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Combining the third vote with traditional elections

by Andranik S. Tangian

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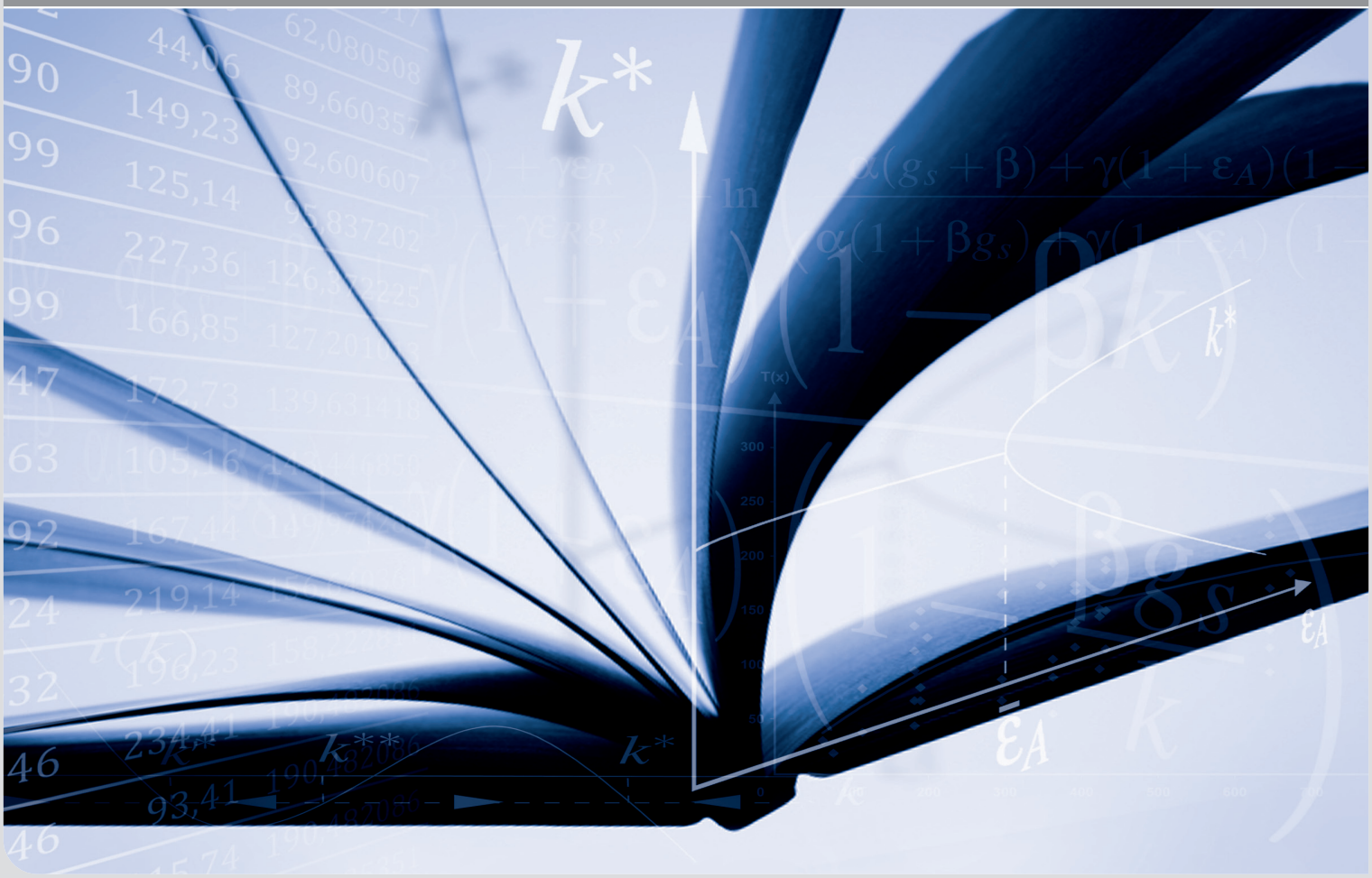

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Combining the Third Vote with Traditional Elections

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Abstract

The German two-vote election system implements two historical conceptions of political representation coined at the end of the 18th century during the American and French Revolutions. The descriptive conception — the parliament portrays the society in miniature — is implemented in the first vote with which local candidates are delegated to the federal parliament. The agent conception — the parliament consists of people's trustees who are not necessarily their countrymen — is implemented in the second vote for a party. The recent conception of representation, policy representation — how well the party system and government represent policy preferences of the electorate, is supported by no election instrument, and the Third Vote election method just aims at filling in this gap.

Under the 'Third Vote', the voters cast no votes but are asked about their preferences on policy issues as declared in the party manifestos (like in VAAs — voting advice applications, e.g. German *Wahl-O-Mat*: Abolish Euro?—Yes/No; Leave NATO?—Yes/No, etc.). Then the policy profile of the electorate with the balance of public opinion on every issue is determined. The degree to which the parties match with it is expressed by the parties' representativeness indices of popularity (the average percentage of electors represented on all the issues) and universality (the percentage of cases when a majority is represented), and the parliament seats are distributed among the parties in proportion to their indices. The voters are no longer swayed by politicians' charisma and communication skills but are directed to subject matters behind personal images and ideological symbols. The focus on choice properties (political and economic implications of elections, or of single decisions like Bexit or involvement in a new war) is supposed to make vote less emotional and superficial but more rational and responsible, aiming finally at a 'more democratic' representative democracy.

The Third Vote has been approbated and improved during the 2016, 2017 and 2018 elections to the Student Parliament (StuPa) of the Karlsruhe Institute of Technology (KIT). In the 2016 experiment, the policy questions for the electoral ballots have been taken from the *StuPa-O-Mat* — the KIT adaptation of the *Wahl-O-Mat* to the StuPa elections. However, the questions proposed by the election committee can be favorable for one party and unfavorable for another, making elections manipulable. To avoid impartiality in the 2017 experiment, the competing parties have formulated the questions themselves on their own responsibility — as an element of the electoral campaign, then all the parties have answered all the questions, and finally an optimization model has selected 25 ones to maximally contrast between the party positions. A more sophisticated optimization model in the 2018 experiment has shown even better results.

This paper has three subjects. The first one is the Third Vote's equalization effect: an unusually small ratio of the resulting parliament faction sizes, which is surmounted by the Third Vote Plus — a minor modification of the Third Vote. The second subject is combining the Third Vote and Third Vote Plus methods with traditional elections. The third subject is comparative evaluation of three optimization models to select questions. Due to these advances, the Third Vote can be considered an election-ready prototype of a voting method either for use alone or for integration into existing election systems.

Keywords: Policy representation, representative democracy, direct democracy, elections, coalitions, theory of voting.

JEL Classification: D71

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Contents

1 Introduction **1**

2 The 2018 Official and Experimental Elections to the KIT Student Parliament **5**

3 Policy Representation by the Student Parties and the Student Parliament **9**

4 Evaluation of Coalitions **21**

5 StuPa's Political Spectrum **26**

6 Optimal Selection of Questions **30**

7 Evaluation of Optimal Selections of Questions **33**

8 Conclusions **40**

9 Appendix: Detailed Tables 10 and 11 **41**

1 Introduction

The Third Vote After the introduction of the Third Vote election method in [Tangian 2014, Tangian 2017b], it has been approbated in three experimental elections to the Student Parliament (StuPa) of the Karlsruhe Institute of Technology (KIT). The public response to the experiments helped to improve the methodology and to resolve implementation problems. The most stimulating feedback was from the *World Forum for Democracy*, Council of Europe, Strasbourg, 2016, where a video documentary on the first experiment has been demonstrated [World Forum for Democracy 2016]; see also the experiments' web-page [Third Vote 2019].

Under the Third Vote, the individuals cast no votes but are asked about their preferences on policy issues as declared in the party manifestos (like in VAAs — voting advice applications, e.g. German *Wahl-O-Mat*:[1] Abolish Euro?—Yes/No; Leave NATO?—Yes/No, etc.). Then the policy profile of the electorate with the balance of public opinion on every issue is defined. The degree to which the parties match with it is expressed by the parties' indices of popularity (the average percentage of electors represented) and universality (the percentage of issues when a majority is represented), and the parliament seats are distributed among the parties in proportion to their indices.

Historical Roots and Current Context What is the need in such an election method? The contemporary representative democracy has been conceptualized at the late 18th century during the American and French Revolutions. The founding debates focused primarily on two questions: *Who should be represented?*, i.e. who is entitled to vote (males or also females, with which civil and property status, etc.) and *Who can be a representative?* (sons of the constituency or all trusted citizens, taxpayers of a certain level, etc.). The question *What should be represented?*, i.e. which policies must be pursued on behalf of the electorate and how well the political system should represent the electorate's policy preferences, was of secondary importance. Indeed, at that time the electorate was concerned with very few political things like taxation or security, topics like foreign affairs or university regulations were for most people of little interest, and many currently debatable matters like social security or environmental protection did not yet exist. Since population's activities were mainly local and the government operated at a higher level, politicians made decisions with a limited accountability to the electorate.

Now globalization expands beyond national boarders and, on the other hand, profoundly affects individual households. The society becomes significantly more advanced and more politicized. The electorate is better educated, comprehensive information is easily available, and political engagement is fueled by numerous medias and social networks. In elections, however, the question *Who?* still outbalances the question *What?*, and voting for candidates or parties by name bears some of the responsibility for that. People often pay more attention to the personal image of politicians than to party manifestos or even ideological platforms and, casting votes that are actually in opposition to their own policy preferences, elect those who do not represent their interests.[2] Being re-elected, the government continues to pursue unpopular polices, people are dissatisfied and protest, often massively and sometimes violently, against the government elected by themselves — not a theoretical but practical democratic paradox often referred to as 'democratic deficit' [European Union 2017, United Nations 2016].

Three Conceptions of Representation — Three Votes It is not surprising that the question *What?* is not articulated in classical conceptions of political representation; see [Pitkin 1967,

[1] *Wahl-O-Mat* — an invented word constructed of *Wahl*—election and *Automat*, something like 'Electomat'; for description and explanations see [Bundeszentrale für politische Bildung 2019].

[2] This phenomenon of irrational voting behavior and this type of election failure are analyzed in [Tangian 2013, Tangian 2017a, Tangian 2017e] using as examples the 2013 and 2017 German federal elections, respectively.

Manin 1997]. The major two conceptions are implemented in the German two-vote system. The descriptive conception — the parliament portrays the society in miniature[3] — is implemented in the first vote with which local candidates are elected and delegated to the federal parliament. These direct mandate holders from 299 German constituencies fill 299 Bundestag seats.

The agent conception — the parliament is a committee of political experts who are people's trustees and don't have to be their countrymen[4] — is implemented in the second vote for a party. This vote is used to define the Bundestag faction ratio. For this purpose, another 299 Bundestag seats are allocated and, if necessary, extra seats (overhang mandates) are added.

In the 1960s, academics started to discuss policy representation — how well the party system and government represent policy preferences of the electorate.[5] In 1989, this idea had been unknowingly used in the Dutch voting advice application *StemWijzer* (= 'VoteMatch') [Pro demos 2019] which model launched in 1998 in internet was taken over by some other countries [Garzia and Marschall 2014]. This third conception of representation is still not implemented in elections, and the Third Vote method just aims at filling in this gap. Under the Third Vote, the electors are no longer swayed by politicians' charisma and their communication skills but are directed to subject matters behind personal images, ideological symbols and gender, cultural or other prejudices. The focus on political and economic implications of choice is supposed to make vote less emotional and superfluous but more rational and responsible.

The Third Vote also contributes to attaining some of the United Nations Sustainable Development Goals [United Nations 2015] that make a special emphasis on social and technical challenges of digitalization [OECD 2017, Van der Velden 2018]. Within digitalization, there are so-called artificial life projects of replacing certain human functions by intelligent robots, e.g. for distant space missions from where signal exchange with the Earth can take hours and which therefore need comprehensive automatic control. The interactions between agents/units in the digital society and artificial life simulate that among people, and when the system size is large, the democratic organizational principles become highly relevant. The Third Vote approach can help in operationalizing the notion of representation and its hierarchical implementation.

Background Political Philosophy The traditional vote and the Third Vote differ in political philosophy. In traditional elections, each voter aggregates his/her partial judgements and chooses the favorite candidate. Since the election winner is derived form individual choices, this approach implements the liberal philosophy of *individual determination* in the sense of [Locke 1689]. Under the Third Vote, the electorate is considered a single body with a public profile constituted by balances of public opinion on each issue. The election winner is determined by the closeness of his/her profile to this *single* public profile. Thereby, the Third Vote implements the collectivist philosophy of *public determination* in the sense of *general will* of [Rousseau 1762]. It should be noted that VAAs (like the *Wahl-O-Mat*) use the same data structure as the Third Vote but, advising optimal candidates to vote for, follow the philosophy of individual determination.

[3]The descriptive conception has been particularly defended in America by John Adams (1735–1826, 2nd President of the US) and in France by Honoré Gabriel de Mirabeau (1749–1791, French Revolution politician).

[4]The agent conception has been developed in America by Alexander Hamilton (1755–1804, 1st US Secretary of the Treasury) and James Madison (1751–1836, 4th President of the US) and in France by Emmanuel Sieyès (1748–1836, clergyman and constitutional theorist).

[5]Policy representation is particularly discussed by [Miller and Stokes 1963, Monroe 1979, Bartels 1991, Hartley and Russett 1992, Stimson et al. 1995, Wlezien 1995, Wlezien 1996, Monroe 1998, Miller et al. 1999, Sharpe 1999, Smith 1999, Powell 2000, Budge et al. 2001, Soroka 2003, Wlezien 2004, Klingemann et al. 2006, Budge and McDonald 2007, Cerami 2007, Soroka and Wlezien 2010, Volkens et al. 2013]. To monitor policy representation in modern democracies, a special database is created within the prize-winning *Manifesto* project (Berlin), aimed at 'quantitative content analysis of parties' election programs from more than 50 countries covering all free, democratic elections since 1945' [WZB 2019].

The traditional vote and the Third Vote can lead to different outcomes. Let us imagine that Brexit is characterized by its three major consequences: Immigration restriction, Closing the Irish border and Economic recession/Pound devaluation, and that three equally large groups of British have the profiles of their attitudes toward these consequences shown in the table below. The first group prefers to keep the current situation, the second and third groups will restrict immigration but differ in what they are ready to pay for it.

Brexit implications	Attitude profiles				Majority	Public
	1	2	3		choice	profile
Immigration restriction	−	+	+	→		+
Closing the Irish border	−	+	−	→		−
Economic recession/Pound devaluation	−	−	+	→		−
	↓	↓	↓			
Votes for Brexit	−	+	+	→	+	↓
Public opinion on Brexit						−

Traditional vote operates in the order $\downarrow\downarrow\downarrow \rightarrow$: each individual aggregates his/her opinion profile which consists of partial judgements and makes his/her final choice. Then two of three groups vote for Brexit (+), and Brexit is approved (+). Under the Third Vote, the order of operations is $\rightrightarrows \downarrow$. The public profile consists of public attitudes toward each issue: one positive and two negative. After their aggregation, Brexit is not approved (−). Thus, we can assume that the Brexit crisis might be avoided if the Brexit referendum were based on the Third Vote principles instead of direct Yes/No-vote.

Concerns In [Tangian 2013, Tangian 2017a, Tangian 2017d], the Third Vote is hypothetically applied to redistribute seats in the 2009, 2013 and 2017 German Bundestags, respectively, achieving a significant gain in their representativeness. The electorate's policy profile is constructed from over 30 public opinion polls preceding the elections, and the party positions are taken from the 2009, 2013 and 2017 *Wahl-O-Mat*'s, respectively. Since the public opinion polls differ in the degree of reliability and relevance to the elections, the conclusions — as they are based on imperfect data — can be considered only with reservations. To judge more definitively the advantages of the Third Vote, it has been tested during the 2016, 2017 and 2018 StuPa elections. In the 2016 experiment, the policy questions for the electoral ballots have been taken from the *StuPa-O-Mat* — the KIT adaptation of the *Wahl-O-Mat* to the StuPa elections [Tangian 2016, Tangian 2017c]. As the *Wahl-O-Mat*, the *StuPa-O-Mat* is operated by a special committee whose members select questions assuming that certain criteria are met. However, questions proposed even by a supposedly neutral committee can be favorable for one party and unfavorable for another, making elections manipulable.

Another not obvious feature of the Third Vote is a so-called equalization effect: a small ratio of the parliament faction sizes. The equalization effect is explained as follows. Under traditional elections, parties are voted on by disjoint groups of their adherents of very different sizes, implying corresponding different sizes of party factions in the parliament. Under the Third Vote, the factions are proportional to the party popularity and universality indices. These indices take into account the size of groups represented by parties on each issue. Instead of many groups of party adherents, on every issue there are only 'Yes'-group and 'No'-group (not to count those who abstain) which are generally quite numerous. Since the groups of party adherents join (differently on each issue), they provide a larger support for weak parties. In other words, the indices reflect the full representativeness of the parties and cannot be therefore considered inadequate, although the equalization of factions looks unusual.

Finally, some voters identify themselves with certain parties and would prefer to continue to vote by party name. This requirement rises the question about the combination of the Third Vote with traditional election methods.

Improvements and Integration in the Existing Election Systems To avoid impartiality in preparing questions for the 2017 experiment, the competing parties have formulated the questions themselves on their own responsibility within the electoral campaign. Then all the parties have answered the collected 94 questions, and an optimization model has selected 25 ones to maximally contrast between the party positions [Tangian 2017e]. In 2018 a more sophisticated optimization model showed even better results [Tangian 2018]. Thereby, the manipulability of the Third Vote is avoided.

The equalization effect can be tackled by removing 'negative representativeness' from consideration. We recall that if a party represents majorities and minorities with equal chances, e.g. the representation of public opinion is decided by tossing a coin, its expected popularity and universality are equal to 50%. The values below this threshold mean that the party is 'more non-representative than representative'. Therefore, we can consider only the 'positive representativeness' — the index segments beyond the threshold of 50%. The replacement of the full indices with their 'positive' segments results in greater parliament faction ratios under the Third Vote, resembling the ones under traditional elections by party name. Such a modification of the Third Vote is called 'Third Vote Plus' or shortly '3rd Vote+'.

Combining the Third Vote with the traditional election by candidate/party name is also possible. It is attained by merging the indices with which the parliament seats are partitioned. Under traditional elections, the seats are distributed in proportion to the index 'percentage of votes'. The Third Vote operates with the indices of representativeness in the same way. To make both indices commensurable, the parties' representativeness indices are normalized, i.e. proportionally reduced to the total of 100%. Then the (weighted) mean of the percentage of votes and the normalized representativeness can be used to allocate the parliament seats.

Due to these advances, the Third Vote can be considered election-ready prototype of a voting method either for use alone or for integration into existing election systems.

Structure of the Working Paper We illustrate these techniques using the data from the 2018 electoral experiment. At first we explain all the notions for the Third Vote based on 30 questions. After that we simulate Third Vote elections with shorter questionnaires extracted from the initial one by three optimization models. Having compared the outcomes, we make recommendations for practical applications.

Section 2, 'The 2018 Official and Experimental Elections to the KIT Student Parliament', describes the students' self-organization in the KIT, introduces student parties and summarizes the outcomes of the 2018 StuPa elections, both official and experimental.

In Section 3, 'Policy Representation by the Student Parties and the Student Parliament', the indices of popularity and universality, both of the student parties and the StuPa, are computed from the experiment data. We consider a modification of the Third Vote, Third Vote Plus, and explain how the Third Vote methods are combined with traditional elections by party name.

In Section 4, 'Evaluation of Coalitions', the representativeness of eligible coalitions in the StuPa, as if elected using the experimental ballots, is estimated. Although the StuPa does not practice coalition building, this analysis of general interest reveals the parliament potential.

In Section 5, 'StuPa's Political Spectrum', we construct the StuPa party space and contiguous ordering of the student parties which reflects their left–right orientation. Preservation of the political spectrum is important while reducing the Third Vote questionnaire.

In Section 6, 'Optimal Selection of Questions', the problem of reducing the Third Vote questionnaire is considered and three models for finding optimal subsets of questions are introduced and applied.

In Section 7, 'Evaluation of Optimal Selections of Questions', 12 heuristic and optimal questionnaires are tested as if for StuPa elections by five methods. They are compared with regard to the representativeness of the resulting parliament and its most realistic coalitions and the preservation of the political spectrum.

In Section 8, 'Conclusions', the main findings are recapitulated and put into the context.
Section 9, 'Appendix', contains extended versions of two concise tables from the main text.

2 The 2018 Official and Experimental Elections to the KIT Student Parliament

The 2018 StuPa Election German student parliaments are university representative bodies established according to the laws of the corresponding German state. In the Karlsruhe Institute of Technology (KIT), the Student Parliament (StuPa) is constituted under the rules of the state of Baden-Württemberg. Its responsibilities include electing officers to the executive organ of the student body, AStA (*Allgemeiner Studierendenausschuss* = General Committee of Students), making decisions about the budget of the student body and participating in the university commissions and councils. During the semester, the StuPa meets bi-weekly and the meetings are open to the public [AStA 2018, StuPa 2018].

Elections to the StuPa are held every summer, and all the KIT students are eligible to vote. The 25 StuPa seats are distributed among student parties in proportion to the number of votes they receive in elections.[6] The 2018/19 StuPa consists of 25 members from six student parties, most of which are nationwide and some having international affiliations; see Table 1. Four of them, Juso, LHG, die Linke.SDS and die LISTE, are closely associated with and supported by German political parties. The RCDS is close to the CDU/CSU but declares its independence. Only the FiPS is completely autonomous, being a local student organization of the KIT. The German student organizations are not strictly affiliated with the aforementioned political parties, as they have discrete historical roots. They prefer to call themselves 'a group', 'an alliance', 'a list', 'an association' or even 'a faculty experience', thereby emphasizing relaxed forms of relations and/or no self-identification as real parties.

Of the 23,118 students eligible to vote, 3,512 took part in the election and cast 3,496 valid ballots including 144 abstentions; 16 were deemed invalid. Thus, the turnout was 15.2%. The results are displayed in Table 1, and the complete official report is downloadable from [Endgueltige Wahlergebnisse 2018, p. 14]. For more information about the StuPa and the 2018 StuPa election see the KIT student journal [Ventil 2018].

The 2018 *StuPa-O-Mat* The AStA webpage has a link to the *StuPa-O-Mat*, the KIT adaptation of the *Wahl-O-Mat* to the StuPa election. Previously, the *StuPa-O-Mat* questions have been formulated by the election committee. Since 2017, the parties are asked to formulate questions themselves, as well as to answer all of them, including the questions by other parties. In 2018, the parties' questions have been sorted by the election committee; the preselected 37 with the party answers are displayed in Table 2. (For the parties' comments to their answers in German and English see [Tangian 2018, Appendix, pp. 45–119]). Questions 32–37 with unanimous parties positions are omitted because they do not distinguish between the parties. Question 31, which poorly discriminates between the parties and, moreover, the party answers duplicate the answers to Questions 18 and 24, is also omitted. Of the remaining 30, the election committee has chosen 25 for the *StuPa-O-Mat*.

