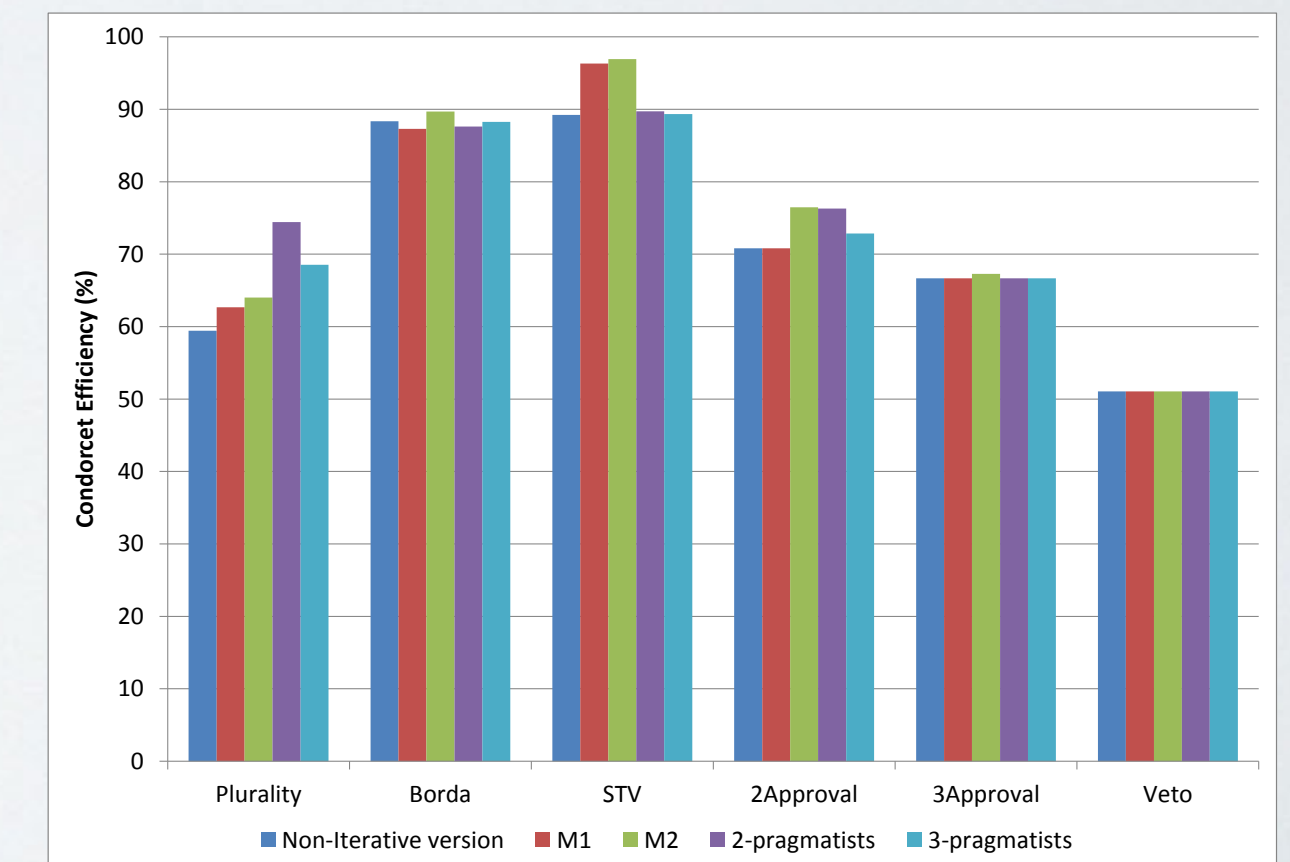
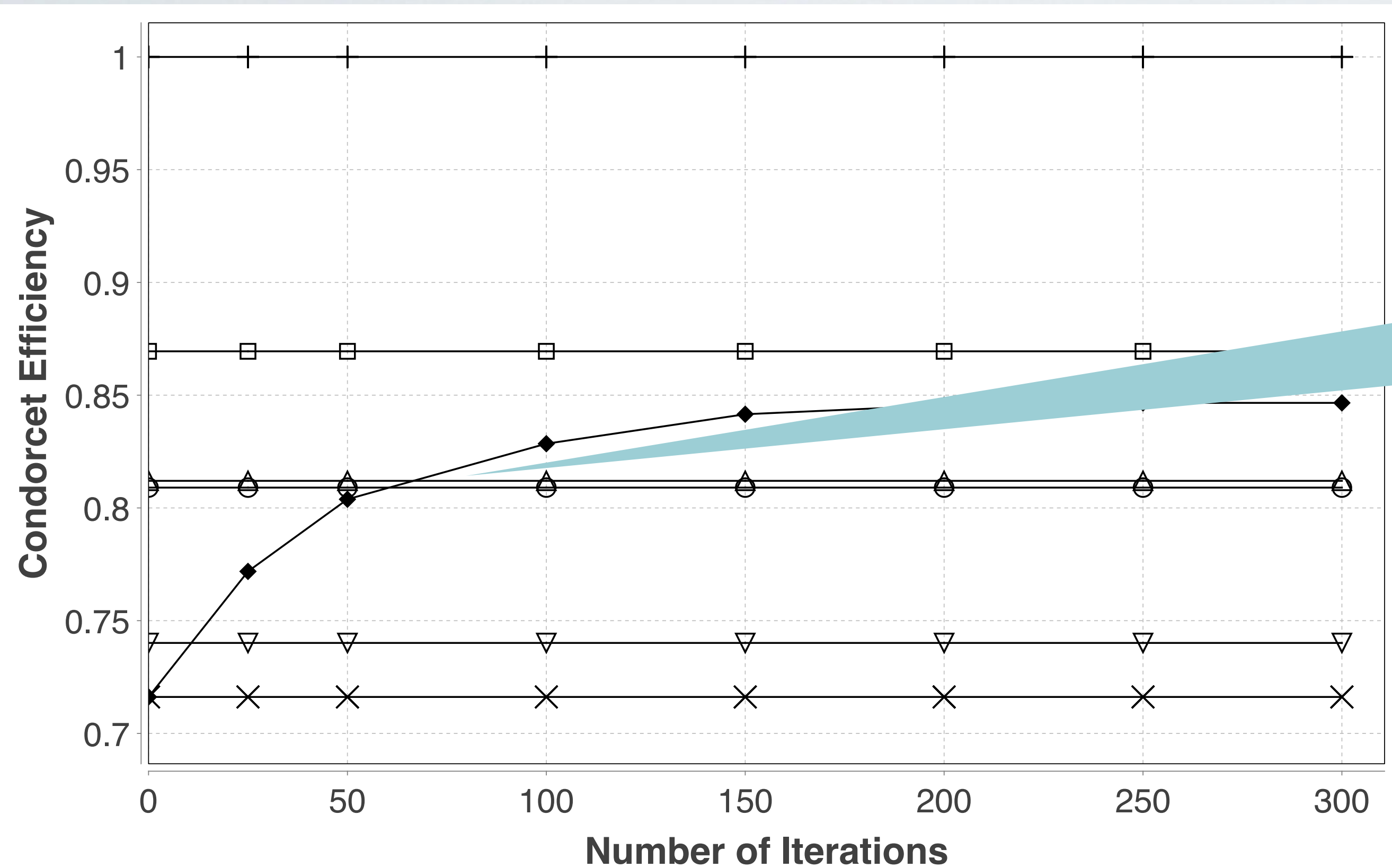


