ENCODE: Explicating the Norms of Collective Deliberation

Summary

From a country's decision to leave the EU, to jury convictions in criminal trials, to friends figuring out where to have dinner: collective decisions are everywhere. But when are they truly democratic?

According to a prominent view, democracy requires more than the *aggregation* of opinions. Citizens should engage in a discussion, justify and mutually adjust their positions, and eventually arrive at a consensus or meta-agreement on the decision problem at hand, before they vote. Such *collective deliberation* should moreover satisfy principles such as rationality, equality, and truthfulness, in order to count as democratic.

This *deliberative ideal* is widely endorsed and even cited as a solution to the current crisis of Western democracies. However, **there is no unified, mathematical model of deliberation** that allows us to clarify exactly what deliberative democrats want and to check the joint compatibility of the various principles they endorse. This stands in sharp contrast with our understanding of opinion aggregation, which has made great progress due to the presence of mathematical models in social choice theory.

The ENCODE project will fill this gap, by developing a formal framework of collective deliberation in which its components and dynamics are characterized with mathematical precision. Drawing on my expertise, the framework will be obtained by a novel synthesis of cutting edge techniques in philosophical logic and informed by state of the art work in political science, decision theory, and argumentation theory. Within this framework, I will study specific combinations of norms that regulate the deliberative ideal, in order to map out the tensions and trade-offs between them.

Although its methods are rooted in analytic philosophy, ENCODE has great **relevance for the general theory and practice of collective decision-making,** which I will valorize by interacting and cooperating with political theorists, computer scientists, and local organizations that promote deliberative democracy.

Research Proposal

A description of the proposed research ⓘ

Overall aim and objectives

State of the Art and Objectives

Western politics is going through a crisis, as witnessed by the rise of extremist parties, the perverse impact of social media campaigns on elections, and growing mistrust in politicians and institutions among citizens. Some scientists warn us that democracies are hollowing out [79] or even dying [62]; others argue that democracy should be replaced with epistocracy [24]. In contrast, many political theorists maintain that democracy is the "lesser evil", but that our institutions should be drastically reformed if we want it to thrive. My project contributes to the latter position, by critically investigating one of its guiding ideas: *deliberative democracy*.

On the classical view, **deliberative democracy requires an open discussion among rational, equal participants, fostering the construction and revision of opinions, preferences, and proposals, ideally resulting in consensus** [38, 27]. Variants of this view were defended by Habermas [51] and Rawls [78]. More generally, there has been a *deliberative turn* in political theory since the 1980s [20, 35, 48, 29, 73, 40] which has been reflected in empirical studies [2, 41, 66]. This shift has also thoroughly influenced political movements in their search for institutional changes that promote participation [55]. Following Van Reybrouck [87], deliberative democracy is promoted by many political organizations in Belgium and the Netherlands, such as the AGORA party in Brussels and LOKAAL in Rotterdam. These

organizations want representative democracy to be complemented by deliberative panels of regular citizens. Finally, the deliberative turn influenced the field of *e-democracy* in AI, where scientists develop software to assist or simulate argument-based decision-making: examples range from *Deliberatorium* [56, 57] to IBM's *Debater* project.[1] Some of these applications have ancestors in argumentation theory and the study of multi-agent systems [45, 46].

Table 1: principles and norms for deliberation

The concept of deliberation that underlies these trends is *normative.* It concerns *fair* and *rational* deliberation, in contrast to cases that do not meet this ideal. From the available literature, one can extract various norms, motivated by general principles (cf. Table 1). Although there are disputes over their precise form and importance, there is broad consensus that each of these norms play an important role in the deliberative ideal [47, 69, 70].

individual rationality	each participant has consistent beliefs and preferences
argumentation	participant's preferences are based on arguments
higher-order rationality	participants take each other to be rational
pluralism	any (rational) position can be endorsed by a given participant
consensus	deliberation leads to consensus
completeness	all private information is made public through deliberation
mutual understanding	deliberation leads to mutual understanding
relevance	interventions are relevant to the debate
equality	all participants are treated equally in a debate
truthfulness	participants only give true information in deliberation

There is, however, also a growing awareness of tensions and trade-offs between these norms. Some doubt whether, given a strong diversity of views, rational discussion alone gets us towards consensus [58, 75]. Also, allowing for a diverse input may well clash with relevance and efficiency considerations at the procedural level and the requirement of a complete and consistent output [71, 1]. Finally, recent work in formal epistemology suggests that individual and group rationality come apart [68] and that when individually rational agents communicate and update their preferences, the resulting group behavior may seem highly irrational from an outsider's perspective [52].