In fact, one would rather eliminate Questions 1, 3, 15, 19, 21 and 22 with almost unanimous party positions (excluding abstentions, the definitive positions are all equal). The remaining 24 'essential' questions are considered later as an alternative to the 25 *StuPa-O-Mat* questions.

[6] The integer number of StuPa seats is finally partitioned using the method by [Saint-Liguë 1910], but we always refer to more accurate percentages of votes received by the parties. To avoid overhang mandates, faction members can be assigned not integer-valued but fraction-valued votes — an unconventional but mathematically natural solution.

Table 1: Results of the 2018 official and experimental elections of the KIT Student Parliament

Party logo	Party description	Official votes		Experimental votes					
				All		Not influenced by the StuPa-O-Mat		Influenced by the StuPa-O-Mat	
		Num	%	Num	%	Num	%	Num	%
	FiPS (Fachschaftserfahrung im Parlament der Studierenden = Faculty Experience in the Parliament of Students). A local student organization of the KIT, independent of established political parties; dedicated, close to students [FiPS 2018].	936	27.9	319	27.3	224	31.2	95	21.2
	Juso (Jung Sozialisten = Young Socialists); the youth wing of the SPD (Social Democratic Party of Germany. Promotes freedom, equality and solidarity, open discussion, democracy in all parts of society, having an impact on all parts of society; representation in many forums [Juso 2018].	843	25.1	264	22.6	173	24.1	91	20.3
	Die Linke.SDS (Die Linke. Sozialistisch-Demokratischer Studierendenverband = The Left. Social Democratic Students' Alliance). The student organization of DIE LINKE = The Left. Promotes a more social, ecological, feminist and sustainable university; separation between economic system and research; supports students with social projects [Linke.SDS 2018].	596	17.8	237	20.3	113	15.7	124	27.6
	LHG (Bundesverband Liberaler Hochschulgruppen = Federal Association of Liberal Student Groups). Associated with the FDP (Free Democratic Party). Liberal, ideology-free [LHG 2018].	408	12.2	154	13.2	85	11.8	69	15.4
	Die LISTE (Liste für basisdemokratische Initiative, Studium, Tierzucht und Elitenbeförderung = List for Grassroots Democratic Initiatives, Education, Animal Breeding and Promotion of Elites), the youth organization of Die PARTEI (Partei für Arbeit, Rechtstaat, Tierschutz, Elitenförderung und basisdemokratische Initiative = Party for Labor, Rule of Law, Animal Protection, Promotion of Elites and Grassroots Democratic Initiative), a party with parodical character. Promotes humanization of studies, solidarity and egalitarianism, particularly among students of different graduation levels [LISTE 2018].	314	9.4	110	9.4	61	8.5	49	10.9
	RCDS (Ring christlich-demokratischer Studenten = Association of Christian Democratic Students). Stands politically near the German conservative union CDU/CSU (Christian Democratic Union/Christian Social Union in Bavaria). Promotes pragmatic and factual thinking, representing the student body without ideological influence; aiming for an ideal development for learning and teaching; strives for greatest possible impact for students [RCDS 2018].	255	7.6	84	7.2	63	8.8	21	4.7
	Total	3352		1168		719		449	

Source for official votes: [Endgueltige Wahlergebnisse 2018, p. 14]

Table 2: The 2018 KIT student party positions on 37 questions preselected by the election committee: +[1]—Yes, −[1]—No, ?—Neutral or missing

Questions preselected by the election committee (the StuPa-O-Mat question numbers are in parentheses)		Party positions (**B**)					
		FiPS	Juso	Linke	LHG	LISTE	RCDS
1(3)	*Improve intra-campus transportation.* Public transportation between campus south and campus north should be improved.	+	+	+	?	?	+
2(6)	*Female quota.* The KIT should establish a comprehensive womens quota for staff members.	?	+	+	−	−	−
3(1)	*Study fees.* There should be study fees.	?	−	−	?	−	−
4(24)	*Vegan meals.* The canteen & cafeteria should extend their offers of vegan and sustainable meals.	?	+	+	?	−	−
5(19)	*No study duration limit.* The maximum period of study should be abolished.	−	?	+	−	+	−
6(17)	*Guaranteed master places.* There should be a master program guarantee for KIT intern applicants.	+	−	+	+	+	+
7(7)	*Guaranteed childcare places.* There should be a guaranteed childcare place for every KIT-member (students included) on the campus.	+	+	+	+	−	+
8(2)	*Off-peak ticket.* There should be a Baden-Württemberg-wide evening and weekend ticket with the semester fee.	−	?	?	−	+	−
9(8)	*Restrict commercial advertisement.* There should be a smaller amount of commercial promotions on the campus.	+	?	+	−	−	+
10	*Lecture halls for courses only.* The student parliament should constitute that symposia and conferences do not use lecture hall capacities.	+	?	?	?	−	−
11(12)	*Financing the student body house from student fees.* A part of the student fee (currently 5,99 EUR) should be used for financing a house of the student body. These rooms would be used for institutions of the student parliament (committees, student groups, etc.)	+	+	+	−	+	+
12(13)	*Student funds for the campus ecology.* Student funds should be used for the ecological shaping of the campus.	−	?	+	−	?	−
13(4)	*The campus should become a traffic-calmed sector.* This would mean to introduce walking speed for the entire vehicle traffic (cars, motorcycles, bikes, etc.).	−	−	+	−	−	−
14(25)	*Lower mensa prices.* Prices in the Cafeteria and the Mensa should be cut.	+	?	?	+	−	+
15	*Larger bike parkings.* More parking slots for bikes should be provided in front of the library and the lecture halls.	+	+	+	?	+	+
16(9)	*Hall for cultural events.* The KIT should provide an event hall (like the garden hall) for student cultural events.	+	?	+	?	−	−
17(14)	*Expense allowances for the student body.* For elected persons of the constituted student body, it should be possible to receive a expense allowance.	−	?	?	−	−	+
18(15)	*Emergency scholarships.* The constituted student body should introduce an emergency scholarship for students who reached short term and not self-inflicted pleite situation.	+	+	+	+	+	−

Continued next page...

Table 2: **(continued)** The 2018 KIT student party positions on 37 questions preselected by the election committee: +[1]—Yes, −[1]—No, ?—Neutral or missing

Questions preselected by the election committee (the StuPa-O-Mat question numbers are in parentheses)		Party positions (**B**)					
		FiPS	Juso	Linke	LHG	LISTE	RCDS
19(16)	*Digitalization of teaching.* The AStA should actively promote the digitalization of teaching. For example: lecture notes, webinars, online platforms, etc.	+	?	+	+	+	+
20(18)	*Career aiming courses.* The courses at KIT should be designed for a quick career entry.	?	?	−	?	−	+
21	*Performance-dependent expense allowances for AStA.* The expense allowance for AStA-referents should be reduced if a referent does not fulfill his tasks.	+	?	?	+	+	+
22	*Engagement against extremism.* The constituted student body should be more involved against extremism of any kind.	+	+	?	+	+	+
23(11)	*Lower student fee.* The student contribution (currently 5,99 EUR) should be lowered.	−	−	?	+	?	+
24(22)	*Anonymous exams.* Exams at the KIT should be written anonymously.	+	+	+	+	+	−
25	*Student body representation in the Senate.* The student body should be more strongly represented in the KIT Senate.	+	+	+	−	?	+
26(23)	*More dormitory rooms.* The student parliament should stand up for more dorm rooms.	+	+	+	?	−	+
27(5)	*Civil clause.* The KIT - campus south included - should have a civil clause.	−	+	+	−	−	−
28(10)	*Student body political involvement.* The student parliament should further on be allowed to express itself to every political topic.	+	+	+	?	+	−
29(21)	*Exams on Saturdays.* To improve the lecture hall situation, exams should more often take place also on Saturdays.	+	−	−	+	−	+
30(20)	*More examination attempts.* The maximum number of examination attempts at the KIT should be increased.	−	+	+	−	+	−
31	*Uniform library breaks.* Uniform regulations for breaks should be introduced at all the KIT-libraries.	+	+	+	+	+	−
32	*Rooms for the student body.* More premises should be granted for the student parliament, also for permanent use.	+	+	+	+	+	+
33	*Removing bike wracks.* Bike wrecks should be removed on a regular basis.	+	+	+	+	+	+
34	*Open libraries on weekends.* Libraries of the faculties should be kept open also on weekends during the exam period, in order to loosen the learning place situation.	+	+	+	+	+	+
35	*Study semester abroad.* The constituted student body should be more committed to students who want to study abroad for a semester and promote it.	+	+	+	+	+	+
36	*More learning places on the campus.* The number of learning places on campus should be increased.	+	+	+	+	+	+
37	*Barrier-free classes.* All courses have to be barrier-free.	+	+	+	+	+	+

The 2018 Experimental Election During the official 2018 StuPa election on June 18–22, an experimental election was organized. Additionally to the official ballot, each voter was offered an experimental ballot with Questions 1–30, either in German or in English (for foreign students) to be filled in on voluntary basis; see Figures 1 and 2.[7] As in 2016 and 2017, the experimental ballot is entitled 'The Third Vote' because it complements the German two-vote system with an additional vote in the form of embedded referenda. The preamble to the ballot explains the goal of the experiment — and that it does not impact the official election. For analysis purposes, the ballot's Question 1.1 asks to indicate the party he/she votes for in the official ballot, and Question 2.1 specifies the degree to which the *StuPa-O-Mat* influences the choice. In the following analysis we reduce the four options to two: either the vote is influenced by the *StuPa-O-Mat* or not influenced. The following Questions 3.1–3.30 are the ones retained from the list of 37 questions.

Although many students were discouraged from participation in the experiment by the length of the experimental ballot's questionnaire, as many as 1,255 students have cast them. Some of students started to fill in the ballot but stopped after having answered a few questions, some might have answered questions rather irrationally (which was not possible to control), and a few equally abstained or equally positively answered to all the 30 questions, which could hardly be considered seriously. Finally, only 1,168 out of 1,255 experimental ballots were selected as valid for further processing. For more details on processing the ballots see [Tangian 2018].

3 Policy Representation by the Student Parties and the Student Parliament

Date Structure for Analysis The party answers to the 30 questions of the experimental ballot and statistics of positive/negative voters' positions are displayed in Table 3. The table is visualized by Figure 3. The grey bars depict the balance of opinions in three vote sets (all experimental votes, the influenced and the not influenced by the SzuPa-O-Mat). For each question and each set of votes, the grey segment to the left of the vertical 0-axis shows the percentage of antagonists, and the grey segment on the right hand shows the percentage of protagonists. To better visualize the majority opinion, the total length of the grey bar is normalized (proportionally extended to 100%) and shown by a box. The majority opinion is on the side where the box surpasses the ±50% limit. For instance, the majority opinion on Question 1 in all three vote sets is 'Yes'. The party positions are shown by the parties' color bars on the left-hand ('No') or right-hand ('Yes') side of the chart. The length of the party bars for each vote set is equal to the percentage of votes received by the party within this set. For a missing (neutral) party answer, its color bar is also missing.

Popularity and Universality of Student Parties Basing on the data collected, we evaluate the representativeness of student parties'. To be specific, let us construct the FiPS' popularity and universality indices for the set of all experimental votes. For Question 1, 'Improve intra-campus transportation…', the balance of public opinion with 28% of protagonists and 4% of antagonists (first line of Table 3) is shown by the upper grey bar in Figure 3. The balance of public opinion is normalized, that is, the grey bar is extended proportionally to 100%, as shown by the framing box. Thereby, we assume that abstaining voters' passive Yes/No positions are distributed in the proportion of the protagonist-to-antagonist ratio. For Question 1, the FiPS

[7]The formatting and scanning the experimental ballots have been done at the the KIT Strategic Development and Communication department's facility for processing questionnaires with teaching course evaluations by students.

EvaSys	Experiment - "The Third Vote" 2018	Electric Paper

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Korrektur: ☐ ■ ☐ ☒ ☐ Bitte beachten Sie im Interesse einer optimalen Datenerfassung die links gegebenen Hinweise beim Ausfüllen.

Das „the Third Vote“ Experiment zielt darauf ab, eine Alternative zum jetzigen Bundestagswahlsystem darzustellen. Durch die Einführung einer Drittstimme wollen wir die Idee von Prof. Andranik Tangian verfolgen, eine repräsentativere Demokratie zu schaffen. Diese zusätzliche Stimme soll ausschließlich eure Meinung zu bestimmten Themengebieten repräsentieren, um somit eine basisdemokratische Komponente in die Wahl mit einfließen zu lassen. So soll die politische Einstellung der Wähler gemessen werden. Diese wird mit der Einstellung der Parteien abgeglichen und soll sich auf das Wahlergebnis auswirken. Dadurch soll ein irrationales Wahlverhalten minimiert werden. Dank der erfolgreichen Ergebnisse der StuPa Wahl aus dem Jahr 2017 soll „the Third Vote“ auch in diesem Jahr bei der StuPa Wahl 2018 umgesetzt werden. Es soll unter anderem der Einfluss des StuPa-O-Mat auf die Wahlentscheidung der Wähler gemessen werden. Die Teilnahme an diesem Experiment ist vollkommen freiwillig, anonym und fließt NICHT in das diesjährige Wahlergebnis ein. Ergebnisse unsere Analyse werden unter www.studienwahl.econ.kit.edu veröffentlicht. Bei weiteren Fragen stehen euch während der Wahl Ansprechpartner an den Urnen zu Verfügung. Vielen Dank für eure Unterstützung!

1. Parteiliste

1.1	Welche Liste hast du auf deinem eigentlichen Wahlzettel gewählt?	☐ FiPs ☐ LHG	☐ Linke.SDS ☐ Die Liste	☐ JuSo ☐ RCDS

2. StuPA-O-Mat

2.1	Hast du den StuPA-O-Mat verwendet, um dich bei deiner Entscheidung zu beeinflussen?	☐ **Ja** ich habe ihn genutzt, dabei hat er mich bei meiner Wahl **beeinflusst.** ☐ **Nein,** ich habe ihn **nicht genutzt.**	☐ **Ja** ich habe ihn genutzt, dabei hat er mich bei meiner Wahl **wenig beeinflusst.**	☐ **Ja** ich habe ihn genutzt, allerdings hat er mich in meiner Wahl **nicht beeinflusst.**

3. Unipolitik

3.1	Die Verkehrsverbindung zwischen Campus Süd und Campus Nord soll verbessert werden.	positiv ☐	☐ negativ	☐ neutral
3.2	Das KIT soll eine flächendeckende Frauenquote für Mitarbeiter*innen einführen.	positiv ☐	☐ negativ	☐ neutral
3.3	Es soll Studiengebühren geben.	positiv ☐	☐ negativ	☐ neutral
3.4	In den Mensen & Cafeterien soll das Angebot an veganen und nachhaltigen Speisen ausgebaut werden.	positiv ☐	☐ negativ	☐ neutral
3.5	Die Maximalstudienzeit soll abgeschafft werden.	positiv ☐	☐ negativ	☐ neutral
3.6	Der Masterplatz für KIT-interne Bewerber* innen soll garantiert werden.	positiv ☐	☐ negativ	☐ neutral
3.7	Es soll für alle Kinder von KIT-Angehörigen, auch von Studierenden, einen garantierten Kita-Platz auf dem Campus geben.	positiv ☐	☐ negativ	☐ neutral
3.8	Ein durch einen verpflichtenden Semesterbeitrag finanziertes Baden-Württembergweites Feierabend und Wochenendticket soll eingeführt werden.	positiv ☐	☐ negativ	☐ neutral
3.9	Es soll weniger kommerzielle Werbung auf dem Campus geben.	positiv ☐	☐ negativ	☐ neutral
3.10	Die verfasste Studierendenschaft soll sich dafür einsetzen, dass Fachtagungen/-kongresse keine Hörsaalkapazitäten verwenden.	positiv ☐	☐ negativ	☐ neutral
3.11	Ein Teil des Studierendenbeitrags (aktuell 5,99 EUR) soll zur Finanzierung eines Hauses der Studierendenschaft verwendet werden. Dieses würde Räume für Organe der verfassten Studierendenschaft (Gremien, Hochschulgruppen etc) bieten.	positiv ☐	☐ negativ	☐ neutral

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Figure 1: The 2018 experimental electoral ballot in German (scanner-ready A4-double-sided)

EvaSys	Experiment - "The Third Vote" 2018	Electric Paper

3. Unipolitik [Fortsetzung]

3.12	Studentische Gelder sollen für die ökologische Gestaltung des Campus verwendet werden.	positiv ☐	☐ negativ	☐ neutral
3.13	Der Campus soll ein verkehrsberuhigter Bereich werden. Dies würde unter anderem Schrittgeschwindigkeit für den gesamten Fahrzeugverkehr (Autos, Motorräder, Fahrräder, usw.) bedeuten.	positiv ☐	☐ negativ	☐ neutral
3.14	Die Preise in der Cafeteria und der Mensa sollen gesenkt werden.	positiv ☐	☐ negativ	☐ neutral
3.15	Es sollen mehr Fahrradstellplätze an Hörsälen und vor der Bibliothek geschaffen werden.	positiv ☐	☐ negativ	☐ neutral
3.16	Das KIT soll für eine Veranstaltungshalle (vgl. Gartenhalle) für studentische Kulturveranstaltungen sorgen.	positiv ☐	☐ negativ	☐ neutral
3.17	Gewählte Personen der verfassten Studierendenschaft sollen eine finanzielle Aufwandsentschädigung erhalten können.	positiv ☐	☐ negativ	☐ neutral
3.18	Die verfasste Studierendenschaft soll ein Notlagenstipendium für Studierende, die kurzfristig und nicht selbst verschuldet in eine Notlage gelangt sind, einführen.	positiv ☐	☐ negativ	☐ neutral
3.19	Der AStA soll sich aktiv dafür einsetzen, dass die Digitalisierung der Lehre vorangetrieben wird. Zum Beispiel: Vorlesungsaufzeichnungen, Webinare, Onlineplattformen, etc.	positiv ☐	☐ negativ	☐ neutral
3.20	Die Studiengänge am KIT sollen auf einen schnellen Berufseinstieg ausgelegt sein.	positiv ☐	☐ negativ	☐ neutral
3.21	Die Aufwandsentschädigung für AStA-Referent*innen soll gekürzt werden, wenn ein Referent seinen Aufgaben nicht nachkommt.	positiv ☐	☐ negativ	☐ neutral
3.22	Die verfasste Studierendenschaft sollte sich mehr gegen Extremismus jeglicher Couleur engagieren.	positiv ☐	☐ negativ	☐ neutral
3.23	Der Studierendenbeitrag (aktuell 5,99 EUR) soll gesenkt werden.	positiv ☐	☐ negativ	☐ neutral
3.24	Klausuren am KIT sollen anonymisiert geschrieben werden.	positiv ☐	☐ negativ	☐ neutral
3.25	Die Studierendenschaft soll im KIT-Senat stärker vertreten sein.	positiv ☐	☐ negativ	☐ neutral
3.26	Die verfasste Studierendenschaft soll sich für mehr Wohnheimplätze einsetzen.	positiv ☐	☐ negativ	☐ neutral
3.27	Das KIT – auch der Campus Süd – soll eine Zivilklausel haben.	positiv ☐	☐ negativ	☐ neutral
3.28	Die verfasste Studierendenschaft soll sich weiterhin zu allen politischen Themen äußern dürfen.	positiv ☐	☐ negativ	☐ neutral
3.29	Klausuren sollen zur Verbesserung der Hörsaalsituation häufiger auch am Samstag stattfinden.	positiv ☐	☐ negativ	☐ neutral
3.30	Die maximale Anzahl an Prüfungsversuchen am KIT soll erhöht werden.	positiv ☐	☐ negativ	☐ neutral

Vielen Dank für Ihre Mitarbeit!

Figure 1: **(continued)** The 2018 experimental electoral ballot in German (scanner-ready A4-double-sided)

EvaSys	Experiment - "The Third Vote" 2018	Electric Paper

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"The third vote" is an experiment, in which we want to test the idea of Prof. Andranik Tangian aimed at making representative democracy more representative. With this alternative election method, the electorate's policy profile is measured using an additional elective vote. The policy profile of the electorate is compared with that of the candidate parties, and the degree to which they match determines the election result. In this way, we endeavor to overcome irrational behavior and voting partiality. Participation in the survey is completely voluntary, anonymous and has NO influence on the official election. Results of our analysis will be made available on www.studierendenwahl.econ.kit.edu for further questions, please do not hesitate to ask the election coordinators at the ballot boxes.

1. Party

1.1 Which party did you choose on the main ballot?

☐ FiPs ☐ Linke.SDS ☐ JuSo
☐ LHG ☐ Die Liste ☐ RCDS

2. StuPA-O-Mat

2.1 Did you use the StuPA-O-Mat?

☐ **Yes** he **influenced** me. ☐ **Yes** he **influenced** me **a little.** ☐ **Yes** but he did **not influence** me.

☐ **No, I did not** use it.

3. Campus Politics

3.1	Public transportation between campus south and campus north should be improved.	positive ☐	☐ negative	☐ neutral
3.2	The KIT should establish a comprehensive women´s quota for staff members.	positive ☐	☐ negative	☐ neutral
3.3	There should be study fees.	positive ☐	☐ negative	☐ neutral
3.4	The canteen and cafeteria should extend their offers of vegan and sustainable meals.	positive ☐	☐ negative	☐ neutral
3.5	The maximum period of study should be abolished.	positive ☐	☐ negative	☐ neutral
3.6	There should be a master program guarantee for KIT intern applicants.	positive ☐	☐ negative	☐ neutral
3.7	There should be a guaranteed childcare place for every KIT-member (students included) on the campus.	positive ☐	☐ negative	☐ neutral
3.8	A Baden-Württemberg wide evening- and weekendticket financed by an obligatory semester fee should be established.	positive ☐	☐ negative	☐ neutral
3.9	There should be a smaller amount of commercial promotions on the campus.	positive ☐	☐ negative	☐ neutral
3.10	The student parliament should constitute that symposia and conferences do not use lecture hall capacities.	positive ☐	☐ negative	☐ neutral
3.11	A part of the student fee (currently 5,99€) should be used for financing a house of the student body. These rooms would be used for institutions of the student parliament (committees, student groups, etc.).	positive ☐	☐ negative	☐ neutral
3.12	Student funds should be used for the ecological shaping of the campus.	positive ☐	☐ negative	☐ neutral
3.13	The campus should become a traffic-calmed sector. This would mean to introduce walking speed for the entire vehicle traffic (cars, motorcycles, bikes, etc.).	positive ☐	☐ negative	☐ neutral
3.14	Prices in the Cafeteria and the Mensa should be cut.	positive ☐	☐ negative	☐ neutral

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Figure 2: The 2018 experimental electoral ballot in English (scanner-ready A4-double-sided)

3. Campus Politics [Fortsetzung]

3.15	More parking spots for bikes should be provided in front of the library and the lecture halls.	positive ☐	☐ negative	☐ neutral
3.16	The KIT should provide an event hall (like the garden hall) for student cultural events.	positive ☐	☐ negative	☐ neutral
3.17	For Elected persons of the constituted student it should be possible to receive a expense allowance.	positive ☐	☐ negative	☐ neutral
3.18	The constituted student body should introduce an emergency scholarship for students who reached short term and not self-inflicted an plight situation.	positive ☐	☐ negative	☐ neutral
3.19	The AStA should actively promote the digitalisation of teaching. For example: lecture notes, webinars, online platforms, etc.	positive ☐	☐ negative	☐ neutral
3.20	The courses at KIT should be designed for a quick career entry.	positive ☐	☐ negative	☐ neutral
3.21	The expense allowance for AStA-referents should be reduced if a referent does not fulfill his tasks.	positive ☐	☐ negative	☐ neutral
3.22	The written student body should be more involved against extremism of any kind.	positive ☐	☐ negative	☐ neutral
3.23	The student contribution (currently 5,99 €) should be lowered.	positive ☐	☐ negative	☐ neutral
3.24	Exams at the KIT should be written anonymously.	positive ☐	☐ negative	☐ neutral
3.25	The student body should be more strongly represented in the KIT Senate.	positive ☐	☐ negative	☐ neutral
3.26	The student parliament should stand up for more dorm rooms.	positive ☐	☐ negative	☐ neutral
3.27	The KIT - campus south included - should have a civil clause.	positive ☐	☐ negative	☐ neutral
3.28	The student parliament should further on be allowed to express itself to every political topic.	positive ☐	☐ negative	☐ neutral
3.29	To improve the lecture hall situation, exams should more often take place also on Saturdays.	positive ☐	☐ negative	☐ neutral
3.30	The maximum number of examination attempts at the KIT should be increased.	positive ☐	☐ negative	☐ neutral

Thank you for your participation!