Figure 1: Average probability of electing the Condorcet winner for 50 voters and 5 alternatives over 10,000 trials. Poll effect on Condorcet efficiency is significant ($p < 0.05$) for plurality, STV and Bucklin.



DO REINFORCEMENT LEARNING AGENT LEARN TO VOTE?



After 50-100 iterations the learning agents reach the Condorcet efficiency of Borda rule

× One Round Plurality + Copeland o Borda □ STV ∇ Iterative 3 Pragmatist
△ Iterative Best Response ◆ Iterative Learning Optimistic Greedy

9 voters, 7 candidates

HOW ABOUT REAL HUMANS?



Nombre de tours consécutifs avec le même vainqueur: 1

	Gauche	Droite
Haut	2	1
Bas	3	0

Votre gain final en fonction de la case gagnante.

Votre choix pour la colonne:
 Gauche Droite

Votre choix pour la ligne:
 Haut
 Bas

Validez votre choix

Historique des tours précédents
en rouge, la case qui a gagné

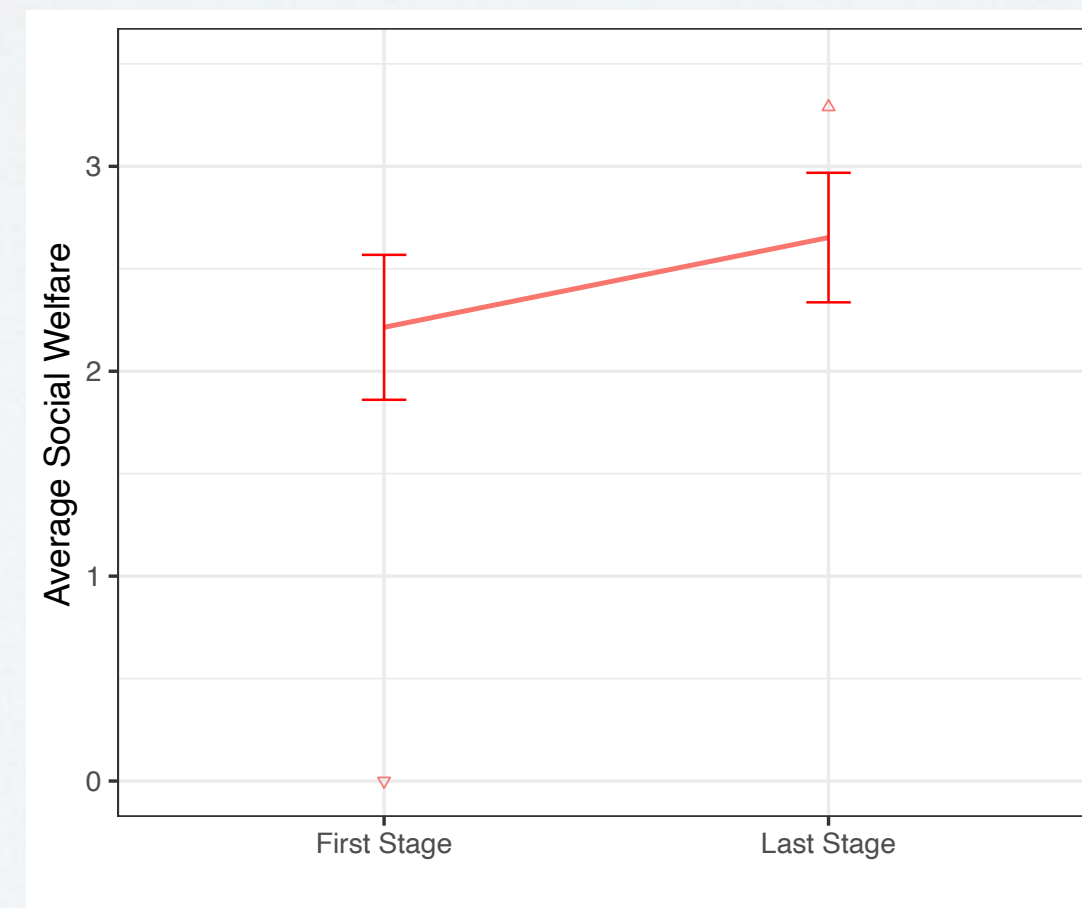
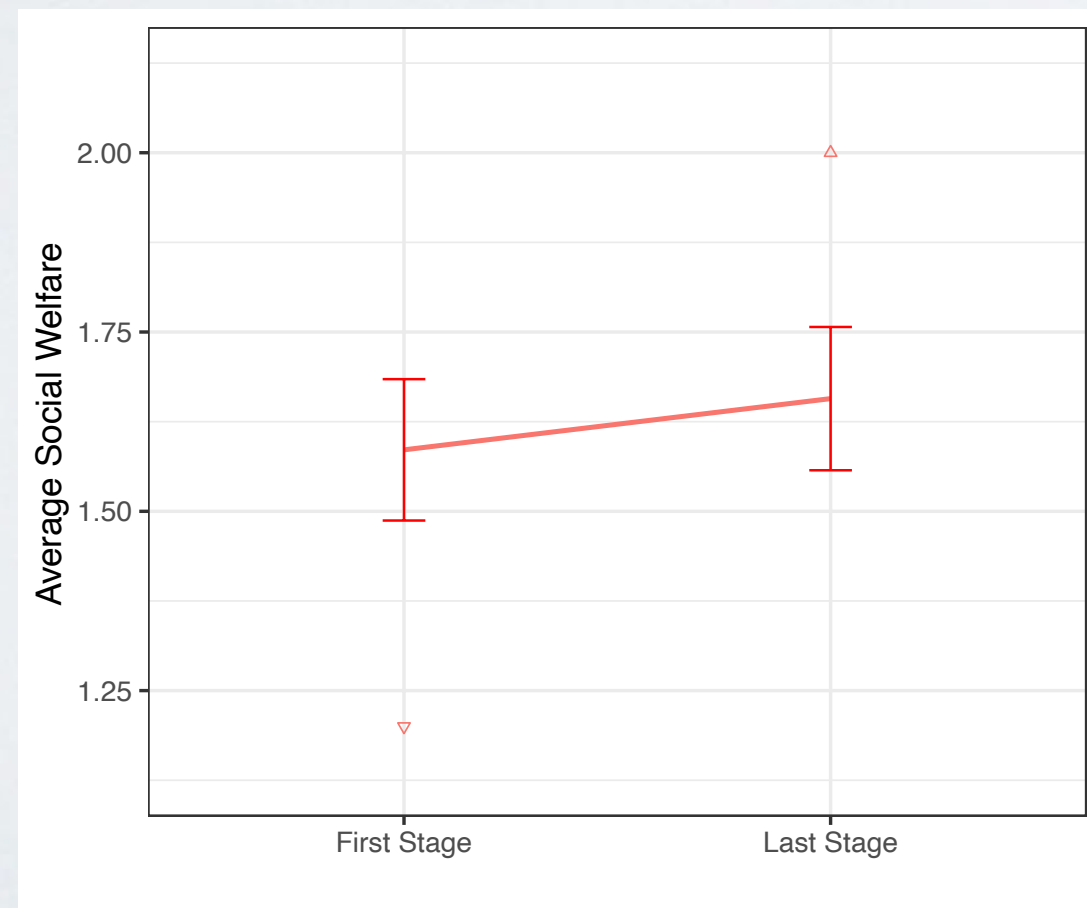
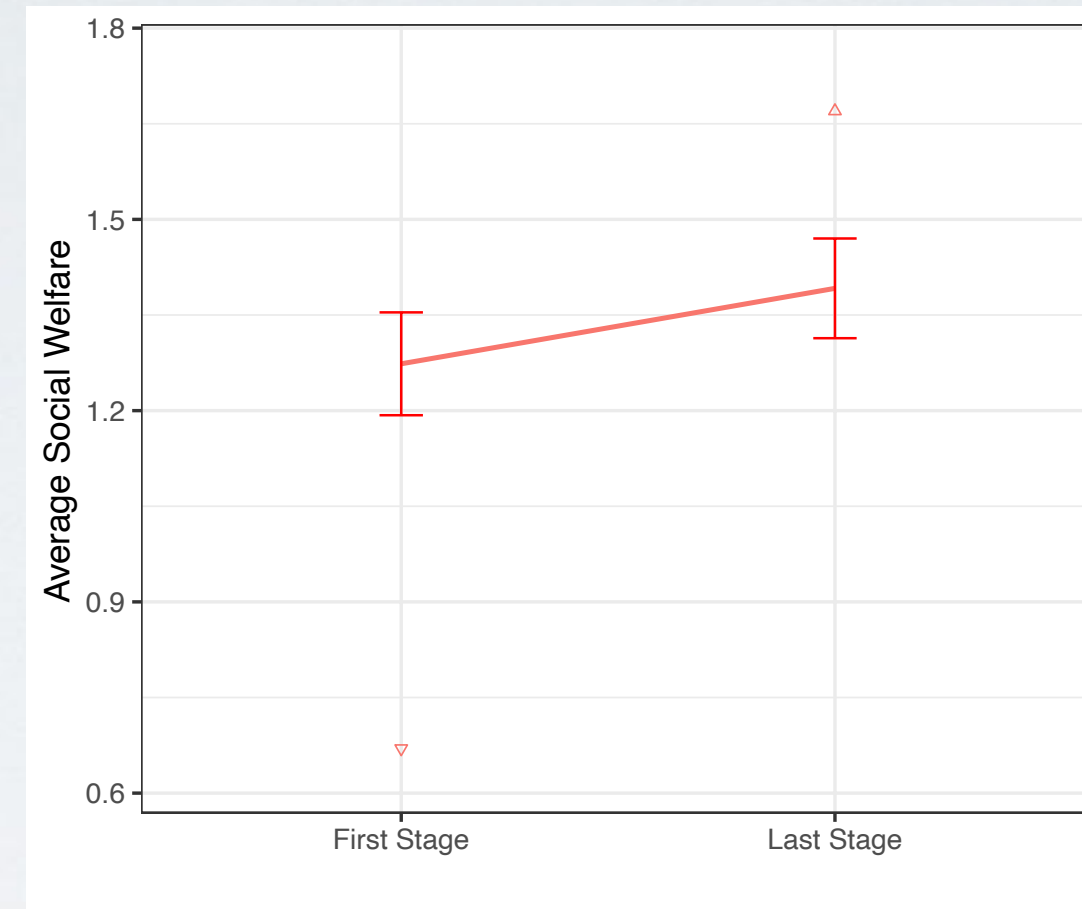
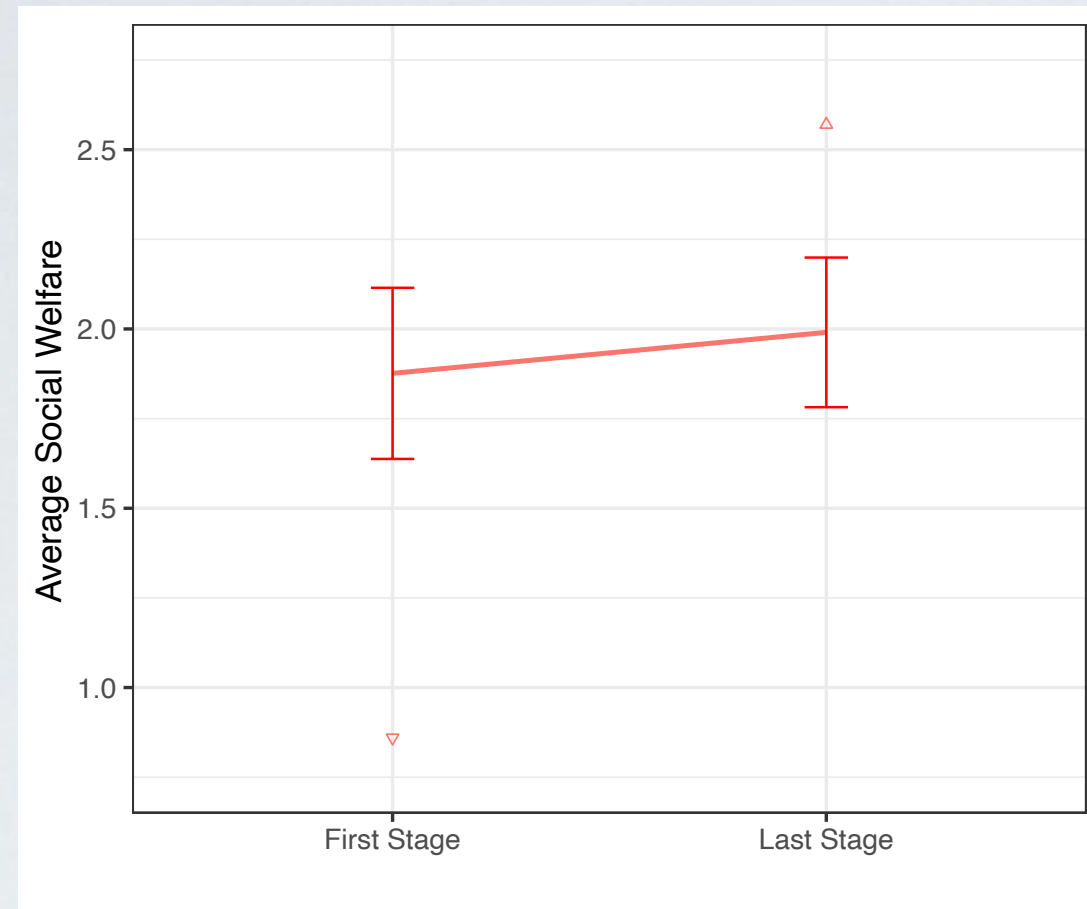
Tour 3:
2 votes pour **Haut**.
5 votes pour **Bas**.
5 votes pour **Gauche**.
2 votes pour **Droite**.
Le vainqueur est : Bas Gauche