Figure 2: **(continued)** The 2018 experimental electoral ballot in English (scanner-ready A4-double-sided)

Table 3: The 2018 KIT student party positions on 30 questions (+[1]—Yes, −[1]—No, ?—Neutral of missing) and the balance of public opinion thereon in three sets of experimental votes

Questions of the experimental electoral ballot (their StuPa-O-Mat numbers in parentheses)	FiPS	Juso	Linke	LHG	LISTE	RCDS	All experimental votes		Experimental votes not influenced by the StuPa-O-Mat		Experimental votes influenced by the StuPa-O-Mat	
							Pros %	Cons %	Pros %	Cons %	Pros %	Cons %
1(3) *Improve intra-campus transportation....*	+	+	+	?	?	+	28	4	27	4	31	4
2(6) *Female quota.* The KIT should establish...	?	+	+	−	−	−	15	54	15	52	14	57
3(1) *Study fees.* There should be study fees.	?	−	−	?	−	−	10	74	9	77	11	69
4(24) *Vegan meals.* The canteen & cafeteria...	?	+	+	?	−	−	44	23	43	24	45	20
5(19) *No study duration limit.* The maximum...	−	?	+	−	+	−	38	38	36	36	40	40
6(17) *Guaranteed master places.* There should...	+	−	+	+	+	+	68	14	68	12	68	16
7(7) *Guaranteed childcare places.* There...	+	+	+	+	−	+	67	6	68	6	65	6
8(2) *Off-peak ticket.* There should be a...	−	?	?	−	+	−	48	30	55	26	37	38
9(8) *Restrict commercial advertisement....*	+	?	+	−	−	+	27	22	28	21	27	23
10 *Lecture halls for courses only.* The...	+	?	?	?	−	−	20	23	19	23	20	22
11(12) *Financing the student body house from...*	+	+	+	−	+	+	47	14	47	13	46	16
12(13) *Student funds for the campus ecology....*	−	?	+	−	?	−	47	25	49	23	43	28
13(4) *The campus should become a...*	−	−	+	−	−	−	39	42	43	39	33	45
14(25) *Lower mensa prices.* Prices in the...	+	?	?	+	−	+	36	26	36	25	37	26
15 *Larger bike parkings.* More parking...	+	+	+	?	+	+	71	6	70	7	73	4
16(9) *Hall for cultural events.* The KIT...	+	?	+	?	−	−	48	14	49	12	46	16
17(14) *Expense allowances for the student...*	−	?	?	−	−	+	23	40	24	39	23	42
18(15) *Emergency scholarships.* The...	+	+	+	+	+	−	69	8	68	8	71	7
19(16) *Digitalization of teaching.* The AStA...	+	?	+	+	+	+	80	4	79	5	82	4
20(18) *Career aiming courses.* The courses at...	?	?	−	?	−	+	35	31	40	25	26	42
21 *Performance-dependent expense...*	+	?	?	+	+	+	63	5	63	5	63	5
22 *Engagement against extremism.* The...	+	+	?	+	+	+	57	10	56	9	57	10
23(11) *Lower student fee.* The student...	−	−	?	+	?	+	13	41	13	39	12	44
24(22) *Anonymous exams.* Exams at the KIT...	+	+	+	+	+	−	39	23	34	26	46	18
25 *Student body representation in the...*	+	+	+	−	?	+	61	2	61	3	59	1
26(23) *More dormitory rooms.* The student...	+	+	+	?	−	+	68	4	67	5	70	3
27(5) *Civil clause.* The KIT - campus south...	−	+	+	−	−	−	29	21	25	18	35	26
28(10) *Student body political involvement....*	+	+	+	?	+	−	80	5	78	5	82	5
29(21) *Exams on Saturdays.* To improve the...	+	−	−	+	−	+	28	44	25	47	32	39
30(20) *More examination attempts.* The...	−	+	+	−	+	−	41	35	43	33	37	39

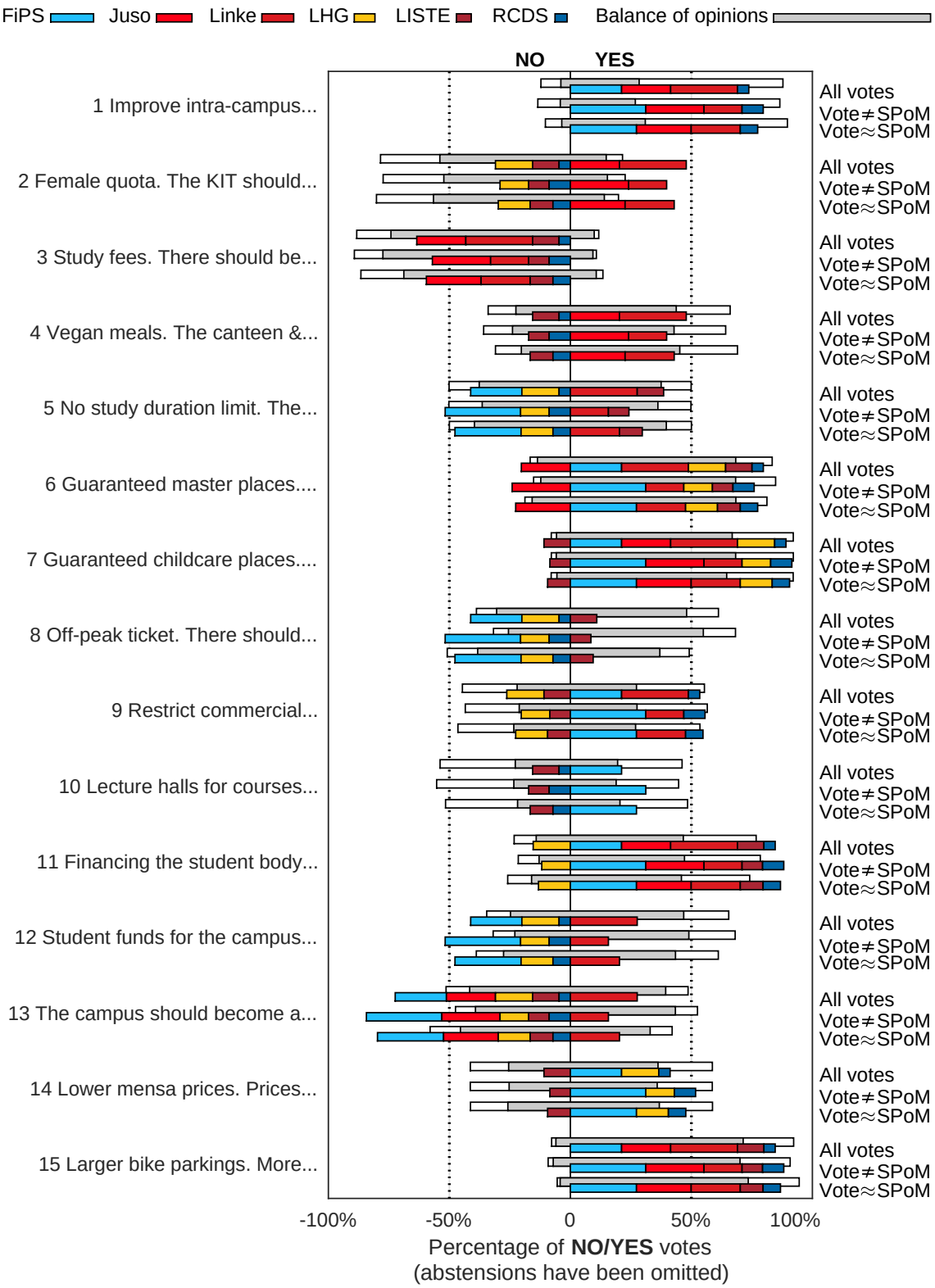

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Figure 3: Balance of public opinion on 30 questions (grey—factual, box—normalized) and representation thereof by the 2018 KIT Student parliament as if elected by party name using three sets of experimental votes: All votes, Vote≠SPoM and Vote≈SPoM—that influenced and not influenced by the StuPa-O-Mat, respectively. The party bar length equals to the party's percentage of votes. The party bar is missing if the party opinion on the question is neutral or unknown.

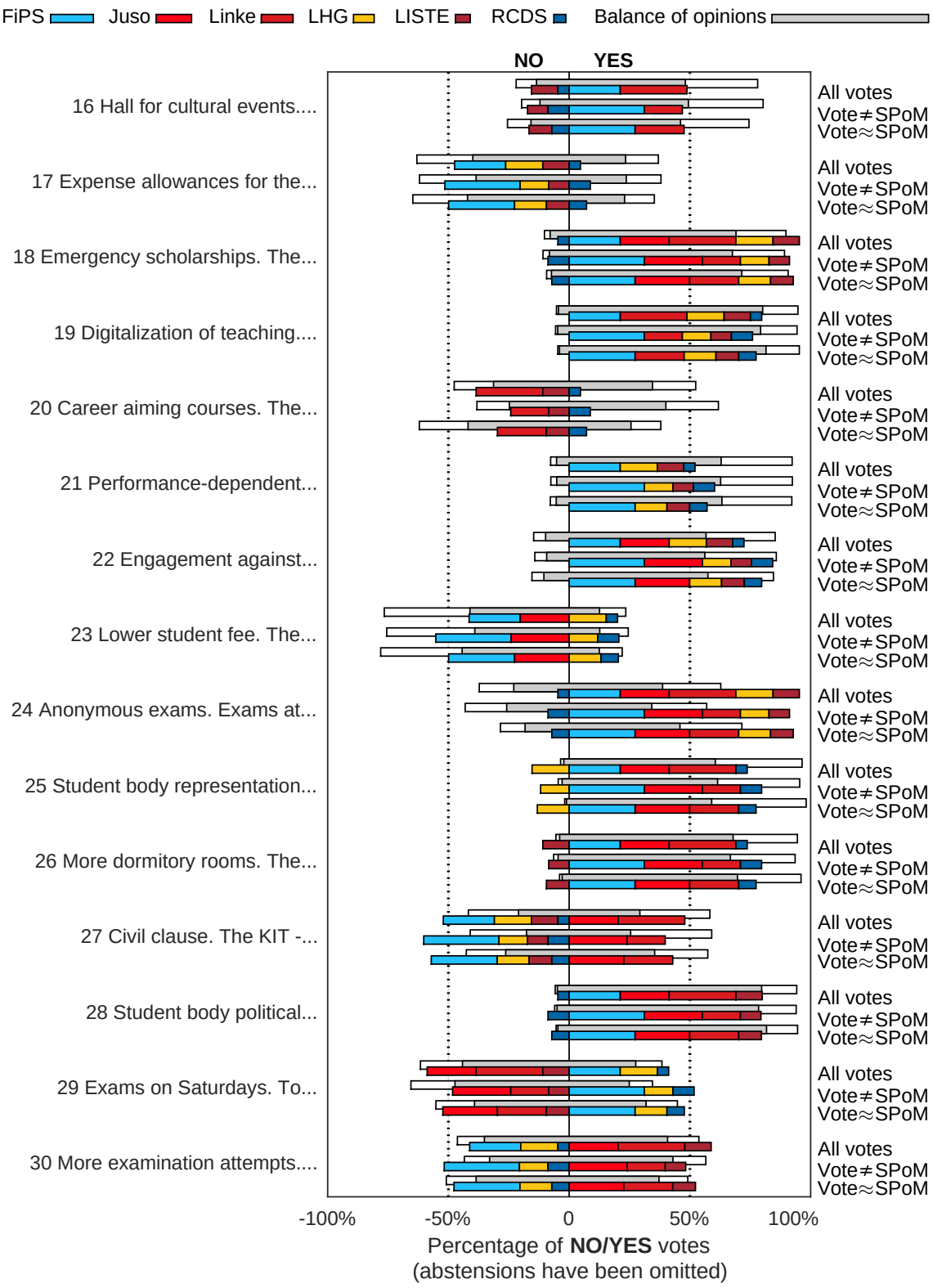

Figure 3: **(continued)** Balance of public opinion on 30 questions (grey—factual, box—normalized) and representation thereof by the 2018 KIT Student parliament as if elected by party name using three sets of experimental votes: All votes, Vote≠SPoM and Vote≈SPoM—that influenced and not influenced by the StuPa-O-Mat, respectively. The party bar length equals to the party's percentage of votes. The party bar is missing if the party opinion on the question is neutral or unknown.

represents the actual and 'passive' protagonists, having the normalized *representativeness*

$$r_{\text{FiPS},1} = \frac{0.28}{0.28 + 0.04} \approx 0.88 \quad (= 88\%) \ .$$

We skip Questions 2–4 with no FiPS's opinion, and come to Question 5, 'No study duration limit'. In this case FiPS represents 37.7% of antagonists against 37.5% of protagonists (in Table 3 both percentages are rounded to 38). Taking into account the 'passive' voters, we find the FiPS' normalized representativeness for Question 5:

$$r_{\text{FiPS},5} = \frac{0.377}{0.375 + 0.377} \approx 0.51 \quad (= 51\%) \ ,$$

and so on. The FiPS' popularity index is its representativeness averaged over the questions with the FiPS' definitive positions (there are 26 such questions, and four answers are missing):[8]

$$\mathsf{P}_{\text{FiPS}} = \frac{0.88 + 0.51 + \cdots}{26} \approx 0.70 \quad (= 70\%) \ .$$

The FiPS universality index is the percentage of questions on which it represents a majority of the voters. Again, we restrict consideration to the 26 questions with the FiPS' definitive positions. Since the FiPS represents a majority on 20 out of the 26 questions, we obtain

$$\mathsf{U}_{\text{FiPS}} = 20/26 \approx 0.77 \quad (= 77\%) \ .$$

These FiPS' popularity and universality indices are shown at the top-left of Table 4. The popularity and universality indices of the student parties for three sets of votes (with different protagonist-to-antagonist ratios) are computed in the same way. They are displayed in the first two columns of Table 4 visualized in Figure 4.

StuPa by the Second Vote (by Party Name) Assuming that the StuPa's position on each question is determined by the StuPa majority, we define the StuPa's policy profile as follows. Column '2nd vote (by party name)' of Table 4 contains the percentages of votes for the student parties within three experimental vote sets (the statistics are taken from Table 1). For instance, four parties are positive regarding Question 1, and two are neutral, implying that the StuPa has a positive position. (The StuPa's position on Question 1 is well seen in Figure 3, where all color bars associated with Question 1 are on the right hand from the central axis.) Regarding Question 2, Juso and Linke with their $23 + 20 = 43\%$ of the 2nd votes ($= 43\%$ of StuPa seats) are positive, LHG, LISTE and RCDS with $13 + 9 + 7 = 29\%$ of the 2nd votes are negative, and FiPS is neutral — so the StuPa is positive regarding Question 2, and so on.

After the StuPa's policy profile has been defined, the StuPa's popularity and universality indices are computed like for a party. The StuPa indices for each vote set, differing in the balances of public opinion, are shown in Rows 'StuPa by 2nd vote' of Table 3 and are visualized by the last block in the middle row of Figure 4.

StuPa by the Third Vote According to the Third Vote method, the parliament seats are distributed among the eligible parties[9] in proportion to the indices of representativeness. In our study, we use the mean of the parties' popularity and universality (but it can be agreed in some other way). The mean of parties' popularity and universality indices are shown in Column 'Abs'

[8] Questions are equally weighted because our previous studies show a low sensitivity of popularity and universality indices to (reasonably constrained) weighting of questions in case they are numerous.

[9] There can be eligibility filters. For instance, to owe Bundestag seats, a German party must get three direct mandates (local representatives elected within 299 constituencies by the first vote) or receive nationwide at least 5% of the second votes. The StuPa has no such a filter.

Table 4: The 30-question-based 2018 indices of the KIT student parties and Student Parliament as if elected using five methods applied to three sets of experimental votes

	P	U	2nd vote (by party name)	3rd vote $\frac{P+U}{2}$		3rd vote+ $\frac{P+U}{2} - \frac{1}{2}$		2nd vote & 3rd vote	2nd vote & 3rd vote+
				Abs	Norm	Abs	Norm	Norm	Norm
	%	%	%	%	%	%	%	%	%
All experimental votes									
FiPS	70	77	27	73	18	23	21	23	24
Juso	72	89	23	81	20	31	28	21	25
Linke	72	83	20	77	19	27	25	20	22
LHG	57	57	13	57	14	7	6	14	10
LISTE	61	65	9	63	15	13	12	12	11
RCDS	58	60	7	59	14	9	8	11	8
Absolute Maximum	74	100							
StuPa by									
2nd vote	69	80							
3rd vote	71	87							
3rd vote+	70	80							
2nd vote/3rd vote	69	83							
2nd vote/3rd vote+	69	80							
Experimental votes not influenced by the StuPa-O-Mat									
FiPS	69	73	31	71	18	21	21	24	26
Juso	71	84	24	78	19	28	28	22	26
Linke	72	87	16	80	20	30	29	18	22
LHG	56	52	12	54	13	4	4	13	8
LISTE	60	62	8	61	15	11	11	12	10
RCDS	58	57	9	58	14	8	7	12	8
Absolute Maximum	75	100							
StuPa by									
2nd vote	67	70							
3rd vote	71	83							
3rd vote+	69	77							
2nd vote/3rd vote	68	77							
2nd vote/3rd vote+	68	77							
Experimental votes influenced by the StuPa-O-Mat									
FiPS	72	85	21	78	18	28	23	20	22
Juso	73	84	20	78	19	28	23	19	22
Linke	72	87	28	80	19	30	24	23	26
LHG	59	67	15	63	15	13	10	15	13
LISTE	61	65	11	63	15	13	11	13	11
RCDS	59	63	5	61	14	11	9	10	7
Absolute Maximum	74	100							
StuPa by									
2nd vote	70	83							
3rd vote	73	90							
3rd vote+	70	83							
2nd vote/3rd vote	71	87							
2nd vote/3rd vote+	70	83							

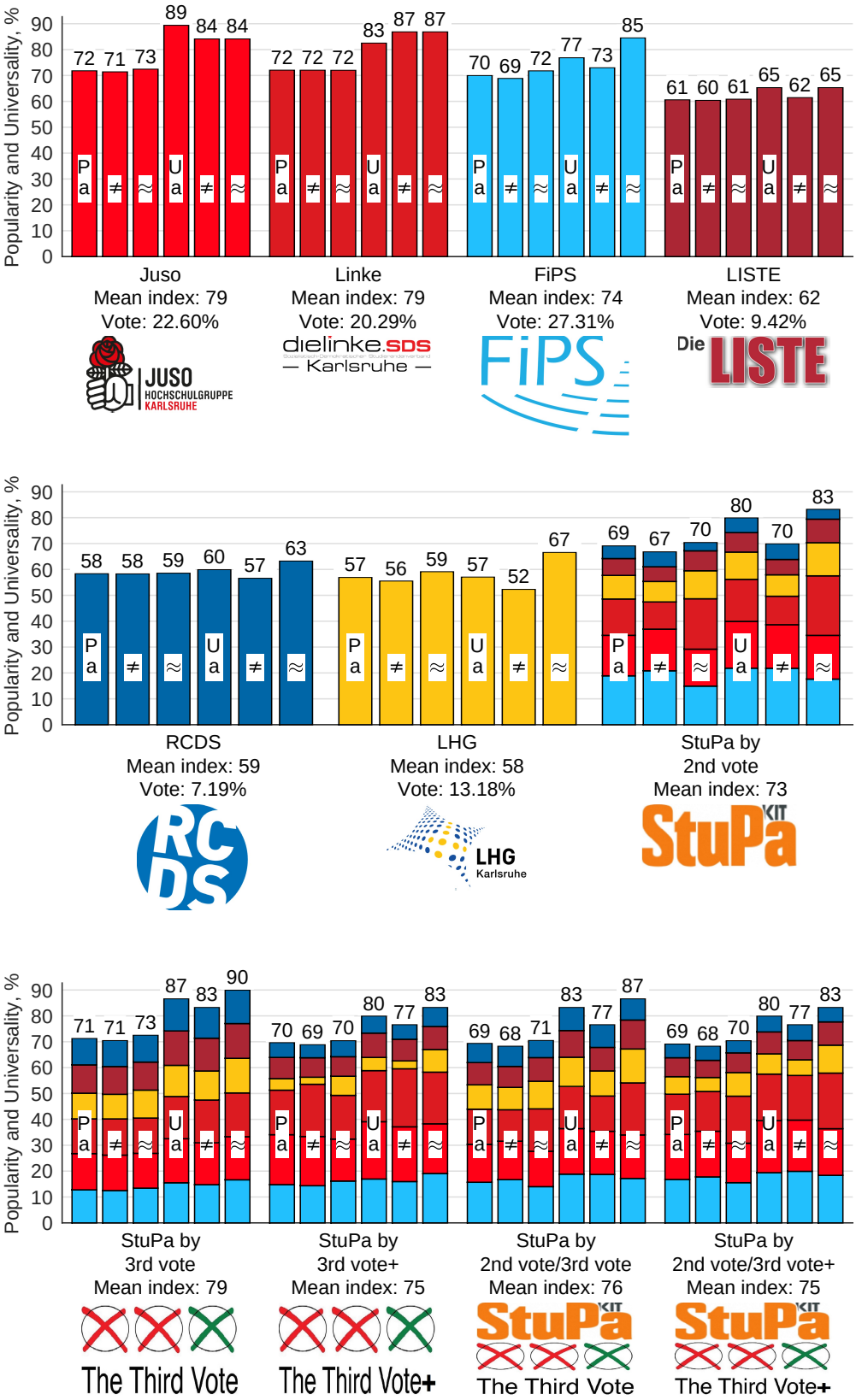

Figure 4: The 30-question-based 2018 indices of the KIT student parties and StuPa as if elected using five methods applied to three sets of experimental votes: all, the not influenced and the influenced by the StuPa-O-Mat denoted by a, $\neq$ and $\approx$, respectively (visualization of Table 4)

(= Absolute value) of Section '3rd vote $\frac{\mathsf{P}+\mathsf{U}}{2}$' of Table 4. To distribute StuPa seats, the parties' mean indices are normalized — proportionally reduced to the total of 100% — as shown in the next Column 'Norm'.