Tour 2:
5 votes pour **Haut**.
2 votes pour **Bas**.
5 votes pour **Gauche**.
2 votes pour **Droite**.
Le vainqueur est : Haut Gauche

Tour 1:

4 one-shot elections, 5 iterative elections, 147 subjects

COLLECTIVE EFFECT



In **four out of five** iterated profiles there was a significant increase in social welfare in iteration

Yet to be explored for Condorcet efficiency

2. COLLECTIVE GOVERNMENT PROGRAM

proposals that unite and proposals that divide

Algorithmic design research question: We know 10+ rules to compute the candidate that is **most-agreed** upon by an electorate. How about computing the candidates that are the **most-divisive**?

Navarrete et al. Understanding political divisiveness using online participation data from the 2022 French and Brazilian presidential elections. Nature Human Behaviour, 2023

Colley et al. Measuring and Controlling Divisiveness in Rank Aggregation. Proceedings of IJCAI 2023

BRAZUCRACIA AND MONPROGRAMME

Propositions

Toutes les propositions | Emploi & Economie | Environnement et Energie
Finances Publiques & Dettes | Fiscalité | Fonction Publique
Gouvernance & Republique | Interieur, Defense & Justice | Politiques Publiques
Social & Solidarité | Territoires & Collectivités

Emploi & Economie

- Allonger le congé paternité à la même durée que le congé maternité
- Augmenter le SMIC
1400€ net par mois | 1500€ net par mois
- Baisser les charges des indépendants
- Imposer un contrat de travail salarié pour les travailleurs des plateformes en ligne (livraison à domicile, véhicule avec chauffeur etc.)
- Interdire tout écart de salaire supérieur à un rapport de 1 à 20 dans une entreprise

Êtes-vous d'accord avec ces propositions ?

- Accélérer les procédures judiciaires: jugements en moins de six mois pour les délits du quotidien et en moins de 15 jours pour les violences conjugales blanc
- Redistribuer une partie des fonds publics alloués aux villes pour soutenir les zones rurales blanc
- Accroître l'industrialisation du pays blanc
- Elire l'Assemblée Nationale au scrutin proportionnel blanc

Suivant

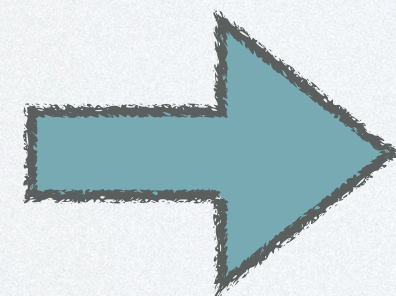
Notre Programme

Voici maintenant les propositions préférées par les 1643 personnes qui ont participé. (objectif: 10 000 personnes)

- 1 Créer des emplois dans les hôpitaux publics
- 2 Consacrer 3 % du PIB à la recherche et au développement
- 3 Comblers les déserts médicaux
- 4 Interdire les pesticides jugés dangereux par l'Autorité Européenne de Sécurité des Aliments
- 5 Développer une fiscalité décourageant l'obsolescence programmée
- 6 Investir pour entretenir et reconstruire les lignes de chemin de fer locales

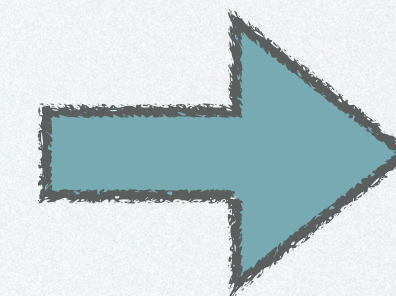
Collect proposals

120 proposals from presidential candidates' programmes



Elicit preferences

“Fallback” ballots: first approve out of X proposals then rank them (plus previous)



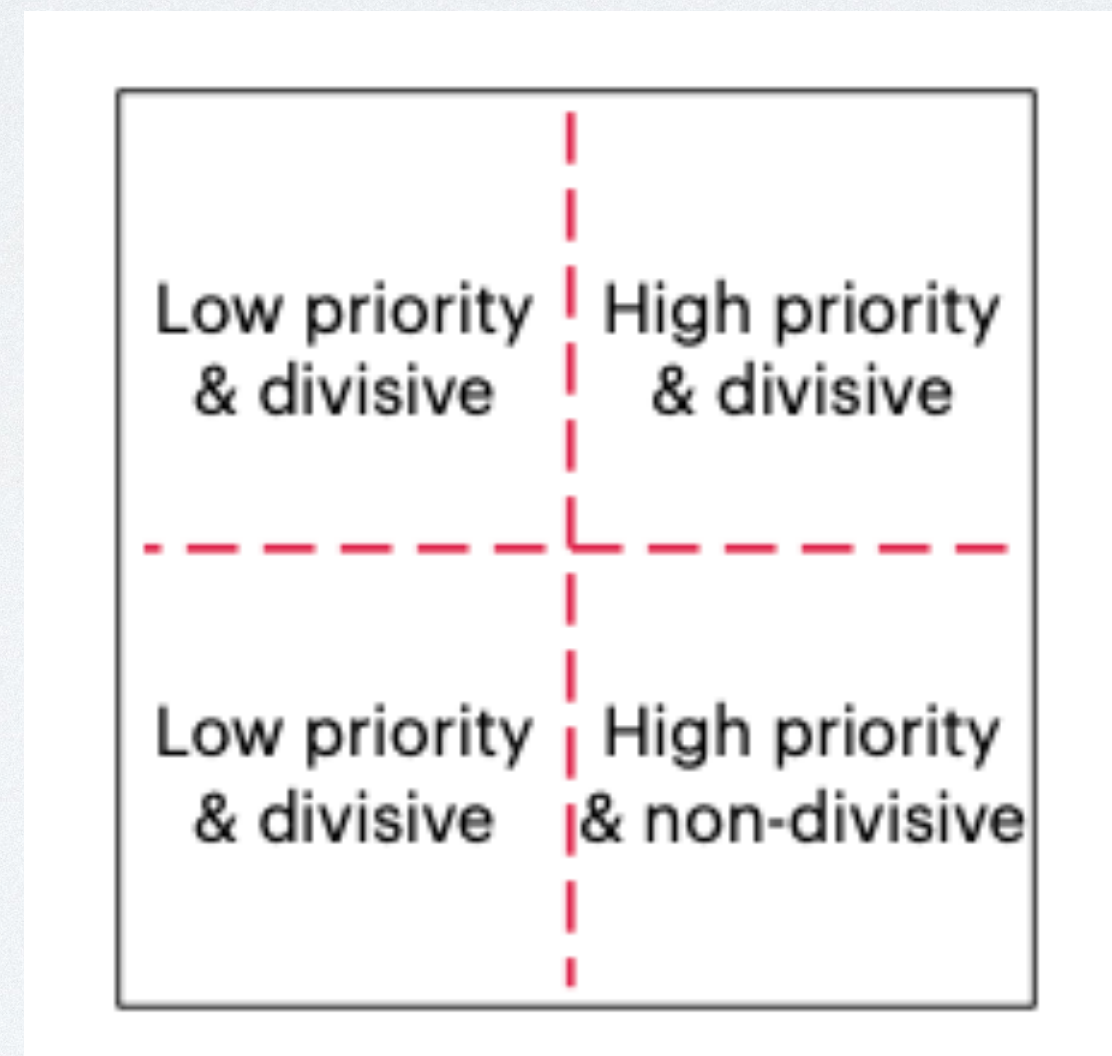
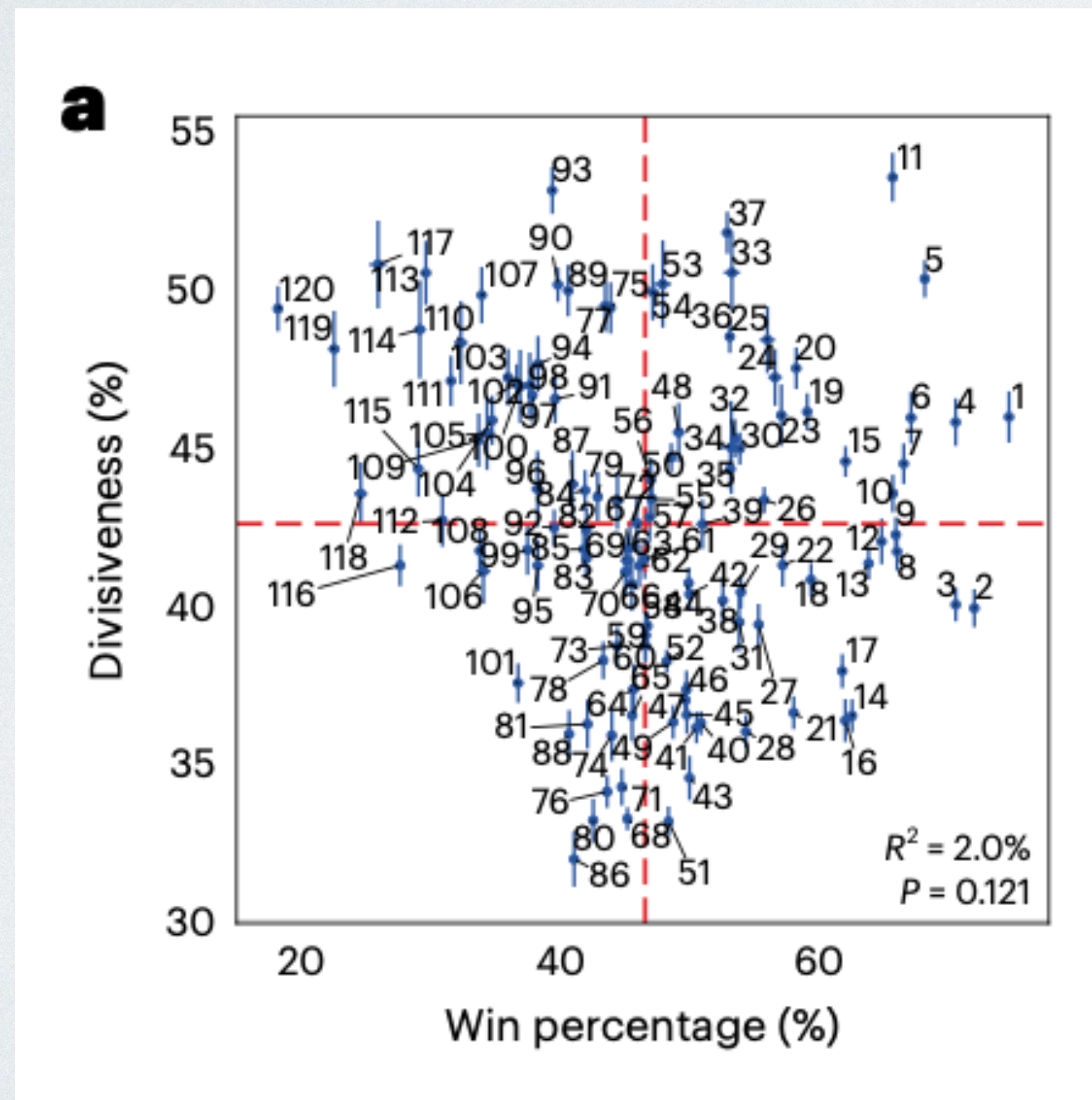
Collective government program

Basically using Borda (=Thurston's comparative judgments)

DIVISIVE AND POPULAR ISSUES

We computed the most popular issues but also the most **divisive**, using an innovative formula

We found that popularity and divisiveness rankings are two axis to interpret the space of collective preferences



Propositions clivantes

Voici les propositions les plus clivantes d'après les préférences exprimées par 1974 personnes. (objectif: 30 000 personnes)

- 1 Créer un nombre important de postes de policier et de gendarmes
- 2 Rembourser le processus de transition médicale des personnes transgenres
- 3 Augmenter le budget de la recherche et du développement militaires
- 4 Expulser les délinquants étrangers à l'issue de leur peine

In Monprogramme2022 | 606 users responded

JUMP INTO A FUTURE

Why stopping at algorithmic design for humans?