The modified StuPa apportionment changes the faction balance, affecting the StuPa's policy profile and representativeness indices. The latter are given in Rows 'StuPa by 3rd vote' of Table 4 and visualized by the bottom-left block in Figure 4. Compared with the StuPa determined by the 2nd vote, a significant gain in representativeness is attained, approaching its absolute maximum (the values of popularity and universality if majorities are represented for all questions are given in Rows 'Absolute Maximum').

StuPa by the Third Vote Plus For the set of all experimental votes, the maximal faction ratio in the StuPa elected by the 2nd vote (see the corresponding column of Table 4) is

$$\text{2nd vote StuPa's maximal faction ratio} = \text{FiPS} : \text{RCDS} = 27 : 7 \approx 4 \ .$$

The maximal faction ratio in the StuPa elected by the 3rd vote is equal to

$$\text{3rd vote StuPa's maximal faction ratio} = \text{Juso} : \text{LHG} = 20 : 14 \approx 1.4 \ .$$

If desired, this so-called equalization effect of the Third Vote can be tackled. Since the indices of representativeness below 50% mean that minorities are represented rather than majorities, we consider only the 'positive representativeness', i.e. the positive segment of the party indices above the threshold of 50% (if this segment is empty, the new index is nullified). The positive representativeness of the parties — the index segments above 50% — are shown in Column 'Abs' of Section '3rd vote+ $\frac{\mathsf{P}+\mathsf{U}}{2} - \frac{1}{2}$' of Table 4. To distribute the StuPa seats, these party indices are normalized, as shown in the next column. This election method is called 'Third Vote Plus' or simply '3rd vote+'. Now the maximal faction ratio (for all experimental votes)

$$\text{3rd vote+ StuPa's maximal faction ratio} = \text{Juso} : \text{LHG} = 28 : 6 \approx 4.7 \ ,$$

somewhat surpassing the faction ratio under the 2nd vote.

The popularity and universality of the StuPa apportioned in accordance with this election method is shown in Rows 'StuPa by 3rd vote+' of Table 4 and the second block of the bottom row of Figure 4. Compared with the 3rd vote, the 3rd vote+ results in a certain decrease in the StuPa's representativeness. In our previous studies we have however observed an increase in the StuPa's indices. This is explained by the fact that the effect of 3rd vote+ depends on the contrast between party positions. If some parties are representative and others are not, the 3rd vote+ strongly reduces or even eliminates the impact of non-representative parties and increases the impact of representative ones, thereby increasing the parliament representativeness. This is not our case, because all the six student parties are more representative than non-representative and the range of their indices is not large. Moreover, the party profiles are not really opposite: their pairwise correlations are either positive or statistically insignificantly negative — for all negative correlations P-values > 0.23. Hence, the 3rd vote+ only increases the disproportion of the party factions, reducing the adequate coverage of public opinion by the parliament.

StuPa by a Combination of 2nd and 3rd votes The influence of committee members is usually defined by some index. For example, a co-owner of a firm has as many votes as the number of his/her shares. Here, the number of shares is an index, percentage of shares is the index normalized, and the share holders' influence is determined by this normalized index. In the German Bundestag, the number of seats owed by a party (= the number of parliament votes) is proportional to the index 'percentage of electoral votes received by the party'.

To combine two methods of allocation of parliament seats, we combine two corresponding indices by taking their unweighted mean. To combine the vote by party name with the Third

Vote, we take the mean of Columns '2nd vote' and '3rd vote/Norm' of Table 4 (both indices are normalized to make them commensurable). The combined index (= size of the resulting StuPa factions) is shown in Column '2nd vote & 3rd vote', and the popularity and universality indices of the StuPa allocated in proportion to the combined index are given in Rows 'StuPa by 2nd vote/3rd vote'. Now the maximal faction ratio (for all experimental votes) is

$$\text{2nd vote \& 3rd vote StuPa's maximal faction ratio} = \text{FiPS} : \text{RCDS} = 23 : 11 \approx 2.1 \ .$$

The combination of the 2nd vote and the 3rd vote+ is analogous. The corresponding StuPa allocation index is in Column '2nd vote & 3rd vote+' of Table 4 which is the mean of Columns '2nd vote' and '3rd vote+/Norm'. The popularity and universality of the StuPa allocated in proportion to this index are shown in Rows 'StuPa by 2nd vote/3rd vote+'. As one can see, the maximal faction ratio (for all experimental votes) is equal to

$$\text{2nd vote \& 3rd vote+ StuPa's maximal faction ratio} = \text{Juso} : \text{RCDS} = 25 : 8 \approx 3.1 \ .$$

As expected, the popularity and universality indices of the StuPa apportioned this way are intermediate between the StuPas allocated using the corresponding single indices. This is also well seen in Figure 4.

4 Evaluation of Coalitions

Although coalition building is not practiced in the StuPa, we nevertheless analyze this option because of its general interest.

In real politics, parliament factions unite in coalitions, and only those with >50% of the parliament seats are eligible to govern. The eligible coalitions are usually *minimal*, i.e. they contain no more parties than necessary, because the more parties, the more complex the negotiations and the less power enjoyed by each faction; cf. with Riker's minimum winning coalitions [Riker 1962]. For instance, coalition FiPS+Juso+Linke+LHG is eligible but not minimal; that is, coalition FiPS+Juso+Linke, being itself eligible, does not need LHG.

Another important condition is the parties' political compatibility, which we measure with the index of *unanimity* — the percentage of questions on which all the coalition factions agree or at least some agree and others are neutral. A high degree of unanimity facilitates coalition building, because parties with close positions cooperate more easily. If the unanimity is below 50% the coalition is more incompatible than compatible. Therefore, we consider only minimal eligible coalitions with the unanimity >50%.

If a coalition is unanimous on a certain question then its position on it is the same as of every member. If coalition members disagree on an issue, then the probabilities of the coalition's Yes/No answer to this question could be assumed proportional to the protagonist-to-antagonist ratio within the coalition. As expressed in a personal conversation by Tobias Lindner, Bundestag member (GRÜNE), the reality is even more uncertain. To characterize this *additional* uncertainty, we introduce the *faction size factor*, $0 \le f \le 1$, which we explain using an example.

Example of a Non-Unanimous Coalition's Position on a Policy Issue Let for a certain question the protagonist-to-antagonist ratio within a coalition be 3:1, that is, the Yes-faction is three times larger than the No-faction. The $f = 0$ denotes no role of faction sizes, when the coalition adopts both answers 'Yes' and 'No' with equal chances 1/2. The $f = 1$ means the decisive role of the faction sizes, when the coalition decision is adopted with the probabilities proportional to the sizes of Yes-faction and No-faction. Since the weights of Yes- and No-factions are equal to $3/(3+1) = 3/4$ and $1/4$, respectively, 'Yes' is adopted with probability 3/4 and 'No'

with probability 1/4. The $f = 1/2$ means that the role of faction sizes is intermediate, being a mix of the two extreme cases in proportion $f = 1/2$ and $1 - f = 1/2$:

$$\begin{aligned}
\mathsf{Prob}(\text{Yes}) &= \underbrace{f}_{1/2} \times \underbrace{3/4}_{\substack{\text{Size influence}\\ \text{of Yes-faction}}} + \underbrace{(1-f)}_{1/2} \times \underbrace{1/2}_{\substack{\text{No influence}\\ \text{of size}}} = 5/8 \\
\mathsf{Prob}(\text{No}) &= \underbrace{f}_{1/2} \times \underbrace{1/4}_{\substack{\text{Size influence}\\ \text{of No-faction}}} + \underbrace{(1-f)}_{1/2} \times \underbrace{1/2}_{\substack{\text{No influence}\\ \text{of size}}} = 3/8 \ .
\end{aligned}$$

In the rest of the paper, all computations are made for the medium uncertainty $f = 1/2$.

Coalition Indices of Representativeness Under uncertainty, the coalition indices of popularity and universality turn into random variables. Then the coalition's popularity and universality are understood as the *expected* size of the group represented, and as the *expected* frequency in representing a majority, respectively. These indices are no longer exact magnitudes but estimates, with their standard deviation regarded as the estimation accuracy. To compute coalition indices, we use formulas from [Tangian 2014, p. 338].

Tables 5–7 illustrated by 3D Figures 5–7, respectively, show coalitions in the 2018 StuPa as if elected using three vote sets (all the participants of the experiment, those who are not influences by the *StuPa-O-Mat* and those who are). Each table and the related figure show StuPa's five most unanimous minimal eligible coalitions — as most realistic — for five election methods: by the 2nd vote, 3rd vote(+) and combinations of the 2nd and 3rd(+) votes. For all the indices, larger values mean 'better' and are ranked higher, whereas greater standard deviations are ranked lower, because they mean a lower index accuracy.

In the figures, each coalition is labeled with the abbreviation of the election method, as in the corresponding table, and depicted by concatenated color bars whose lengths are proportional to the faction sizes. The red flagstaff distinguishes the coalition of the StuPa elected by the 2nd vote, i.e. by party name. The green flagstaff denotes the coalition of the StuPa elected by the 3rd vote, and the blue one — by the 3rd vote+. The mixed election methods are highlighted by dashed flagstaffs with the colors of the methods involved. The coalition's unanimity is shown by the height of the flagstaff, and its XY coordinates are the coalition indices of popularity and universality.

According to Table 4, the highest StuPa representativeness is attained under the 3rd vote, whereas the most representative coalitions emerge under the 3rd vote+; see Tables 5 and 6. This is explained by the fact that the 3rd vote+ boosts the size of two most representative parties, Juso and Linke, makeing them sufficient for an eligible coalition. Since they have very close party profiles (Unanimity = 92%) their coalition inherits their high representativeness which is greater than that of the StuPa.

Table 7 and Figure 7 are computed for the set of votes influenced by the *StuPa-O-Mat*. Here, the 3rd vote methods show no superiority over the 2nd vote because the electors advised by the *StuPa-O-Mat* vote for the parties that best represent their preferences. Hence, the popularity and universality indices of all coalitions in Table 7, unlike that in previous two tables, are practically equal, differing at most by 0.1%. Therefore, the 'strange' location of the coalitions in Figure 7 should not be misinterpreted, because all the 'flags' are in fact densely clustered.

Table 5: Indices of the most unanimous minimal eligible coalitions of the 2018 StuPa as if elected by five methods with *all experimental votes* assuming the faction size factor $f = 0.5$

Election method Coalition	StuPa seats	Unanimity	Popularity		Universality	
			Expectation	Standard deviation	Expectation	Standard deviation
	%/Rank	%/Rank	%/Rank	%/Rank	%/Rank	%/Rank
2—2nd vote						
FiPS+Juso+Linke	27+23+20=70/2	76.67/2	68.56/5	±1.30/1	82.13/2	±4.37/5
3—3rd vote						
FiPS+Juso+Linke	18+20+19=56/4	76.67/2	68.63/2	±1.31/3	81.89/5	±4.36/2
3+—3rd vote+						
Juso+Linke	28+25=52/5	92.00/1	71.53/1	±1.34/5	84.00/1	±2.83/1
23—2nd vote/3rd vote						
FiPS+Juso+Linke	23+21+20=63/3	76.67/2	68.59/4	±1.31/2	82.02/3	±4.37/4
23+—2nd vote/3rd vote+						
FiPS+Juso+Linke	24+25+22=72/1	76.67/2	68.60/3	±1.31/4	81.96/4	±4.37/3

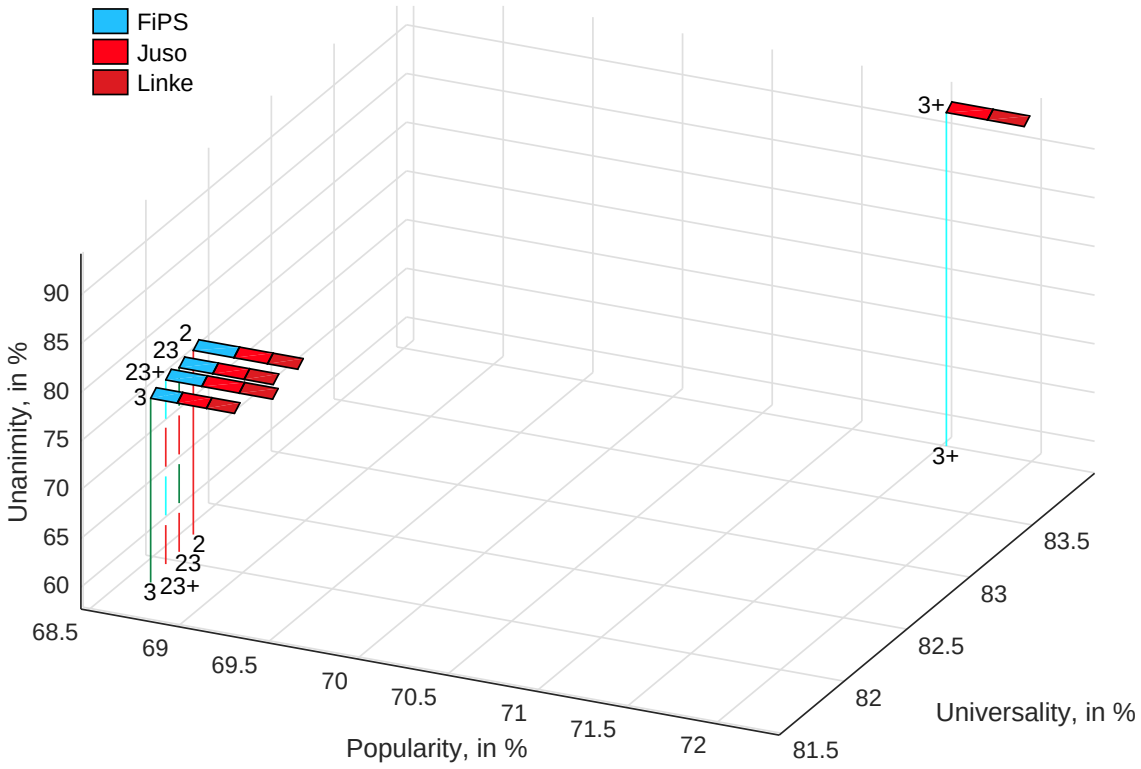

Figure 5: Visualization of Table 5. Election method by flagstaff: red 2 — 2nd vote, green 3 — 3rd vote, blue 3+ — 3rd vote+, red/green 23 — mix of 2nd and 3rd votes, red/blue 23+ — mix of 2nd vote and 3rd vote+.

Table 6: Indices of the most unanimous minimal eligible coalitions of the 2018 StuPa as if elected by five methods with *the experimental votes not influenced by the StuPa-O-Mat* assuming the faction size factor $f = 0.5$

Election method Coalition	StuPa seats	Unanimity	Popularity		Universality	
			Expectation	Standard deviation	Expectation	Standard deviation
	%/Rank	%/Rank	%/Rank	%/Rank	%/Rank	%/Rank
2—2nd vote FiPS+Juso	31+24=55/4	86.21/2	67.76/3	±1.37/1	72.64/4	±3.44/2
3—3rd vote FiPS+Juso+Linke	18+19+20=57/2	76.67/3	67.83/2	±1.44/4	79.04/3	±4.36/4
3+—3rd vote+ Juso+Linke	28+29=57/3	92.00/1	71.34/1	±1.40/3	87.94/1	±2.83/1
23—2nd vote/3rd vote FiPS+Juso+Linke	24+22+18=64/1	76.67/3	67.69/5	±1.44/5	79.51/2	±4.37/5
23+—2nd vote/3rd vote+ FiPS+Juso	26+26=52/5	86.21/2	67.75/4	±1.37/2	72.42/5	±3.45/3

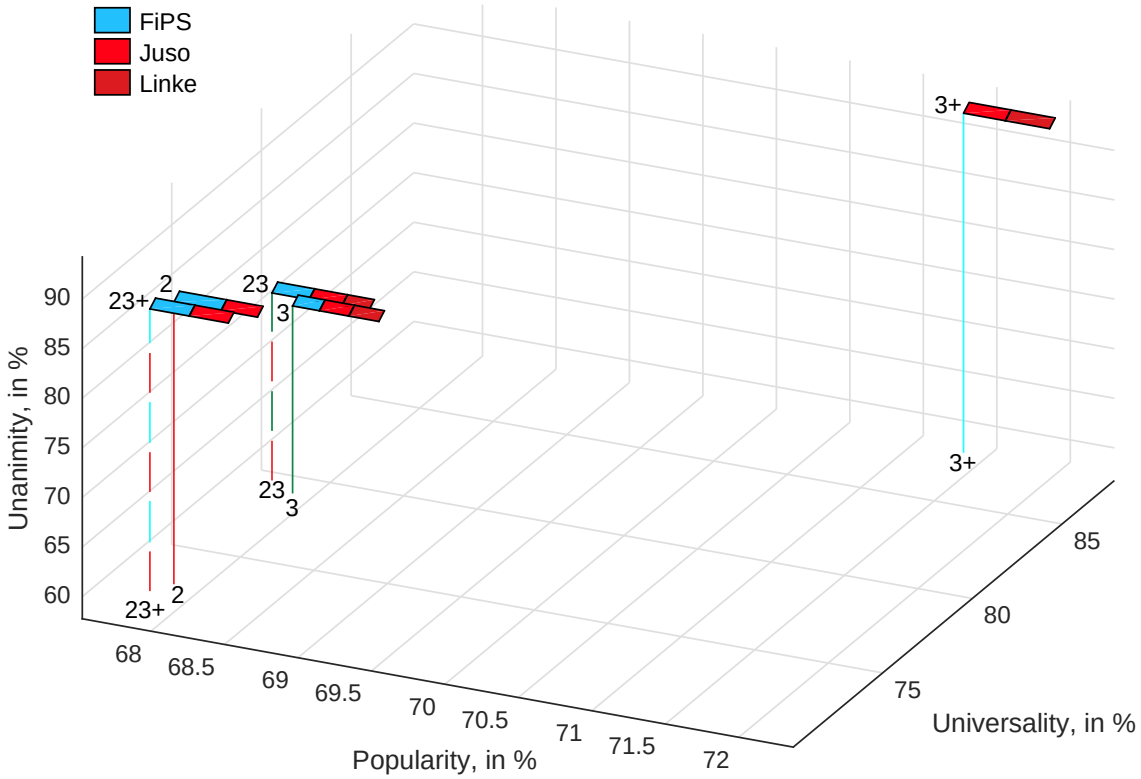

Figure 6: Visualization of Table 6. Election method by flagstaff: red 2 — 2nd vote, green 3 — 3rd vote, blue 3+ — 3rd vote+, red/green 23 — mix of 2nd and 3rd votes, red/blue 23+ — mix of 2nd vote and 3rd vote+.

Table 7: Indices of the most unanimous minimal eligible coalitions of the 2018 StuPa as if elected by five methods with *the experimental votes influenced by the StuPa-O-Mat* assuming the faction size factor $f = 0.5$

Election method Coalition	StuPa seats	Unanimity	Popularity		Universality	
			Expectation	Standard deviation	Expectation	Standard deviation
	%/Rank	%/Rank	%/Rank	%/Rank	%/Rank	%/Rank
2—2nd vote						
FiPS+Juso+Linke	21+20+28=69/3	76.67/1	70.00/1	±1.15/1	89.06/5	±4.02/1
3—3rd vote						
FiPS+Juso+Linke	18+19+19=56/5	76.67/1	69.94/5	±1.16/5	89.16/1	±4.03/5
3+—3rd vote+						
FiPS+Juso+Linke	23+23+24=70/1	76.67/1	69.95/4	±1.16/4	89.15/2	±4.03/4
23—2nd vote/3rd vote						
FiPS+Juso+Linke	20+19+23=62/4	76.67/1	69.98/2	±1.16/2	89.10/4	±4.03/3
23+—2nd vote/3rd vote+						
FiPS+Juso+Linke	22+22+26=69/2	76.67/1	69.98/3	±1.16/3	89.10/3	±4.03/2

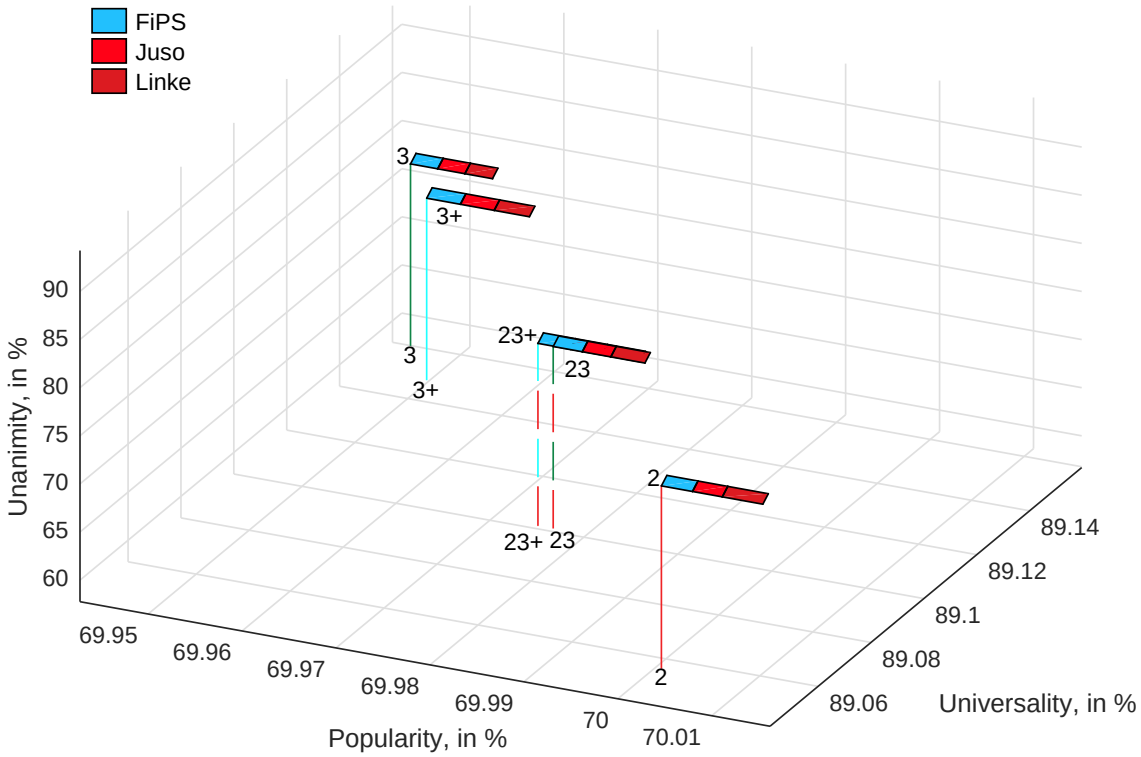

Figure 7: Visualization of Table 7. Election method by flagstaff: red 2 — 2nd vote, green 3 — 3rd vote, blue 3+ — 3rd vote+, red/green 23 — mix of 2nd and 3rd votes, red/blue 23+ — mix of 2nd vote and 3rd vote+.

5 StuPa's Political Spectrum

The location of parties in the political space is the central question of most theories of political competition. Since [Smithies 1941, Downs 1957] (for recent comments on the latter see [Van Houweling and Sniderman 2005]), this question has been extensively elaborated, both theoretically and methodologically. Although the objectivity of political space is sometimes called into question [Benoit and Laver 2012, Otjes and Louwerse 2014], a number of particular directions have been developed.

For instance, [Hinich and Munger 1994, Poole 2005, Poole and Rosenthal 2007] and more recently [Carroll et al. 2013] created a theory of ideological space which was applied to 'dimensionalize' the U.S. Congress ideological space, having overcome the paradox of low-dimensionality using one-dimensional scaling with the least squares metric. The spatial theory of elections by [Enelow and Hinich 1984, Enelow 1994, Enelow and Hinich 1990, Hinich and Munger 1997] was developed mathematically by [Saari 1994, Saari 1995, Kriesi et al. 2006, Kriesi 2008] and later by [Armstrong et al. 2014, Wheatley 2012, Wheatley et al. 2014, Wheatley 2015].

In our case, we construct the StuPa political spectrum by contiguously ordering student parties, i.e. so that the neighboring parties would have close policy profiles.

Correlation as a Proximity Measure for Party Profiles Computing indices of popularity and universality in Sections 3 and 4, we disregard neutral/missing party opinions, reducing party policy profiles to the questions with definitive answers. For contiguously ordering student parties, these neutral/missing opinions are coded by 0s. The reasons are as follows. In this context, the proximity of two profiles A, B is measured by their correlation ρ_{AB}. If the profiles are reduced to questions with definitive answers then the 'identity' of profiles (correlation = 1) is intransitive. For example, let three parties have the following profiles for three questions:

Question	LISTE	LHG	RCDS
	A	B	C
2 (6) Female quota	-1	-1	-1
6(17) Guaranteed master places	1	1	1
20(18) Career aiming courses	-1	?	1

If pairwise correlations between columns are computed omitting the row with the missing value then

$$\rho_{AB} = \rho_{BC} = 1 \text{ but } \rho_{AC} = 0.5 \implies A \sim B \sim C \text{ but } A \not\sim C \,.$$

If we replace the missing value by 0 then the implications are consistent:

$$\rho_{AB} = \rho_{BC} = 0.87 \text{ and } \rho_{AC} = 0.5 \implies A \not\sim B \not\sim C \text{ and } A \not\sim C \,.$$

Correlation, even transformed into $1 - \rho \geq 0$, is not a distance in the mathematical sense, therefore we name it 'proximity measure'. Correlation is however a standard reference for contiguously ordering statistical variables [Friendly 2002, Friendly and Kwan 2003].

Another inconvenience of correlation is its indefiniteness if one variable is constant (or both), for instance, when one party answers 'No' to all questions:

Question	LISTE	LHG
	A	B
2 (6) Female quota	-1	-1
5(19) No study duration limit	1	-1
8 (2) Off-peak ticket	1	-1

$\Rightarrow \quad \rho_{AB} = \infty$ (due to division by 0).

This situation is quite typical while reducing the number of questions because certain profiles after removing several questions become constant and cannot be processed.

To overcome such situations, we duplicate the questions in the negative form, inverting the answers as shown below (this can be done by computer):

Question		LISTE A	LHG B
2 (6)	Female quota	-1	-1
5(19)	No study duration limit	1	-1
8 (2)	Off-peak ticket	1	-1
2 (6) in negative form:	No female quota	1	1
5(19) in negative form:	Study duration limit	-1	1
8 (2) in negative form:	No off-peak ticket	-1	1

$$\Rightarrow \quad \rho_{AB} = 0.33 \ .$$

For the duplicated questionnaire the correlation is always defined (except for the case when one party is neutral on all questions; then the duplication can be done with adding a constant to the codes of opinions). It can be shown that such a duplication of questions does not change the indices of representativeness.

Political Spectrum by Dimensionality Reduction A political spectrum is a map of political space where the parties are located. To construct it, the multidimensional location of the parties is reduced to one or two most significant dimensions using the principal component analysis (PCA) [Tangian 2015, Tangian 2019]. Contiguously ordering statistical variables by means of PCA described by [Friendly 2002, Friendly and Kwan 2003] can be easily adapted to contiguously ordering policy profiles.

Being based on linear transformations, PCA approximates a 'cloud of observations', given as vectors in a multi-dimensional space, by an ellipsoid whose first diameter is directed along the observations' maximal variance, the second diameter is directed along the second maximal variance, etc. These orthogonal diameters are new coordinate axes, and the first ones 'explain' most of the variance, so that other dimensions can be omitted without much loss of information. These new orthogonal axes are linear combinations of the initial axes and are interpreted either as composite factors or just as a geometric characteristic of the set of observations. Each principal component is the set of projections of the initial vectors on the corresponding diameter, so we can speak of the observations' variance along each diameter. For an introduction to PCA see [Husson et al. 2011, Hyun et al. 2009, Jackson 1988, Krzanowski 1988, Seber 1984].

First of all, we explain PCA using an example of making a 2D map of a country which in actuality is on the 3D globe. Let n reference points, e.g. cities, be given as 3D vectors in the three-dimensional space. If the country is small, the least significant dimension associated with the earth's curvature is omitted and only North-South and East-West directions (explained by two principal components) are retained. However, the task is not that straightforward. For instance, in the case of Chile, which is a North-South strip 4250 km long and on average only 180 km wide, the first component is associated with the North-South direction, the second with the earth's curvature, and the least significant third component with the East-West direction. Then the Chile map based on the first and second components would look like an arc — the side view of Chile on the globe — instead of the usual bird's-eye view. In fact, to make a map, we instead need to reflect the air distances between the cities. Therefore, we associate every city with a $(n \times 1)$-vector of its distances to other cities, including the 0-distance to itself, and apply the dimensionality reduction to the $(n \times n)$-matrix of intercity distances rather than to the $(3 \times n)$-matrix of 3D city spatial coordinates.

Since a political spectrum is a kind of map, its construction using PCA is very similar. In our model, we have parties instead of cities, and the party profiles in Table 3 are analogous to the set of the cities' 3D coordinates. Instead of matrix of intercity distances, we have the party proximity matrix — the (6×6)-matrix of correlations between the parties' policy profiles.[10]

[10]For pseudodistance between parties i, j, it is natural to use not correlation between the party profiles ρ_{ij} but inverse correlation $1 - \rho_{ij} \geq 0$. Since PCA is based on linear transformations, the results for correlation and inverse correlation are the same. So, we refer to correlation.

This means that the jth party is identified with the vector of its proximity to other parties (= correlations between their profiles), including the proximity to itself, that is, with the jth column of the correlation matrix:

$$\vec{\rho_j} = \{\rho_{ij} : i = 1, \ldots, 6\} \quad \text{(vector of the } j\text{th party)} \ .$$

Thus, party vectors are *not party profiles* but vectors of *proximities to other party profiles*. Since these vectors have 6 elements each, they constitute a 5-dimensional configuration, and PCA finds its 5 orthogonal diameters — eigenvectors of the covariance matrix of the correlation matrix

$$\vec{e}_k, \quad k = 1, \ldots, 5, \quad \text{(diameters of the 'cloud' of vectors } \vec{\rho_j})$$

and orders them by decreasing eigenvalues. Each party vector $\vec{\rho_j}$ receives in this new orthogonal basis $\{\vec{e}_k\}$ coordinates $\{e_{kj}\}$:

$$\vec{\rho_j} \ \leftrightarrow \ \{e_{kj} : k = 1, \ldots, 5\} \quad \text{(new coordinates of vector } \vec{\rho_j}) \ .$$

The coordinates of vectors $\vec{\rho_j}$ on the first diameter $\vec{e}_1$ is the first principal component

$$\{e_{1j} : j = 1, \ldots, 6\} \quad \text{(1st principal component with variance = 64.06\%)} \ .$$

The coordinates of vectors $\vec{\rho_j}$ on the second diameter $\vec{e}_2$ is the second principal component

$$\{e_{2j} : j = 1, \ldots, 6\} \quad \text{(2nd principal component with variance = 21.53\%)} \ ,$$

and so forth. The projections of the parties' vectors $\vec{\rho_j}$ on the plane of the first two eigenvectors (diameters),

$$\vec{\rho_j} \ \leftrightarrow \ \{e_{1j}, e_{2j}\}, \quad j = 1, \ldots, 6 \quad \text{(first two new coordinates of vectors } \vec{\rho_j}),$$

are shown in Figure 8. Together they explain 85.6% of the total variance, and the characteristics of other principal components are displayed in Table 8, showing how rapidly the total variance is exhausted by the first principal components.

The angle between the jth party vector and the first eigenvector (X-axis) is equal to

$$\alpha_j = \begin{cases} \arctan\left(\frac{e_{2j}}{e_{1j}}\right) & \text{if } e_{1j} > 0 \\ \arctan\left(\frac{e_{2j}}{e_{1j}}\right) + \pi & \text{otherwise} \end{cases} \ ,$$

and the closeness of two parties' policy profiles is approximated by the angular closeness of the party vectors. To be precise, the correlation between profiles of two parties i, j is approximated by the cosine of the angle between their vectors:

$$\rho_{ij} \approx \cos|\alpha_i - \alpha_j| \ .$$

We obtain a circular ordering, in which adjacent parties have close policy profiles. This circular ordering can be unfolded to a linear one by splitting it at the largest gap — between the LISTE and the LHG or between the LISTE and the Linke; see Figure 8. The resulting party ordering Linke–Juso–FiPS–RCDS–LHG coincides with the intuitive left–right party arrangement. The LISTE, a party of parodical character, stands apart but formally between the Linke and the liberal-right LHG. Since PCA, finding a contiguous circular ordering, prescribes neither its split point nor its direction — clockwise or counterclockwise — we shall always start from the LISTE and follow the ideological left–right axis.

Figure 9 shows the correlation triangle for the unfolded ordering. It is a 'relief table' [Tangian 2011, p. 108] where the levels are distinguished by colors like the altitude on geographic maps: high values are shown in brown as mountains, the moderately positive in green

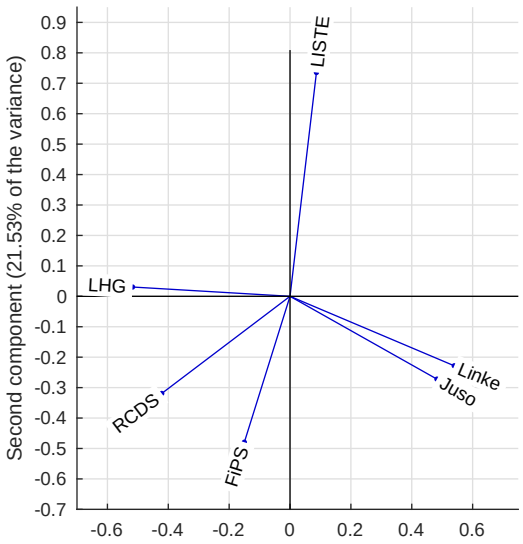

Figure 8: Eigenvector plot for PCA analysis of party profiles based on 30 questions with their doubles in negative form

Table 8: PCA of the correlation matrix for party policy profiles: explanation of variance and cumulative sums

Principal component i	Principal component variances V_i	Cumulative sum of principal component variances
	%	%
1	64.06	64.06
2	21.53	85.60
3	8.79	94.39
4	3.19	97.58
5	2.42	100.00
Sum of squared principal component variances $S_{\text{PCA}} = \sum_{i=1}^{5} \mathsf{V}_i^2$	4661.38	

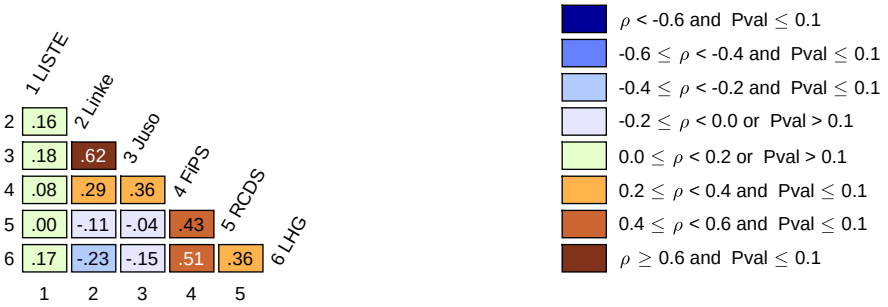

Figure 9: Correlation triangle for the 2018 KIT parties' vectors for 30 questions with their doubles in negative form

as plains, the moderately negative in pale blue as shallow waters, and strongly negative ones in dark blue — as deep ocean. For a contiguous party ordering, the following rule would hold: the closer to the diagonal, the higher the correlation (the higher the altitude).

Since our party ordering results from projecting 5D vectors (in the new coordinates) on the 2D plane of the first two principal components, the distances between the party vectors in Figure 8 only approximate that in the 5D space (the plane projections explain not 100 but 85.6% of the total variance). Figure 9, on the contrary, shows the exact proximity (correlation) of the party vectors, so there are some disproportions between correlation coefficients along the triangle diagonal and the angles in Figure 8. By the same reason, there are some irregularities in the location of 'higher altitudes' closer to the triangle diagonal. Regardless of these minor inaccuracies, the general structure of the correlation triangle with the left–right party ordering looks quite adequate and can be regarded as the StuPa's political spectrum.

6 Optimal Selection of Questions

In this section we analyze the process of reducing the initial set of questions. We assume that the preselected 30 questions cover all important topics and find subsets of most essential questions which optimally highlight the differences between the party positions.

A similar problem emerges in testing products, whereby evaluation criteria should highlight the differences in their quality. If the criteria poorly discriminate between the products — for instance, if the power consumption of electric devices is equal, the noise is of the same level, and the size of the units is the same, then a test based on these features is ill-designed. Likewise, a survey questionnaire should also reveal differences, because nearly-identical responses are of little use.

Related Studies This task can be formulated in terms of reduction of the number of observations (items) or variables with little loss of information. In psychometrics, selection of records, called 'item analysis', is used to design reliable psychometrics tests, i.e. to select a few interview questions sufficient for measuring a certain subjective attitude [Guilford 1936, Kline 1986]. The lower bounds for these tests are often estimated with the so-called Cronbach's α [Cronbach 1951]. In the machine learning and data mining literature, this problem is known as 'feature selection' or 'variable subset selection' [Feature selection 2017]. In combinatorial mathematics, the goal is formulated as reduction of matrices while preserving most of the column data, which is called 'the column subset selection'; for surveys see [Kumar and Schneider 2016, Zheng et al. 2010]. In the 'principal component variable selection', one finds the principal components that are linear combinations of the initial variables and then reduces the number of variables while preserving the most important components. The first results date back to 1970s; see [Jolliffe 1972, McCabe 1975]. They were developed further by [McKay and Campbell 1982, McCabe 1984, Krzanowski 1988, Jolliffe 2002, Al Kandari and Jolliffe 2005, Mori et al. 2007]. Among more recent publications we can mention [Husson et al. 2011, Kuroda et al. 2011, Pacheco et al. 2013, Armstrong et al. 2014, Mori et al. 2016]. The particular case of binary variables is considered by [Broadbent et al. 2010, De Leeuw 2006].

The known methods are however of limited applicability for our purpose, because they have other goals. The psychometrics tests are aimed at revealing an average subjective attitude to a single object's quality by means of several more or less indirect questions; therefore, the ideal reliable test must have not very high and not very low correlation between answers — we, on the contrary, need minimal correlation. The methods of machine learning and feature selection, being primarily designed for big data, use approximations which are not necessarily optimal. Moreover, they attempt to maintain the initial distances between the observations, whereas our goal is to accentuate the distinctions by increasing them. The 'principal component variable selection' deals with elimination of variables (= parties in our consideration) which cannot be

disregarded. Above all, these methods cannot be easily explained to non-mathematicians, which is critical in convincing the general public to apply them in the context of elections.

However, the 'principal component variable selection' prompts the idea of preserving the political spectrum (= the party ordering and the ratio of inter-party distances) while removing questions.

Maximizing the Distance Between the Party Profiles First of all we suggest a simple direct procedure to select questions from a larger list. Let us consider the task performed by the 2018 StuPa election committee: from 30 preselected questions in Table 3 choose 25 for the *StuPa-O-Mat*. Our goal is to reduce the number of questions while accentuating the contrast between the parties. To do this, we refer to the total Euclidean distance between the party policy profiles in Table 3 (after replacing $-/?/+$ with $-1/0/+1$, respectively, they constitute matrix $\mathbf{B}$). To make the total distances for question sets of different size commensurable, we normalize the total Euclidean distance by dividing it by the square root of the number of questions in the set:[11]

$$S_{\text{Dist}} = \text{Total normalized Euclidean distance} = \frac{1}{\sqrt{|Q|}} \sum_{i<j} \sqrt{\sum_{q\in Q} [\mathbf{B}(q,i) - \mathbf{B}(q,j)]^2} \ , \qquad (1)$$

where

Q is a set of questions, e.g. $Q = \{1:30\}$ denotes the set of 30 questions indexed from 1 to 30,

$|Q|$ is the number of questions in set Q,

q are indices of questions,

$\mathbf{B}$ is the (30×6) matrix of policy profiles of six student parties with answers to 30 questions coded by $-1/0/+1$,

$\mathbf{B}(q,i)$ is the qith element of matrix $\mathbf{B}$ (answer of Party i to Question q,)

: denotes the full or restricted range of matrix rows or columns; for instance, $\mathbf{B}(:,i)$, $\mathbf{B}(:,j)$ are the ith and jth columns of matrix $\mathbf{B}$, respectively, and $\mathbf{B}(Q,:)$ consists of the rows of $\mathbf{B}$ associated with the set of questions Q.

To select 25 questions that maximize the total Euclidian distance between the columns of the remainder of matrix $\mathbf{B}$, we have to solve the maximization problem

$$\sum_{i<j} \sqrt{\sum_{q\in Q} [\mathbf{B}(q,i) - \mathbf{B}(q,j)]^2} \quad \to \quad \max_{Q:\ Q\subset\{1:30\},\ |Q|=25} \ . \qquad (2)$$

Table 9 shows the initial 30 questions and the 25 ones heuristically selected by the election committee for the *StuPa-O-Mat*. The next column contains 24 'essential' questions obtained by removing those with weakly unanimous party positions (when all positions are equal or neutral — these questions poorly discriminate between the parties and are removed). The following columns of Table 9 show selections of 20, 15 and 10 questions obtained by three optimization models (another two models are considered below). The first column in each group labeled 'Dist' results from maximizing the Euclidean distance between the party profiles. The penultimate row of the table provides the total normalized Euclidean distances for the selections of questions. The growing total normalized Euclidean distance indicates at a growing contrast between the parties as the size of optimal selection of questions decreases.

[11] This is a standard way of bringing multidimensional characteristics to the 'common denominator'. For instance, the distance between the vertices of an n-dimensional cube $(0,\dots,0)$ and $(1,\dots,1)$ is equal to $\sqrt{n}$; dividing it by $\sqrt{n}$, the distance is reduced to 1 regardless of the cube's dimensionality.

Table 9: Heuristic and optimal selections of questions

Preselected 30 questions (StuPa-O-Mat numbers in parentheses)	Number of questions retained										
	25	24	20			15			10		
	SPoM	Model	Dist	PCAm	PCAM	Dist	PCAm	PCAM	Dist	PCAm	PCAM
1(3)	×										
2(6)	×	×	×		×	×		×	×		
3(1)	×										
4(24)	×	×	×	×	×	×		×	×		
5(19)	×	×	×	×	×	×		×	×	×	×
6(17)	×	×	×	×	×	×	×	×		×	
7(7)	×	×	×	×			×				
8(2)	×	×		×	×		×	×			×
9(8)	×	×	×	×		×	×		×	×	
10		×		×	×		×	×		×	
11(12)	×	×	×	×	×		×	×		×	×
12(13)	×	×	×	×	×		×	×			×
13(4)	×	×	×	×	×	×	×	×		×	
14(25)	×	×		×	×		×	×		×	×
15											
16(9)	×	×	×	×	×	×	×		×	×	
17(14)	×	×	×	×		×	×			×	
18(15)	×	×	×	×	×		×				
19(16)	×										
20(18)	×	×		×	×		×	×			×
21											
22											
23(11)	×	×	×	×	×	×			×		
24(22)	×	×	×	×	×		×			×	
25		×	×	×	×	×	×		×		
26(23)	×	×	×	×		×					
27(5)	×	×	×		×	×		×	×		×
28(10)	×	×	×	×	×	×		×			×
29(21)	×	×	×		×	×		×	×		×
30(20)	×	×	×		×	×		×	×		×
S_{Dist} 17.09	17.78	18.44	18.84	17.65	18.46	19.38	17.32	18.45	20.16	17.98	18.38
S_{PCA} 4661	4817	4639	4645	3313	6090	5571	2824	7593	6211	2571	9078

Conglobating the StuPa's Political Spectrum Maximization of the total distance between the party profiles while reducing the list of questions can flatten the political spectrum. To preserve it from reshaping, we attempt to conglobate (= enhance the spherical form of) the party vectors' configuration. For this purpose, the principal component variances in Table 8 are equalized by minimizing the sum of their squares S_{PCA} (at the bottom of the table). Thus, to reduce the number of questions from 30 to k, we solve the optimization problem

$$S_{\mathrm{PCA}} = \sum_{i=1}^{5} \mathsf{V}_i^2 \quad \rightarrow \quad \min_{Q \subset \{1:30\}:|Q|=k} \tag{3}$$

subject to constraint

$$\mathsf{V}_i \quad \text{are principal component variances for correlation matrix}^{12} \quad \rho \begin{bmatrix} \mathbf{B}(Q,:) \\ -\mathbf{B}(Q,:) \end{bmatrix} .$$

Equalizing the variances by the least squares criterion is justified by the observation that if $\sum_{i=1}^{n} x_i = 1$ and $x_1, \ldots, x_n \geq 0$ then $\min \sum_{i=1}^{n} x_i^2$ is attained for $x_1 = \cdots = x_n = 1/n$.

Columns 'PCAm' of Table 9 (PCA with minimization of squared principal component variances) show selections of 20, 15 and 10 questions satisfying this criterion. The last row of the table provides the values of the objective function S_{PCA} for these selections of questions. The decreasing S_{PCA} indicates at a growing conglobation of the configuration of party vectors.

Flattening the StuPa's Political Spectrum On the other hand, a flattened spectrum is better approximated by the 2D projections of party vectors on the plane of the first two principal components. Then the correspondence between the angles in Figure 8 and the coefficients at the correlation triangle's diagonal in Figure 9 is more accurate, whence the party ordering based on Figure 8 is more contiguous.