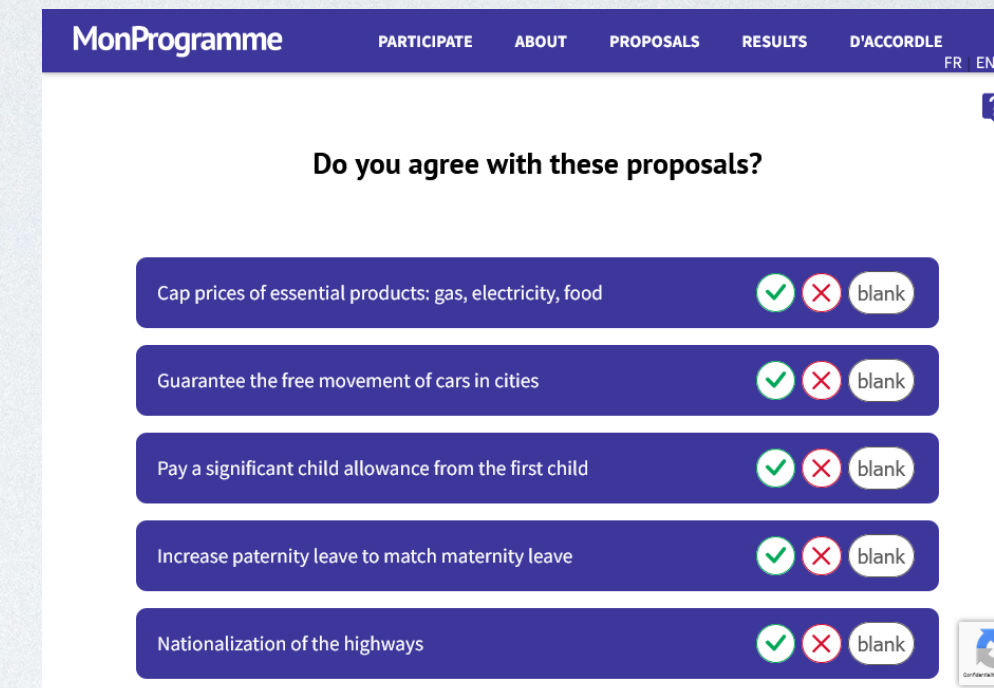
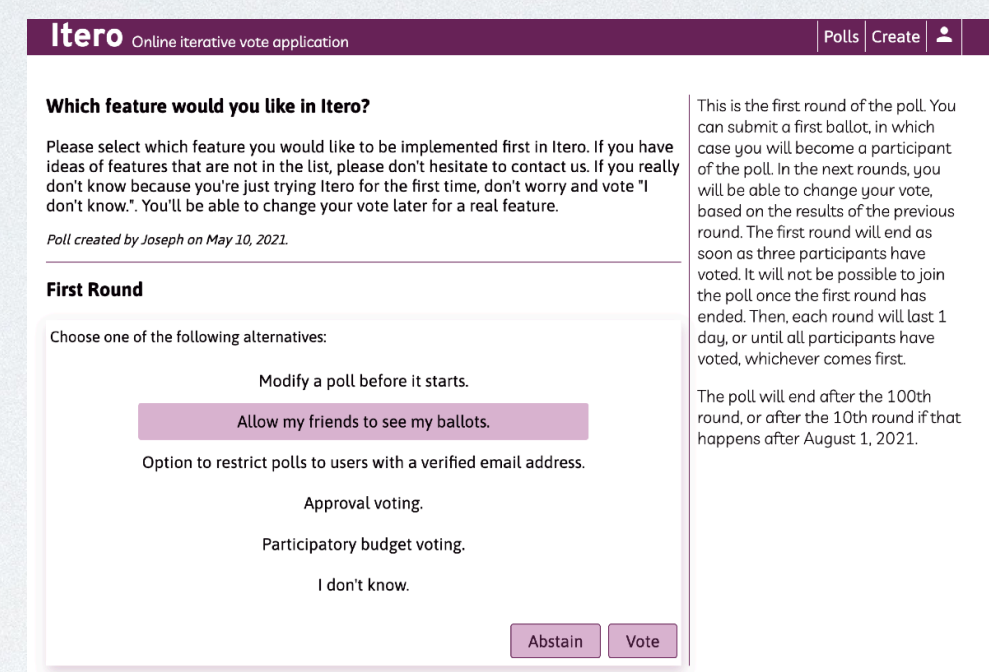
Picture from www.peopledemocracy.com

Further material:

- U. Grandi. Agent-mediated social choice. *The Future of Economic Design*, 2019
- C. Hidalgo. A bold idea to replace politicians. *TED Talk*, 2018

CONCLUSION

This presentation: 3 examples of algorithmic design for collective decision making



Related questions in legal research:

- comparative studies of democratic innovation regulations,
- work with “constitutionalists” for electoral applications (majority judgement vs two-step approvals)
- legal concept of voting platform and legitimacy of electronic participation
- smart contracts and blockchain implementations of collective decisions