Therefore, it makes sense to test the criterion of flattening the party vectors' configuration while removing questions. Thus, to reduce the number of questions from 30 to k, we solve the optimization problem (3) with max substituted for min:

$$S_{\mathrm{PCA}} = \sum_{i=1}^{5} \mathsf{V}_i^2 \quad \rightarrow \quad \max_{Q \subset \{1:30\}:|Q|=k}$$

subject to constraint

$$\mathsf{V}_i \quad \text{are principal component variances for correlation matrix} \quad \rho \begin{bmatrix} \mathbf{B}(Q,:) \\ -\mathbf{B}(Q,:) \end{bmatrix} .$$

The use of the largest squares criterion is justified by the observation that if $\sum_{i=1}^{n} x_i = 1$ and $x_1 \geq x_2 \geq \cdots \geq x_n \geq 0$ then $\max \sum_{i=1}^{n} x_i^2$ is attained for $x_1 = 1,\ x_2 = \cdots = x_n = 0$.

Columns 'PCAM' of Table 9 (PCA with maximization of squared principal component variances) show selections of 20, 15 and 10 questions found for this criterion. The last row of the table provides the values of the objective function S_{PCA} for these selections of questions. The increasing S_{PCA} indicates at flattening of the party vectors' configuration.

7 Evaluation of Optimal Selections of Questions

The party indices and, correspondingly, the Third Vote election outcomes depend on the questions included in the experimental ballot. The 12 sets of questions considered so far are selected in accordance to some heuristic and normative criteria, and now we evaluate them regarding the

[12] Since we perform PCA for the matrix of correlations between policy profiles, the matrix of policy profiles $\mathbf{B}$ (initial or for reduced number of questions) is concatenated with its negative copy $-\mathbf{B}$ — for the negatively reformulated questionnaire; see p. 26.

StuPa representativeness, the representativeness of its most plausible coalitions and preservation of the political spectrum.

StuPa by the Third Vote with Shorter Questionnaires To estimate the StuPa's representativeness, we repeat all computations described in Section 3, assuming that the Third Vote ballot is based on one of 12 sets of questions in Table 9.

The popularity and universality indices of the StuPas as if elected using these versions of the Third Vote are displayed in Table 10 and its detailed version, Table 13 (each horizontal section of the former is detailed by a sheet of the latter). The first vertical section of Table 10, computed for the Third Vote ballot with 30 questions, contains the same StuPas' representativeness indices (P/U) as Table 4. Additionally it shows the ranking (R) of their means and the maximal faction ratio (FR) for the StuPa elected that way.

It should be emphasized that the indices are rounded to within one percent, so minor differences between the indices are neglected. The ranks are computed for the means of the *rounded* indices not column-by column but throughout each horizontal section of the table associated with a particular type of the *StuPa-O-Mat* influence. This is done for comparability of election outcomes for all the versions of the Third Vote ballots differing in the number of questions and the models with which they are selected.

To be specific, we explain the upper-left block of the table which is computed for all experimental votes with 30 questions. The ranks of the mean indices are 6, 1, 5, 4, 6. Rank 3 is missing, but it appears in other blocks of the upper horizontal section of the table as well as Ranks 7 and 8. The maximal StuPa faction ratios, depending on the election method, are 3.8, 1.4, 4.3, 2.1 and 3.2. These ratios are computed from Columns '2rd vote', '3rd vote/Norm', '3rd vote+/Norm', '2rd vote & 3rd vote/Norm' and '2rd vote & 3rd vote+/Norm' in the upper section of Table 4. For instance, Faction Ratio 1.4 for the 3rd vote is the maximal ratio $20 : 14 \approx 1.4$ of the percentages of normalized 3rd votes (= percentages of StuPa seats) in Column '3rd vote/Norm' of Table 4. Table 13 displays this column completely, and one can see that this maximal ratio is attained for factions of Juso and LHG or Juso and RCDS.

The second upper block of Table 10 is computed in the same way assuming that the experimental electoral ballot contains 25 *StuPa-O-Mat* questions instead of 30 (one can imagine Table 4 recalculated). Since the party indices of popularity and universality computed for 25 questions are not the same as before, the StuPa elected by the Third Vote methods is apportioned in a modified way. The indices of popularity and universality of the StuPa, unlike that of the parties, are computed again for all 30 questions. This enables comparing the 'complete' representativeness of the StuPa elected using the Third Vote with different questionnaires.

The main objective of our analysis is to understand whether the parliament elected by the Third Vote with a short questionnaire is as representative as elected by the Third Vote with 30 questions. Therefore, we evaluate the questionnaires by the representativeness of the resulting parliaments. Since each questionnaire is tested using five election methods, the average evaluation of a questionnaire is given by the total of five ranks shown under each block of Table 10. A smaller total rank indicates the questionnaire that, on the average, implies a more representative StuPa. Since the 2nd vote (by party name) is independent of the questionnaire, the indices and, consequently, the ranks in Rows '2' (characterizing the 2nd vote) of Table 10 are all the same. Since all total ranks of the table's horizontal section contain this constant rank, they characterize the Third Vote questionnaires only.

Comparing ranks from the table's different horizontal sections makes little sense. For instance, the StuPa's representativeness for the votes influenced by the *StuPa-O-Mat* (the table's bottom section) depends very little on the election method, because the votes are consistent with the electors' preferences. The fewness of the StuPa index levels results in the fewness of ranks, making the total ranks smaller than in other table's sections. The range of total ranks 14–17 is also the smallest. The largest range of total ranks of 13–31 is inherent in the middle

Table 10: 30 question-based indices of representativeness of the 2018 KIT Student Parliament as if elected by the Third Vote with different selections of questions and the maximal faction size ratios FR

Election method	Number of questions in the Third Vote ballot and method of their selection																							
	30			25			24			20					15					10					
	Preselected			SPoM			Essential			Dist			PCAm			PCAM			Dist			PCAm			PCAM	
	P/U	R	FR	P/U	R	FR	P/U	R	FR	P/U	R	FR	P/U	R	FR	P/U	R	FR	P/U	R	FR	P/U	R	FR	P/U	R FR
All experimental votes																										
2	69/80	6	3.8	69/80	6	3.8	69/80	6	3.8	69/80	6	3.8	69/80	6	3.8	69/80	6	3.8	69/80	6	3.8	69/80	6	3.8	69/80	6 3.8
3	71/87	1	1.4	71/87	1	1.5	71/87	1	1.5	71/87	1	1.6	71/87	1	1.6	71/87	1	1.6	71/87	1	1.4	71/87	1	1.4	69/80	6 2.5
3+	70/80	5	4.3	70/80	5	10	71/83	2	101	71/83	2	Inf	70/83	3	12	71/83	2	Inf	70/80	5	Inf	70/83	3	4.5	71/87	1 Inf
23	69/83	4	2.1	69/80	6	2.2	69/80	6	2.2	69/80	6	2.4	69/80	6	2.3	69/83	4	2.3	69/80	6	2.3	69/80	6	2.1	69/83	4 1.9
23+	69/80	6	3.2	70/83	3	5.2	70/83	3	7.8	70/83	3	7.6	70/83	3	5.7	70/80	5	7.9	70/83	3	8.2	69/80	6	3.6	70/83	3 5.6
Total rank	22			21			18			18			19			18			21			22			15	
The experimental votes not influenced by the StuPa-O-Mat																										
2	67/70	7	3.7	67/70	7	3.7	67/70	7	3.7	67/70	7	3.7	67/70	7	3.7	67/70	7	3.7	67/70	7	3.7	67/70	7	3.7	67/70	7 3.7
3	71/83	1	1.5	71/83	1	1.5	69/80	3	1.6	69/80	3	1.8	69/80	3	1.6	71/83	1	1.7	69/80	3	1.8	71/83	1	1.6	69/80	3 2.3
3+	69/77	4	7.4	70/80	2	44	70/80	2	Inf	70/80	2	Inf	70/80	2	Inf	70/80	2	Inf	70/80	2	Inf	70/80	2	31	71/83	1 Inf
23	68/77	5	2.1	68/77	5	2.2	68/77	5	2.2	68/77	5	2.4	68/77	5	2.3	68/77	5	2.3	68/77	5	2.3	68/77	5	2.2	69/80	3 1.9
23+	68/77	5	3.3	69/80	3	5.7	69/80	3	6.7	69/80	3	6.5	69/80	3	7.0	69/77	4	6.4	69/80	3	7.1	69/80	3	4.3	71/83	1 7.3
Total rank	22			18			20			20			20			19			20			18			13	
The experimental votes influenced by the StuPa-O-Mat																										
2	70/83	4	5.9	70/83	4	5.9	70/83	4	5.9	70/83	4	5.9	70/83	4	5.9	70/83	4	5.9	70/83	4	5.9	70/83	4	5.9	70/83	4 5.9
3	73/90	1	1.3	73/90	1	1.4	73/90	1	1.5	73/90	1	1.5	73/90	1	1.6	73/90	1	1.5	73/90	1	1.5	73/90	1	1.2	71/87	3 1.7
3+	70/83	4	2.7	70/83	4	5.8	71/87	3	11	71/87	3	61	71/87	3	14	71/87	3	Inf	71/87	3	14	71/87	3	4.9	71/87	3 3.3
23	71/87	3	2.4	71/87	3	2.6	71/87	3	2.6	71/87	3	2.7	71/87	3	2.8	71/87	3	2.7	71/87	3	2.5	71/87	3	2.6	71/87	3 2.3
23+	70/83	4	3.8	70/83	4	5.9	71/87	3	7.7	71/87	3	11	71/87	3	8.4	71/87	3	12	71/87	3	7.1	71/87	3	5.4	71/87	3 4.3
Total rank	16			16			14			14			14			14			14			14			14	

Election method	Number of questions in the Third Vote ballot and method of their selection																							
	30			25			24			20					15				10					
	Preselected			SPoM			Essential			Dist			PCAm			PCAM			Dist			PCAm			PCAM
	P/U	R	FR	P/U	R	FR	P/U	R	FR	P/U	R	FR	P/U	R	FR	P/U	R	FR	P/U	R	FR	P/U	R	FR	P/U R FR
All experimental votes																								
2	69/80	6	3.8	69/80	6	3.8	69/80	6	3.8	69/80	6	3.8	69/80	6	3.8	69/80	6	3.8	69/80	6	3.8	69/80	6	3.8	69/80 6 3.8
3	71/87	1	1.4	71/87	1	1.5	71/87	1	1.5	71/87	1	1.6	71/87	1	1.6	71/87	1	1.6	71/87	1	1.4	71/87	1	1.4	69/83	4 2.2
3+	70/80	5	4.3	70/80	5	10	71/83	2	101	71/83	2	Inf	70/83	3	12	71/83	2	Inf	70/80	5	Inf	70/83	3	4.5	71/87	1 Inf
23	69/83	4	2.1	69/80	6	2.2	69/80	6	2.2	69/80	6	2.4	69/80	6	2.3	69/83	4	2.3	69/80	6	2.3	69/80	6	2.1	69/83	4 1.9
23+	69/80	6	3.2	70/83	3	5.2	70/83	3	7.8	70/83	3	7.6	70/83	3	5.7	70/80	5	7.9	70/83	3	8.2	69/80	6	3.6	70/83	3 5.6
Total rank	22			21			18			18			19			18			21			22			15
The experimental votes not influenced by the StuPa-O-Mat																								
2	67/70	7	3.7	67/70	7	3.7	67/70	7	3.7	67/70	7	3.7	67/70	7	3.7	67/70	7	3.7	67/70	7	3.7	67/70	7	3.7	67/70	7 3.7
3	71/83	1	1.5	71/83	1	1.5	69/80	3	1.6	69/80	3	1.8	69/80	3	1.6	71/83	1	1.7	69/80	3	1.8	71/83	1	1.6	69/80	3 2.3
3+	69/77	4	7.4	70/80	2	44	70/80	2	Inf	70/80	2	Inf	70/80	2	Inf	70/80	2	Inf	70/80	2	Inf	70/80	2	31	71/83	1 Inf
23	68/77	5	2.1	68/77	5	2.2	68/77	5	2.2	68/77	5	2.4	68/77	5	2.3	68/77	5	2.3	68/77	5	2.3	68/77	5	2.2	69/80	3 1.9
23+	68/77	5	3.3	69/80	3	5.7	69/80	3	6.7	69/80	3	6.5	69/80	3	7.0	69/77	4	6.4	69/80	3	7.1	69/80	3	4.3	71/83	1 7.3
Total rank	22			18			20			20			20			19			20			18			13
The experimental votes influenced by the StuPa-O-Mat																								
2	70/83	4	5.9	70/83	4	5.9	70/83	4	5.9	70/83	4	5.9	70/83	4	5.9	70/83	4	5.9	70/83	4	5.9	70/83	4	5.9	70/83	4 5.9
3	73/90	1	1.3	73/90	1	1.4	73/90	1	1.5	73/90	1	1.5	73/90	1	1.6	73/90	1	1.5	73/90	1	1.5	73/90	1	1.2	71/87	3 1.7
3+	70/83	4	2.7	70/83	4	5.8	71/87	3	11	71/87	3	61	71/87	3	14	71/87	3	Inf	71/87	3	14	71/87	3	4.9	71/87	3 3.3
23	71/87	3	2.4	71/87	3	2.6	71/87	3	2.6	71/87	3	2.7	71/87	3	2.8	71/87	3	2.7	71/87	3	2.5	71/87	3	2.6	71/87	3 2.3
23+	70/83	4	3.8	70/83	4	5.9	71/87	3	7.7	71/87	3	11	71/87	3	8.4	71/87	3	12	71/87	3	7.1	71/87	3	5.4	71/87	3 4.3
Total rank	16			16			14			14			14			14			14			14			14

Election method	Number of questions in the Third Vote ballot and method of their selection																							
	30			25			24			20					15				10					
	Preselected			SPoM			Essential			Dist			PCAm			PCAM			Dist			PCAm			PCAM
	P/U	R	FR	P/U	R	FR	P/U	R	FR	P/U	R	FR	P/U	R	FR	P/U	R	FR	P/U	R	FR	P/U	R	FR	P/U R FR
All experimental votes																								
2	69/80	6	3.8	69/80	6	3.8	69/80	6	3.8	69/80	6	3.8	69/80	6	3.8	69/80	6	3.8	69/80	6	3.8	69/80	6	3.8	69/80 6 3.8
3	71/87	1	1.4	71/87	1	1.5	71/87	1	1.5	71/87	1	1.6	71/87	1	1.6	71/87	1	1.6	71/87	1	1.4	71/87	1	1.4	69/83	4 2.2
3+	70/80	5	4.3	70/80	5	10	71/83	2	101	71/83	2	Inf	70/83	3	12	71/83	2	Inf	70/80	5	Inf	70/83	3	4.5	71/87	1 Inf
23	69/83	4	2.1	69/80	6	2.2	69/80	6	2.2	69/80	6	2.4	69/80	6	2.3	69/83	4	2.3	69/80	6	2.3	69/80	6	2.1	69/83	4 1.9
23+	69/80	6	3.2	70/83	3	5.2	70/83	3	7.8	70/83	3	7.6	70/83	3	5.7	70/80	5	7.9	70/83	3	8.2	69/80	6	3.6	70/83	3 5.6
Total rank	22			21			18			18			19			18			21			22			15
The experimental votes not influenced by the StuPa-O-Mat																								
2	67/70	7	3.7	67/70	7	3.7	67/70	7	3.7	67/70	7	3.7	67/70	7	3.7	67/70	7	3.7	67/70	7	3.7	67/70	7	3.7	67/70	7 3.7
3	71/83	1	1.5	71/83	1	1.5	69/80	3	1.6	69/80	3	1.8	69/80	3	1.6	71/83	1	1.7	69/80	3	1.8	71/83	1	1.6	69/80	3 2.3
3+	69/77	4	7.4	70/80	2	44	70/80	2	Inf	70/80	2	Inf	70/80	2	Inf	70/80	2	Inf	70/80	2	Inf	70/80	2	31	71/83	1 Inf
23	68/77	5	2.1	68/77	5	2.2	68/77	5	2.2	68/77	5	2.4	68/77	5	2.3	68/77	5	2.3	68/77	5	2.3	68/77	5	2.2	69/80	3 1.9
23+	68/77	5	3.3	69/80	3	5.7	69/80	3	6.7	69/80	3	6.5	69/80	3	7.0	69/77	4	6.4	69/80	3	7.1	69/80	3	4.3	71/83	1 7.3
Total rank	22			18			20			20			20			19			20			18			13
The experimental votes influenced by the StuPa-O-Mat																								
2	70/83	4	5.9	70/83	4	5.9	70/83	4	5.9	70/83	4	5.9	70/83	4	5.9	70/83	4	5.9	70/83	4	5.9	70/83	4	5.9	70/83	4 5.9
3	73/90	1	1.3	73/90	1	1.4	73/90	1	1.5	73/90	1	1.5	73/90	1	1.6	73/90	1	1.5	73/90	1	1.5	73/90	1	1.2	71/87	3 1.7
3+	70/83	4	2.7	70/83	4	5.8	71/87	3	11	71/87	3	61	71/87	3	14	71/87	3	Inf	71/87	3	14	71/87	3	4.9	71/87	3 3.3
23	71/87	3	2.4	71/87	3	2.6	71/87	3	2.6	71/87	3	2.7	71/87	3	2.8	71/87	3	2.7	71/87	3	2.5	71/87	3	2.6	71/87	3 2.3
23+	70/83	4	3.8	70/83	4	5.9	71/87	3	7.7	71/87	3	11	71/87	3	8.4	71/87	3	12	71/87	3	7.1	71/87	3	5.4	71/87	3 4.3
Total rank	16			16			14			14			14			14			14			14			14

Election method	Number of questions in the Third Vote ballot and method of their selection																							
	30			25			24			20					15				10					
	Preselected			SPoM			Essential			Dist			PCAm			PCAM			Dist			PCAm			PCAM
	P/U	R	FR	P/U	R	FR	P/U	R	FR	P/U	R	FR	P/U	R	FR	P/U	R	FR	P/U	R	FR	P/U	R	FR	P/U R FR
All experimental votes																								
2	69/80	6	3.8	69/80	6	3.8	69/80	6	3.8	69/80	6	3.8	69/80	6	3.8	69/80	6	3.8	69/80	6	3.8	69/80	6	3.8	69/80 6 3.8
3	71/87	1	1.4	71/87	1	1.5	71/87	1	1.5	71/87	1	1.6	71/87	1	1.6	71/87	1	1.6	71/87	1	1.4	71/87	1	1.4	69/80	6 2.5
3+	70/80	5	4.3	70/80	5	10	71/83	2	101	71/83	2	Inf	70/83	3	12	71/83	2	Inf	70/80	5	Inf	70/83	3	4.5	71/87	1 Inf
23	69/83	4	2.1	69/80	6	2.2	69/80	6	2.2	69/80	6	2.4	69/80	6	2.3	69/83	4	2.3	69/80	6	2.3	69/80	6	2.1	69/83	4 1.9
23+	69/80	6	3.2	70/83	3	5.2	70/83	3	7.8	70/83	3	7.6	70/83	3	5.7	70/80	5	7.9	70/83	3	8.2	69/80	6	3.6	70/83	3 5.6
Total rank	22			21			18			18			19			18			21			22			15
The experimental votes not influenced by the StuPa-O-Mat																								
2	67/70	7	3.7	67/70	7	3.7	67/70	7	3.7	67/70	7	3.7	67/70	7	3.7	67/70	7	3.7	67/70	7	3.7	67/70	7	3.7	67/70	7 3.7
3	71/83	1	1.5	71/83	1	1.5	69/80	3	1.6	69/80	3	1.8	69/80	3	1.6	71/83	1	1.7	69/80	3	1.8	71/83	1	1.6	69/80	3 2.3
3+	69/77	4	7.4	70/80	2	44	70/80	2	Inf	70/80	2	Inf	70/80	2	Inf	70/80	2	Inf	70/80	2	Inf	70/80	2	31	71/83	1 Inf
23	68/77	5	2.1	68/77	5	2.2	68/77	5	2.2	68/77	5	2.4	68/77	5	2.3	68/77	5	2.3	68/77	5	2.3	68/77	5	2.2	69/80	3 1.9
23+	68/77	5	3.3	69/80	3	5.7	69/80	3	6.7	69/80	3	6.5	69/80	3	7.0	69/77	4	6.4	69/80	3	7.1	69/80	3	4.3	71/83	1 7.3
Total rank	22			18			20			20			20			19			20			18			13
The experimental votes influenced by the StuPa-O-Mat																								
2	70/83	4	5.9	70/83	4	5.9	70/83	4	5.9	70/83	4	5.9	70/83	4	5.9	70/83	4	5.9	70/83	4	5.9	70/83	4	5.9	70/83	4 5.9
3	73/90	1	1.3	73/90	1	1.4	73/90	1	1.5	73/90	1	1.5	73/90	1	1.6	73/90	1	1.5	73/90	1	1.5	73/90	1	1.2	71/87	3 1.7
3+	70/83	4	2.7	70/83	4	5.8	71/87	3	11	71/87	3	61	71/87	3	14	71/87	3	Inf	71/87	3	14	71/87	3	4.9	71/87	3 3.3
23	71/87	3	2.4	71/87	3	2.6	71/87	3	2.6	71/87	3	2.7	71/87	3	2.8	71/87	3	2.7	71/87	3	2.5	71/87	3	2.6	71/87	3 2.3
23+	70/83	4	3.8	70/83	4	5.9	71/87	3	7.7	71/87	3	11	71/87	3	8.4	71/87	3	12	71/87	3	7.1	71/87	3	5.4	71/87	3 4.3
Total rank	16			16			14			14			14			14			14			14			14

section of the table which describes the case of votes not influenced by the *StuPa-O-Mat*, i.e. the case when the electors vote least consistently with their preferences. For this category of electors, the Third Vote is most efficient, and the best criterion seems to be the PCAM — which flattens the policy spectrum.

StuPa Coalitions under the Third Vote with Shorter Questionnaires We consider the most realistic — most unanimous minimal eligible — coalitions in the StuPa as if elected using the experimental ballots with different selections of questions shown in Table 9. For each selection, we perform the analysis described in Section 4 and summarize the results in Table 11 and its detailed version, Table 14 (each horizontal section of the former is detailed by a sheet of the latter). Their design is analogous to that of Tables 10 and 13 but we nevertheless make a few remarks.

The left vertical section of Table 11 shows the results obtained for the questionnaire of 30 questions, as in Section 4. It contains most important elements of Tables 5–7 — the rounded indices of popularity and universality of the most unanimous minimal eligible coalition under five election methods and the ranks of their means (computed throughout the horizontal section of the table). The coalition's composition, faction size and unanimity are additionally displayed in Table 13.

As in Table 10, the questionnaires are evaluated by the total ranks, in this case of the StuPa's most realistic coalitions under five election methods. Again, smaller total ranks within a horizontal section of the table indicate 'better' questionnaires. As in the previous paragraph, for the set of votes not influenced by the StuPa-O-Mat (for which the Third Vote is most relevant), the best criterion seems to be the PCAM which aims at policy spectrum flattening.

StuPa's Political Spectrum for Shorter Questionnaires Figure 10 displays 12 PCA eigenvector plots for the party profiles based on 12 selections of questions from Table 9. The corresponding correlation triangles for the contiguous party orderings are shown in Figure 11. They are computed exactly in the same way as in Section 5, and the upper-left plots in Figures 10 and 11 repeat the plots of Figures 8 and 9, respectively.

To facilitate comparisons, all party orderings begin with the LISTE. Its vector stands apart from other vectors in all the plots of Figure 10 except for the 11th set of questions; see the central-bottom plot. As well seen from 'higher altitudes' along the correlation triangle diagonals in Figure 11, the party orderings are fairly contiguous. The party orderings are very similar, the only deviations from the initial ordering (in the upper-left plot) are four permutations of adjacent Juso and Linke and two permutations of adjacent RCDS and LHG.

To judge about the differences between political spectra more formally, we compute the correlations between them. We proceed in the following way. For each selection of questions $Q_t,\ t = 1, \ldots, 12$, we compute the (6×6)-matrix of correlations $\mathbf{C}_t$ between six duplicated party policy profiles based on questions Q_t. The columns of matrix $\mathbf{C}_t$ are concatenated, resulting in a (36×1)-vector $\mathbf{c}_t$ whose elements are correlations (proximities) of party profile pairs:

$$\mathbf{C}_t = \rho \begin{bmatrix} \mathbf{B}(Q_t, :) \\ -\mathbf{B}(Q_t, :) \end{bmatrix} \qquad \Rightarrow \qquad \mathbf{c}_t \ , \quad t = 1, \ldots, 12 \ .$$

Vectors $\mathbf{c}_t,\ t = 1, \ldots, 12$, have the invariable order of party pairs, and comprehensively describe 12 configurations of party vectors in the 5D space — the political spectra based on different questionnaires. We characterize the proximity between these spectra by the (12×12)-matrix of their correlations $\rho(\mathbf{c}_1 \cdots \mathbf{c}_{12})$ shown in Table 12.

The table's first row is for us most interesting. It characterizes the distortions of the initial spectrum (based on 30 questions) as the Third Vote questionnaire is becoming shorter. This is a natural consequence of information losses, the correlations displayed in the table's first row

Table 11: 30-question-based indices of the most unanimous minimal eligible coalitions of the 2018 StuPa as if elected by Third Vote methods using different selections of questions, assuming the faction size factor $f = 0.5$

Election method	Number of questions in the Third Vote ballot and method of their selection																	
	30		25		24		20			15			10					
	Preselected		SPoM		Essential		Dist		PCAm	PCAM		Dist		PCAm	PCAM		Dist		PCAm	PCAM
	P/U	R	P/U	R	P/U	R	P/U	R	P/U R	P/U R		P/U R		P/U R	P/U R		P/U R		P/U R	P/U R
All experimental votes																				
2	69/82	5	69/82	5	69/82	5	69/82	5	69/82 5	69/82 5		69/82 5		69/82 5	69/82 5		69/82 5		69/82 5	69/82 5
3	69/82	5	69/82	5	69/82	5	69/82	5	69/82 5	69/82 5		69/82 5		69/82 5	69/82 5		69/82 5		69/82 5	69/82 5
3+	72/84	2	72/84	2	72/84	2	72/84	2	71/84 3	72/84 2		72/84 2		72/84 2	71/84 3		71/84 3		69/82 5	72/89 1
23	69/82	5	69/82	5	69/82	5	69/82	5	69/82 5	69/82 5		69/82 5		69/82 5	69/82 5		69/82 5		69/82 5	69/82 5
23+	69/82	5	72/84	2	72/84	2	72/84	2	72/84 2	72/84 2		72/84 2		69/83 4	72/84 2		72/84 2		69/82 5	71/84 3
Total rank	22		19		19		19		20	19		19		21	20		20		25	19
The experimental votes not influenced by the StuPa-O-Mat																				
2	68/73	7	68/73	7	68/73	7	68/73	7	68/73 7	68/73 7		68/73 7		68/73 7	68/73 7		68/73 7		68/73 7	68/73 7
3	68/79	6	68/79	6	68/79	6	68/79	6	68/79 6	68/79 6		68/79 6		68/79 6	68/79 6		68/79 6		68/79 6	68/79 6
3+	71/88	1	71/88	1	71/88	1	71/88	1	71/88 1	71/88 1		71/88 1		71/88 1	71/88 1		71/80 4		69/83 3	71/84 2
23	68/80	5	68/80	5	68/79	6	68/80	5	68/79 6	68/79 6		68/79 6		68/79 6	68/79 6		68/79 6		68/80 5	68/79 6
23+	68/72	8	71/80	4	71/80	4	71/80	4	71/80 4	71/80 4		71/88 1		71/88 1	71/88 1		71/80 4		69/70 9	71/81 3
Total rank	27		23		24		23		24	24		21		21	21		27		30	24
The experimental votes influenced by the StuPa-O-Mat																				
2	70/89	2	70/89	2	70/89	2	70/89	2	70/89 2	70/89 2		70/89 2		70/89 2	70/89 2		70/89 2		70/89 2	70/89 2
3	70/89	2	70/89	2	70/89	2	70/86	4	70/89 2	70/89 2		70/86 4		70/89 2	70/89 2		70/86 4		70/86 4	70/89 2
3+	70/89	2	71/87	3	72/88	1	72/88	1	72/88 1	72/88 1		72/88 1		72/88 1	70/89 2		72/88 1		70/86 4	72/88 1
23	70/89	2	70/89	2	70/89	2	70/89	2	70/89 2	70/89 2		70/89 2		70/89 2	70/89 2		70/89 2		70/89 2	70/89 2
23+	70/89	2	71/87	3	72/88	1	72/88	1	72/88 1	72/88 1		72/88 1		72/88 1	70/89 2		72/88 1		70/89 2	72/88 1
Total rank	10		12		8		10		8	8		10		8	10		10		14	8

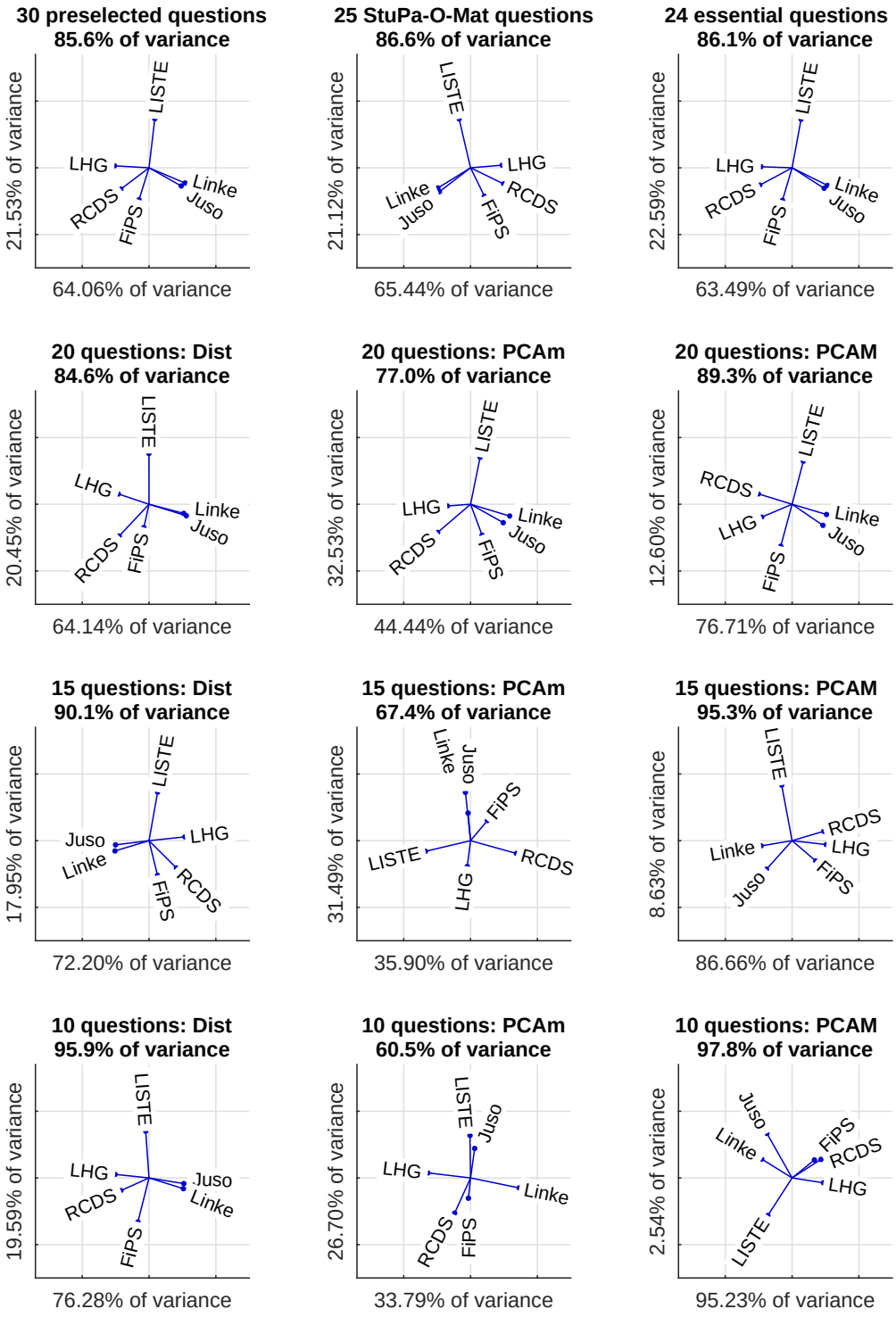

Figure 10: Eigenvector plots for PCA analysis of party profiles based on different selections of questions with their doubles in negative form

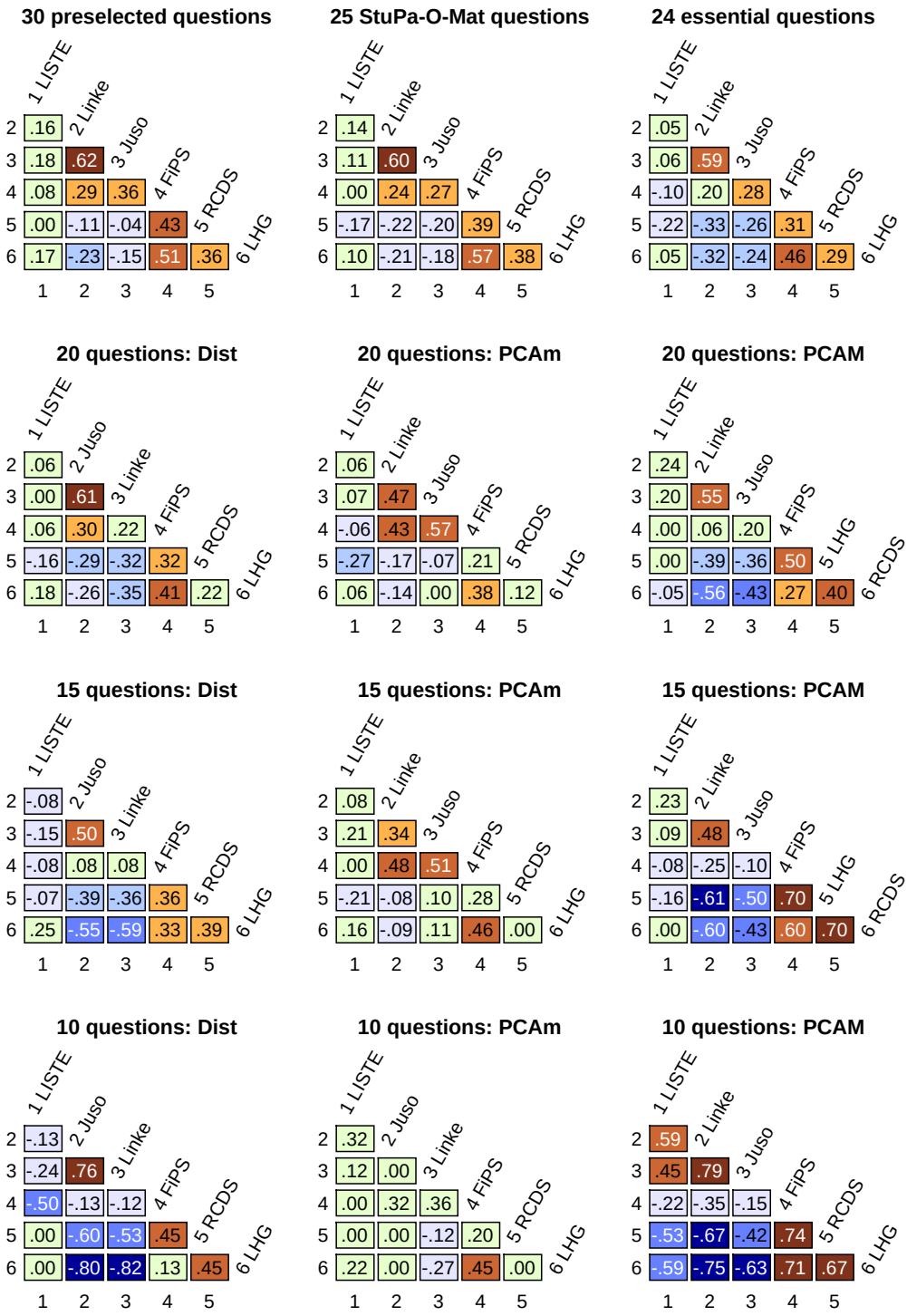

Figure 11: Correlation triangles for the 2018 KIT parties' policy profiles for 12 selections of questions

Table 12: Pearson correlations between the political spectra obtained for different selections of questions

	Number of questions in the Third Vote ballot and method of their selection											
	30	25	24	20			15			10		
	Preselected	SPoM	Essential	Dist	PCAm	PCAM	Dist	PCAm	PCAM	Dist	PCAm	PCAM
30 Preselected	1.00	0.99	1.00	0.99	0.94	0.97	0.97	0.91	0.92	0.95	0.89	0.86
25 SPoM	0.99	1.00	1.00	0.99	0.94	0.97	0.96	0.90	0.92	0.93	0.87	0.88
24 Essential	1.00	1.00	1.00	0.99	0.95	0.97	0.96	0.92	0.91	0.93	0.88	0.86
20 Dist	0.99	0.99	0.99	1.00	0.95	0.96	0.97	0.91	0.89	0.93	0.88	0.82
PCAm	0.94	0.94	0.95	0.95	1.00	0.88	0.87	0.98	0.76	0.81	0.91	0.72
PCAM	0.97	0.97	0.97	0.96	0.88	1.00	0.95	0.83	0.95	0.93	0.85	0.91
15 Dist	0.97	0.96	0.96	0.97	0.87	0.95	1.00	0.83	0.92	0.97	0.85	0.82
PCAm	0.91	0.90	0.92	0.91	0.98	0.83	0.83	1.00	0.71	0.76	0.95	0.68
PCAM	0.92	0.92	0.91	0.89	0.76	0.95	0.92	0.71	1.00	0.93	0.75	0.95
10 Dist	0.95	0.93	0.93	0.93	0.81	0.93	0.97	0.76	0.93	1.00	0.76	0.85
PCAm	0.89	0.87	0.88	0.88	0.91	0.85	0.85	0.95	0.75	0.76	1.00	0.67
PCAM	0.86	0.88	0.86	0.82	0.72	0.91	0.82	0.68	0.95	0.85	0.67	1.00

PVAL < 0.0005 for all elements of the table

are very high. Even the questionnaire reduction to 10 questions (loss of 2/3 of information) is not critical: the correlation between the resulting political spectrum and the initial one is of the range 0.86–0.95.

For questionnaires of the same size, e.g. with 20 questions, the political spectrum is best preserved if the questionnaires are selected using the Dist criterion. In fact, with regard to extremities attained under the conglobation PCAm and flattening PCAM criteria, the Dist criterion provides a medium conglobation/flattening of the political spectrum; see the last row in Table 9.

8 Conclusions

The 2018 experiment demonstrates that the Third Vote election methods, particularly the Third Vote+, also combined with the traditional second vote, can significantly improve policy representation both of a parliament and of governing coalitions. To avoid manipulability of elections, it is suggested that the questions could be drawn up by the parties themselves and shared with all other parties, giving them an opportunity to make their positions comparable. This process, if considered part of the electoral campaign, would exclude all claims of partiality. However, the questions can be too numerous to be included in the electoral ballots and, at the same time, can poorly highlight the parties' distinctions. By practical reasons, the questions should be rather few in number and independent — not to overweight some topics — and maximally discriminate between the parties. To reduce long questionnaires, three optimization models are proposed and tested. It looks that the most appropriate is the combination of the 2nd and 3rd vote+ methods, and the reduction of the questionnaire can be done using the Dist criterion.

It should be noted that mathematical advancements alone are insufficient. They do not replace the parties' creativity and fantasy in formulating challenging policy issues. As economics, Western politics is based rather on supply than demand, and following this principle leaves much to be desired. The student parties often focus on secondary problems and respond to them in the same key. All of these result in a political landscape with limited diversity and weak opposition. Correspondingly, the student electorate's turnout is low and voting outcomes are not always rational. This means that there are matters beyond the election methodology that may need serious consideration.

9 Appendix: Detailed Tables 10 and 11

Table 13: Table 10 with faction size ratios FiPS : Juso : Linke : LHG : LISTE : RCDS and their maxima

Election method	30 preselected questions				25 SPoM questions				24 essential questions			
	P/U	R	Faction ratio	max	P/U	R	Faction ratio	max	P/U	R	Faction ratio	max
All experimental votes												
2	69/80	6	27:23:20:13:9:7	3.8	69/80	6	27:23:20:13:9:7	3.8	69/80	6	27:23:20:13:9:7	3.8
3	71/87	1	18:20:19:14:15:14	1.4	71/87	1	18:20:19:14:15:13	1.5	71/87	1	18:21:20:14:15:13	1.5
3+	70/80	5	21:28:25:6:12:8	4.3	70/80	5	24:30:28:7:9:3	10	71/83	2	24:36:31:1:7:0	101
23	69/83	4	23:21:20:14:12:11	2.1	69/80	6	23:21:20:14:12:10	2.2	69/80	6	23:22:20:13:12:10	2.2
23+	69/80	6	24:25:22:10:11:8	3.2	70/83	3	25:26:24:10:9:5	5.2	70/83	3	26:29:26:7:8:4	7.8
Total rank		22				21				18		

Election method	20 questions in the Third Vote ballot											
	Dist				PCAm				PCAM			
	P/U	R	Faction ratio	max	P/U	R	Faction ratio	max	P/U	R	Faction ratio	max
All experimental votes												
2	69/80	6	27:23:20:13:9:7	3.8	69/80	6	27:23:20:13:9:7	3.8	69/80	6	27:23:20:13:9:7	3.8
3	71/87	1	19:20:20:13:15:13	1.6	71/87	1	19:21:19:14:13:13	1.6	71/87	1	18:20:19:13:17:13	1.6
3+	71/83	2	27:32:31:1:8:0	Inf	70/83	3	28:34:28:4:3:3	12	71/83	2	19:34:29:0:17:0	Inf
23	69/80	6	23:21:20:13:12:10	2.4	69/80	6	23:22:20:13:11:10	2.3	69/83	4	22:21:20:13:13:10	2.3
23+	70/83	3	27:27:26:7:9:4	7.6	70/83	3	27:28:24:9:6:5	5.7	70/80	5	23:28:25:7:13:4	7.9
Total rank		18				19				18		

Election method	15 questions in the Third Vote ballot											
	Dist				PCAm				PCAM			
	P/U	R	Faction ratio	max	P/U	R	Faction ratio	max	P/U	R	Faction ratio	max
All experimental votes												
2	69/80	6	27:23:20:13:9:7	3.8	69/80	6	27:23:20:13:9:7	3.8	69/80	6	27:23:20:13:9:7	3.8
3	71/87	1	20:20:20:13:15:13	1.6	71/87	1	18:20:19:14:15:14	1.4	71/87	1	15:19:19:14:18:15	1.4
3+	70/80	5	32:32:31:0:5:0	Inf	70/83	3	23:28:28:6:8:7	4.5	71/87	1	5:36:30:0:26:3	Inf
23	69/80	6	24:21:20:13:12:10	2.3	69/80	6	23:21:20:14:12:11	2.1	69/83	4	21:21:19:14:14:11	1.9
23+	70/83	3	30:27:26:7:7:4	8.2	69/80	6	25:25:24:10:9:7	3.6	70/83	3	16:29:25:7:17:5	5.6
Total rank		21				22				15		

Election method	10 questions in the Third Vote ballot											
	Dist				PCAm				PCAM			
	P/U	R	Faction ratio	max	P/U	R	Faction ratio	max	P/U	R	Faction ratio	max
All experimental votes												
2	69/80	6	27:23:20:13:9:7	3.8	69/80	6	27:23:20:13:9:7	3.8	69/80	6	27:23:20:13:9:7	3.8
3	69/83	4	19:23:21:10:13:14	2.2	70/80	5	19:16:17:17:15:16	1.3	69/80	6	15:25:21:10:17:13	2.5
3+	71/83	2	21:44:35:0:0:0	Inf	70/77	7	29:15:20:16:8:12	3.5	69/83	4	0:57:32:0:12:0	Inf
23	69/80	6	23:23:21:12:11:10	2.2	71/87	1	23:19:19:15:12:11	2.0	69/83	4	21:24:20:12:13:10	2.4
23+	70/83	3	24:33:28:7:5:4	9.3	68/73	8	28:19:20:15:9:10	3.2	71/87	1	14:40:26:7:11:4	11
Total rank		21				27				21		

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Table 13: **(continued)** Table 10 with faction size ratios FiPS : Juso : Linke : LHG : LISTE : RCDS and their maxima

Election method	30 preselected questions			25 SPoM questions			24 essential questions		
	P/U	R	Faction ratio max	P/U	R	Faction ratio max	P/U	R	Faction ratio max
The experimental votes not influenced by the StuPa-O-Mat									
2	67/70	7	31:24:16:12:8:9 3.7	67/70	7	31:24:16:12:8:9 3.7	67/70	7	31:24:16:12:8:9 3.7
3	71/83	1	18:19:20:13:15:14 1.5	71/83	1	18:20:21:14:15:13 1.5	69/80	3	18:20:21:13:15:13 1.6
3+	69/77	4	21:28:29:4:11:7 7.4	70/80	2	23:31:35:3:7:1 44	70/80	2	23:35:39:0:4:0 Inf
23	68/77	5	24:22:18:13:12:12 2.1	68/77	5	25:22:18:13:12:11 2.2	68/77	5	25:22:18:12:12:11 2.2
23+	68/77	5	26:26:22:8:10:8 3.3	69/80	3	27:27:25:7:8:5 5.7	69/80	3	27:29:27:6:6:4 6.7
Total rank		22			18			20	

Election method	20 questions in the Third Vote ballot								
	Dist			PCAm			PCAM		
	P/U	R	Faction ratio max	P/U	R	Faction ratio max	P/U	R	Faction ratio max
The experimental votes not influenced by the StuPa-O-Mat									
2	67/70	7	31:24:16:12:8:9 3.7	67/70	7	31:24:16:12:8:9 3.7	67/70	7	31:24:16:12:8:9 3.7
3	69/80	3	19:20:22:13:15:12 1.8	69/80	3	19:20:21:13:13:13 1.6	71/83	1	17:20:21:12:17:12 1.7
3+	70/80	2	26:31:39:0:4:0 Inf	70/80	2	28:34:37:0:0:0 Inf	70/80	2	16:32:38:0:14:0 Inf
23	68/77	5	25:22:19:12:11:11 2.4	68/77	5	25:22:18:12:11:11 2.3	68/77	5	24:22:18:12:13:11 2.3
23+	69/80	3	28:28:27:6:6:4 6.5	69/80	3	30:29:26:6:4:5 7.0	69/77	4	24:28:27:6:11:4 6.4
Total rank		20			20			19	

Election method	15 questions in the Third Vote ballot								
	Dist			PCAm			PCAM		
	P/U	R	Faction ratio max	P/U	R	Faction ratio max	P/U	R	Faction ratio max
The experimental votes not influenced by the StuPa-O-Mat									
2	67/70	7	31:24:16:12:8:9 3.7	67/70	7	31:24:16:12:8:9 3.7	67/70	7	31:24:16:12:8:9 3.7
3	69/80	3	19:20:22:12:14:13 1.8	71/83	1	18:18:22:14:14:14 1.6	71/83	1	15:19:21:13:18:15 1.6
3+	70/80	2	29:29:42:0:0:0 Inf	70/80	2	24:25:41:1:5:5 31	71/83	1	0:30:48:0:22:0 Inf
23	68/77	5	25:22:19:12:11:11 2.3	68/77	5	25:21:19:13:11:11 2.2	69/80	3	23:21:18:12:13:12 1.9
23+	69/80	3	30:26:29:6:4:4 7.1	69/80	3	27:25:28:7:7:7 4.3	71/83	1	16:27:32:6:15:4 7.3
Total rank		20			18			13	

Election method	10 questions in the Third Vote ballot								
	Dist			PCAm			PCAM		
	P/U	R	Faction ratio max	P/U	R	Faction ratio max	P/U	R	Faction ratio max
The experimental votes not influenced by the StuPa-O-Mat									
2	67/70	7	31:24:16:12:8:9 3.7	67/70	7	31:24:16:12:8:9 3.7	67/70	7	31:24:16:12:8:9 3.7
3	69/80	3	19:23:21:10:13:14 2.3	69/77	4	20:14:21:16:14:16 1.5	69/77	4	14:26:21:10:17:13 2.7
3+	70/80	2	20:44:36:0:0:0 Inf	67/70	7	33:0:41:12:3:10 Inf	69/80	3	0:57:31:0:12:0 Inf
23	68/77	5	25:23:19:11:11:11 2.3	69/73	6	25:19:18:14:11:12 2.2	69/80	3	23:25:18:11:13:11 2.3
23+	69/80	3	26:34:26:6:4:4 8.1	67/70	7	32:12:28:12:6:10 5.6	69/77	4	16:40:23:6:10:4 9.2
Total rank		20			31			21	

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Table 13: **(continued)** Table 10 with faction size ratios FiPS : Juso : Linke : LHG : LISTE : RCDS and their maxima

Election method	30 preselected questions				25 SPoM questions				24 essential questions			
	P/U	R	Faction ratio	max	P/U	R	Faction ratio	max	P/U	R	Faction ratio	max
The experimental votes influenced by the StuPa-O-Mat												
2	70/83	4	21:20:28:15:11:5	5.9	70/83	4	21:20:28:15:11:5	5.9	70/83	4	21:20:28:15:11:5	5.9
3	73/90	1	18:19:19:15:15:14	1.3	73/90	1	19:18:19:15:14:13	1.4	73/90	1	19:19:20:15:14:13	1.5
3+	70/83	4	23:23:24:10:11:9	2.7	70/83	4	26:24:26:12:8:4	5.8	71/87	3	27:27:29:8:6:3	11
23	71/87	3	20:19:23:15:13:10	2.4	71/87	3	20:19:23:15:13:9	2.6	71/87	3	20:20:24:15:13:9	2.6
23+	70/83	4	22:22:26:13:11:7	3.8	70/83	4	23:22:27:14:9:5	5.9	71/87	3	24:24:28:12:9:4	7.7
Total rank		16				16				14		

Election method	20 questions in the Third Vote ballot											
	Dist				PCAm				PCAM			
	P/U	R	Faction ratio	max	P/U	R	Faction ratio	max	P/U	R	Faction ratio	max
The experimental votes influenced by the StuPa-O-Mat												
2	70/83	4	21:20:28:15:11:5	5.9	70/83	4	21:20:28:15:11:5	5.9	70/83	4	21:20:28:15:11:5	5.9
3	73/90	1	20:19:20:14:15:13	1.5	73/90	1	19:20:20:14:14:13	1.6	73/90	1	19:19:19:15:16:13	1.5
3+	71/87	3	30:27:29:6:8:0	61	71/87	3	26:29:29:8:5:2	14	71/87	3	25:25:28:7:15:0	Inf
23	71/87	3	20:20:24:15:13:9	2.7	71/87	3	20:20:24:15:12:9	2.8	71/87	3	20:19:23:15:14:9	2.7
23+	71/87	3	26:24:28:11:9:3	11	71/87	3	24:25:28:12:8:3	8.4	71/87	3	23:23:28:11:13:2	12
Total rank		14				14				14		

Election method	15 questions in the Third Vote ballot											
	Dist				PCAm				PCAM			
	P/U	R	Faction ratio	max	P/U	R	Faction ratio	max	P/U	R	Faction ratio	max
The experimental votes influenced by the StuPa-O-Mat												
2	70/83	4	21:20:28:15:11:5	5.9	70/83	4	21:20:28:15:11:5	5.9	70/83	4	21:20:28:15:11:5	5.9
3	73/90	1	21:18:19:14:14:14	1.5	73/90	1	19:19:20:15:14:14	1.5	73/90	1	17:17:18:16:17:15	1.2
3+	71/87	3	36:25:29:3:4:3	14	71/87	3	24:25:28:10:8:6	4.9	71/87	3	19:17:27:13:17:8	3.3
23	71/87	3	21:19:23:15:13:9	2.5	71/87	3	20:20:24:15:13:9	2.6	71/87	3	19:18:23:16:14:10	2.3
23+	71/87	3	29:22:28:9:8:4	7.1	71/87	3	22:23:28:13:9:5	5.4	71/87	3	20:18:27:14:14:6	4.3
Total rank		14				14				14		

Election method	10 questions in the Third Vote ballot											
	Dist				PCAm				PCAM			
	P/U	R	Faction ratio	max	P/U	R	Faction ratio	max	P/U	R	Faction ratio	max
The experimental votes influenced by the StuPa-O-Mat												
2	70/83	4	21:20:28:15:11:5	5.9	70/83	4	21:20:28:15:11:5	5.9	70/83	4	21:20:28:15:11:5	5.9
3	71/87	3	20:20:20:12:13:15	1.7	72/90	2	19:16:18:16:16:15	1.3	73/90	1	17:20:21:13:16:13	1.6
3+	71/87	3	35:31:34:0:0:0	Inf	70/83	4	25:14:23:15:12:10	2.5	72/90	2	17:35:38:0:10:0	Inf
23	71/87	3	21:20:24:14:12:10	2.4	71/87	3	20:18:23:16:13:10	2.3	71/87	3	19:20:24:14:13:9	2.7
23+	71/87	3	28:26:31:8:5:2	13	70/83	4	23:17:25:15:12:7	3.4	72/90	2	19:28:33:8:10:2	14
Total rank		16				17				12		

Table 14: Detailed Table 11

Election method	30 preselected questions					25 SPoM questions					24 essential questions				
	Coalition	StuPa seats, %	Un	P/U	R	Coalition	StuPa seats, %	Un	P/U	R	Coalition	StuPa seats, %	Un	P/U	R
All experimental votes															
2	FiPS+Juso+Linke	27+23+20=70	77	69/82	5	FiPS+Juso+Linke	27+23+20=70	77	69/82	5	FiPS+Juso+Linke	27+23+20=70	77	69/82	5
3	FiPS+Juso+Linke	18+20+19=56	77	69/82	5	FiPS+Juso+Linke	18+20+19=57	77	69/82	5	FiPS+Juso+Linke	18+21+20=58	77	69/82	5
3+	Juso+Linke	28+25=52	92	72/84	2	Juso+Linke	30+28=58	92	72/84	2	Juso+Linke	36+31=67	92	72/84	2
23	FiPS+Juso+Linke	23+21+20=63	77	69/82	5	FiPS+Juso+Linke	23+21+20=64	77	69/82	5	FiPS+Juso+Linke	23+22+20=64	77	69/82	5
23+	FiPS+Juso+Linke	24+25+22=72	77	69/82	5	Juso+Linke	26+24=51	92	72/84	2	Juso+Linke	29+26=55	92	72/84	2
Total rank					22					19					19

Election method	20 questions in the Third Vote ballot														
	Dist					PCAm					PCAM				
	Coalition	StuPa seats, %	Un	P/U	R	Coalition	StuPa seats, %	Un	P/U	R	Coalition	StuPa seats, %	Un	P/U	R
All experimental votes															
2	FiPS+Juso+Linke	27+23+20=70	77	69/82	5	FiPS+Juso+Linke	27+23+20=70	77	69/82	5	FiPS+Juso+Linke	27+23+20=70	77	69/82	5
3	FiPS+Juso+Linke	19+20+20=59	77	69/82	5	FiPS+Juso+Linke	19+21+19=60	77	69/82	5	FiPS+Juso+Linke	18+20+19=57	77	69/82	5
3+	Juso+Linke	32+31=64	92	72/84	2	Juso+Linke	34+28=62	92	71/84	3	Juso+Linke	34+29=64	92	72/84	2
23	FiPS+Juso+Linke	23+21+20=65	77	69/82	5	FiPS+Juso+Linke	23+22+20=65	77	69/82	5	FiPS+Juso+Linke	22+21+20=64	77	69/82	5
23+	Juso+Linke	27+26=53	92	72/84	2	Juso+Linke	28+24=53	92	72/84	2	Juso+Linke	28+25=53	92	72/84	2
Total rank					19					20					19

Election method	15 questions in the Third Vote ballot														
	Dist					PCAm					PCAM				
	Coalition	StuPa seats, %	Un	P/U	R	Coalition	StuPa seats, %	Un	P/U	R	Coalition	StuPa seats, %	Un	P/U	R
All experimental votes															
2	FiPS+Juso+Linke	27+23+20=70	77	69/82	5	FiPS+Juso+Linke	27+23+20=70	77	69/82	5	FiPS+Juso+Linke	27+23+20=70	77	69/82	5
3	FiPS+Juso+Linke	20+20+20=59	77	69/82	5	FiPS+Juso+Linke	18+20+19=57	77	69/82	5	FiPS+Juso+Linke	15+19+19=53	77	69/82	5
3+	Juso+Linke	32+31=64	92	72/84	2	Juso+Linke	28+28=56	92	72/84	2	Juso+Linke	36+30=66	92	71/84	3
23	FiPS+Juso+Linke	24+21+20=65	77	69/82	5	FiPS+Juso+Linke	23+21+20=64	77	69/82	5	FiPS+Juso+Linke	21+21+19=62	77	69/82	5
23+	Juso+Linke	27+26=53	92	72/84	2	FiPS+Juso	25+25=51	86	69/83	4	Juso+Linke	29+25=54	92	72/84	2
Total rank					19					21					20

Election method	10 questions in the Third Vote ballot														
	Dist					PCAm					PCAM				
	Coalition	StuPa seats, %	Un	P/U	R	Coalition	StuPa seats, %	Un	P/U	R	Coalition	StuPa seats, %	Un	P/U	R
All experimental votes															
2	FiPS+Juso+Linke	27+23+20=70	77	69/82	5	FiPS+Juso+Linke	27+23+20=70	77	69/82	5	FiPS+Juso+Linke	27+23+20=70	77	69/82	5
3	FiPS+Juso+Linke	19+23+21=63	77	69/82	5	FiPS+Juso+Linke	19+16+17=53	77	69/82	5	FiPS+Juso+Linke	15+25+21=60	77	69/82	5
3+	Juso+Linke	44+35=79	92	71/84	3	FiPS+Juso+Linke	29+15+20=63	77	69/82	5	Juso	57=57	100	72/89	1
23	FiPS+Juso+Linke	23+23+21=67	77	69/82	5	FiPS+Juso+Linke	23+19+19=62	77	69/82	5	FiPS+Juso+Linke	21+24+20=65	77	69/82	5
23+	Juso+Linke	33+28=61	92	72/84	2	FiPS+Juso+Linke	28+19+20=67	77	69/82	5	Juso+Linke	40+26=66	92	71/84	3
Total rank					20					25					19

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Table 14: **(continued)** Detailed Table 11

Election method	30 preselected questions					25 SPoM questions					24 essential questions				
	Coalition	StuPa seats, %	Un	P/U	R	Coalition	StuPa seats, %	Un	P/U	R	Coalition	StuPa seats, %	Un	P/U	R
The experimental votes not influenced by the StuPa-O-Mat															
2	FiPS+Juso	31+24=55	86	68/73	7	FiPS+Juso	31+24=55	86	68/73	7	FiPS+Juso	31+24=55	86	68/73	7
3	FiPS+Juso+Linke	18+19+20=57	77	68/79	6	FiPS+Juso+Linke	18+20+21=58	77	68/79	6	FiPS+Juso+Linke	18+20+21=59	77	68/79	6
3+	Juso+Linke	28+29=57	92	71/88	1	Juso+Linke	31+35=66	92	71/88	1	Juso+Linke	35+39=73	92	71/88	1
23	FiPS+Juso+Linke	24+22+18=64	77	68/80	5	FiPS+Juso+Linke	25+22+18=65	77	68/80	5	FiPS+Juso+Linke	25+22+18=65	77	68/79	6
23+	FiPS+Juso	26+26=52	86	68/72	8	Juso+Linke	27+25=53	92	71/80	4	Juso+Linke	29+27=57	92	71/80	4
Total rank					27					23					24

Election method	20 questions in the Third Vote ballot														
	Dist					PCAm					PCAM				
	Coalition	StuPa seats, %	Un	P/U	R	Coalition	StuPa seats, %	Un	P/U	R	Coalition	StuPa seats, %	Un	P/U	R
The experimental votes not influenced by the StuPa-O-Mat															
2	FiPS+Juso	31+24=55	86	68/73	7	FiPS+Juso	31+24=55	86	68/73	7	FiPS+Juso	31+24=55	86	68/73	7
3	FiPS+Juso+Linke	19+20+22=60	77	68/79	6	FiPS+Juso+Linke	19+20+21=61	77	68/79	6	FiPS+Juso+Linke	17+20+21=58	77	68/79	6
3+	Juso+Linke	31+39=70	92	71/88	1	Juso+Linke	34+37=71	92	71/88	1	Juso+Linke	32+38=70	92	71/88	1
23	FiPS+Juso+Linke	25+22+19=66	77	68/79	6	FiPS+Juso+Linke	25+22+18=66	77	68/80	5	FiPS+Juso+Linke	24+22+18=65	77	68/79	6
23+	Juso+Linke	28+27=55	92	71/80	4	Juso+Linke	29+26=55	92	71/80	4	Juso+Linke	28+27=55	92	71/80	4
Total rank					24					23					24

Election method	15 questions in the Third Vote ballot														
	Dist					PCAm					PCAM				
	Coalition	StuPa seats, %	Un	P/U	R	Coalition	StuPa seats, %	Un	P/U	R	Coalition	StuPa seats, %	Un	P/U	R
The experimental votes not influenced by the StuPa-O-Mat															
2	FiPS+Juso	31+24=55	86	68/73	7	FiPS+Juso	31+24=55	86	68/73	7	FiPS+Juso	31+24=55	86	68/73	7
3	FiPS+Juso+Linke	19+20+22=61	77	68/79	6	FiPS+Juso+Linke	18+18+22=58	77	68/79	6	FiPS+Juso+Linke	15+19+21=54	77	68/79	6
3+	Juso+Linke	29+42=71	92	71/88	1	Juso+Linke	25+41=66	92	71/88	1	Juso+Linke	30+48=78	92	71/88	1
23	FiPS+Juso+Linke	25+22+19=66	77	68/79	6	FiPS+Juso+Linke	25+21+19=65	77	68/79	6	FiPS+Juso+Linke	23+21+18=63	77	68/79	6
23+	Juso+Linke	26+29=55	92	71/88	1	Juso+Linke	25+28=53	92	71/88	1	Juso+Linke	27+32=59	92	71/88	1
Total rank					21					21					21

Election method	10 questions in the Third Vote ballot														
	Dist					PCAm					PCAM				
	Coalition	StuPa seats, %	Un	P/U	R	Coalition	StuPa seats, %	Un	P/U	R	Coalition	StuPa seats, %	Un	P/U	R
The experimental votes not influenced by the StuPa-O-Mat															
2	FiPS+Juso	31+24=55	86	68/73	7	FiPS+Juso	31+24=55	86	68/73	7	FiPS+Juso	31+24=55	86	68/73	7
3	FiPS+Juso+Linke	19+23+21=63	77	68/79	6	FiPS+Juso+Linke	20+14+21=54	77	68/79	6	FiPS+Juso+Linke	14+26+21=61	77	68/79	6
3+	Juso+Linke	44+36=80	92	71/80	4	FiPS+Linke	33+41=74	80	69/83	3	Juso	57=57	100	71/84	2
23	FiPS+Juso+Linke	25+23+19=67	77	68/79	6	FiPS+Juso+Linke	25+19+18=63	77	68/80	5	FiPS+Juso+Linke	23+25+18=66	77	68/79	6
23+	Juso+Linke	34+26=60	92	71/80	4	FiPS+Linke	32+28=60	80	69/70	9	Juso+Linke	40+23=64	92	71/81	3
Total rank					27					30					24

Continued next page...

Table 14: **(continued)** Detailed Table 11

Election method	30 preselected questions					25 SPoM questions					24 essential questions				
	Coalition	StuPa seats, %	Un	P/U	R	Coalition	StuPa seats, %	Un	P/U	R	Coalition	StuPa seats, %	Un	P/U	R
The experimental votes influenced by the StuPa-O-Mat															
2	FiPS+Juso+Linke	21+20+28=69	77	70/89	2	FiPS+Juso+Linke	21+20+28=69	77	70/89	2	FiPS+Juso+Linke	21+20+28=69	77	70/89	2
3	FiPS+Juso+Linke	18+19+19=56	77	70/89	2	FiPS+Juso+Linke	19+18+19=57	77	70/89	2	FiPS+Juso+Linke	19+19+20=58	77	70/89	2
3+	FiPS+Juso+Linke	23+23+24=70	77	70/89	2	FiPS+Linke	26+26=52	80	71/87	3	Juso+Linke	27+29=56	92	72/88	1
23	FiPS+Juso+Linke	20+19+23=62	77	70/89	2	FiPS+Juso+Linke	20+19+23=63	77	70/89	2	FiPS+Juso+Linke	20+20+24=63	77	70/89	2
23+	FiPS+Juso+Linke	22+22+26=69	77	70/89	2	FiPS+Linke	23+27=50	80	71/87	3	Juso+Linke	24+28=52	92	72/88	1
Total rank					10					12					8

Election method	20 questions in the Third Vote ballot														
	Dist					PCAm					PCAM				
	Coalition	StuPa seats, %	Un	P/U	R	Coalition	StuPa seats, %	Un	P/U	R	Coalition	StuPa seats, %	Un	P/U	R
The experimental votes influenced by the StuPa-O-Mat															
2	FiPS+Juso+Linke	21+20+28=69	77	70/89	2	FiPS+Juso+Linke	21+20+28=69	77	70/89	2	FiPS+Juso+Linke	21+20+28=69	77	70/89	2
3	FiPS+Juso+Linke	20+19+20=58	77	70/86	4	FiPS+Juso+Linke	19+20+20=60	77	70/89	2	FiPS+Juso+Linke	19+19+19=56	77	70/89	2
3+	Juso+Linke	27+29=56	92	72/88	1	Juso+Linke	29+29=59	92	72/88	1	Juso+Linke	25+28=53	92	72/88	1
23	FiPS+Juso+Linke	20+20+24=64	77	70/89	2	FiPS+Juso+Linke	20+20+24=64	77	70/89	2	FiPS+Juso+Linke	20+19+23=63	77	70/89	2
23+	Juso+Linke	24+28=52	92	72/88	1	Juso+Linke	25+28=53	92	72/88	1	Juso+Linke	23+28=51	92	72/88	1
Total rank					10					8					8

Election method	15 questions in the Third Vote ballot														
	Dist					PCAm					PCAM				
	Coalition	StuPa seats, %	Un	P/U	R	Coalition	StuPa seats, %	Un	P/U	R	Coalition	StuPa seats, %	Un	P/U	R
The experimental votes influenced by the StuPa-O-Mat															
2	FiPS+Juso+Linke	21+20+28=69	77	70/89	2	FiPS+Juso+Linke	21+20+28=69	77	70/89	2	FiPS+Juso+Linke	21+20+28=69	77	70/89	2
3	FiPS+Juso+Linke	21+18+19=58	77	70/86	4	FiPS+Juso+Linke	19+19+20=57	77	70/89	2	FiPS+Juso+Linke	17+17+18=52	77	70/89	2
3+	Juso+Linke	25+29=53	92	72/88	1	Juso+Linke	25+28=53	92	72/88	1	FiPS+Juso+Linke	19+17+27=62	77	70/89	2
23	FiPS+Juso+Linke	21+19+23=63	77	70/89	2	FiPS+Juso+Linke	20+20+24=63	77	70/89	2	FiPS+Juso+Linke	19+18+23=61	77	70/89	2
23+	Juso+Linke	22+28=51	92	72/88	1	Juso+Linke	23+28=50	92	72/88	1	FiPS+Juso+Linke	20+18+27=65	77	70/89	2
Total rank					10					8					10

Election method	10 questions in the Third Vote ballot														
	Dist					PCAm					PCAM				
	Coalition	StuPa seats, %	Un	P/U	R	Coalition	StuPa seats, %	Un	P/U	R	Coalition	StuPa seats, %	Un	P/U	R
The experimental votes influenced by the StuPa-O-Mat															
2	FiPS+Juso+Linke	21+20+28=69	77	70/89	2	FiPS+Juso+Linke	21+20+28=69	77	70/89	2	FiPS+Juso+Linke	21+20+28=69	77	70/89	2
3	FiPS+Juso+Linke	20+20+20=60	77	70/86	4	FiPS+Juso+Linke	19+16+18=53	77	70/86	4	FiPS+Juso+Linke	17+20+21=58	77	70/89	2
3+	Juso+Linke	31+34=65	92	72/88	1	FiPS+Juso+Linke	25+14+23=63	77	70/86	4	Juso+Linke	35+38=73	92	72/88	1
23	FiPS+Juso+Linke	21+20+24=65	77	70/89	2	FiPS+Juso+Linke	20+18+23=61	77	70/89	2	FiPS+Juso+Linke	19+20+24=64	77	70/89	2
23+	Juso+Linke	26+31=57	92	72/88	1	FiPS+Juso+Linke	23+17+25=66	77	70/89	2	Juso+Linke	28+33=60	92	72/88	1
Total rank					10					14					8

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