So before we can call upon the deliberative ideal in an attempt to save democracy, there is an urgent need to find out exactly what we can, and what we cannot expect of deliberation. This is what ENCODE will do:

My *high-level aim* is **to uncover and explicate the logical relations, tensions, and trade-offs between norms that are taken to be characteristic of deliberative democracy.**

ENCODE's high-level aim is inspired by impossibility results in *social choice theory*, starting with the seminal work of Arrow [5]. Rather than excluding the possibility of democratic decision-making, these results allow us to map aggregation procedures in terms of how they deal with conflicting principles [63]. Formal models of aggregation also allow us to apply sophisticated tools from mathematics and computer science to democratic theory, as witnessed by the booming area of *computational social choice* [23]. At the same time, social choice theory raises puzzling questions concerning the relation between aggregation and deliberation: Is deliberation confronted with similar impossibilities as aggregation [64] or can it somehow sidestep them? Does it face other, equally troubling conflicts? Can deliberation *shape* our preferences so that they can be consistently aggregated [72, 58, 36, 65]?

Answering these questions is impossible without specifying a model of collective deliberation. However, in contrast to the theory of aggregation, there is no consensus about how deliberation should be captured by a mathematical model. Three categories of candidate models have been studied:

(i)   *models of opinion dynamics* in formal epistemology, using weighted averaging [30, 61, 53] or iterative Bayesian updates [42];

(ii)   *game-theoretic models of information disclosure* in voting [7, 8, 9];

(iii) protocols for *deliberation dialogues* in formal argumentation theory [71, 59, 21, 88].

While these models capture certain aspects of collective deliberation, they also have important shortcomings. Models of type (i) do not represent the argumentative aspects that are distinctive of deliberation. Models of type (ii) assume that participants in a debate are individual utility maximizers, which does not square well with the ideal of open, cooperative debate. Moreover, models of type (i) and (ii) assume that alternatives and preferences are exogenous, whereas political theorists emphasize how deliberation must also include the way we *frame* the collective decision problem [17]. Finally, models of type (iii) are much closer to the deliberative ideal, but lack a fine-grained representation of participants' opinions and the agreements among them.

In sum, the existing models fall short, when seen from the viewpoint of ENCODE's high-level aim. We need an altogether new framework for the explication of norms of collective deliberation. This framework should satisfy five <u>key desiderata</u> (D1)-(D5):

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[1] https://www.research.ibm.com/artificial-intelligence/project-debater/.

(D1) It should be firmly rooted in political theory, thus taking *all* the principles from Table 1 at heart, without presupposing that any combination of them is uniquely constitutive of deliberative democracy.

(D2) It should provide an explicit representation of how *arguments* ground participants' preferences and preference change.

(D3) It should accommodate the *openness* of rational, fair deliberation: alternatives, preferences, and beliefs should all be open to revision in a debate.

(D4) It should model deliberation as a *stepwise process* of information exchange and revision.

(D5) It should deliver models of collective deliberation that are *mathematically precise*, thus enabling logical analysis and comparison of combinations of norms.

With the proposed framework in hand, we will be able to pinpoint where and how different norms of collective deliberation are jointly (in)compatible. This will in turn make for a more informed choice between such principles in the design of political institutions and software for *e-democracy* [1]. So although ENCODE is a theoretical project rooted in formal philosophy, it nonetheless has **important repercussions for the general theory and practice of collective decision-making,** which will be valorized by interacting and cooperating with political theorists, computer scientists, and organizations that promote deliberative democracy (cf. Section 2b)**.**

Methods and Techniques

My working hypothesis is that in the study of collective deliberation, a crucial role is preserved for logical formalization, beside critical literature review and conceptual analysis. Indeed, by representing the *logical relations* between the components of an agent's views explicitly, we can fully understand and justify how agents may communicate and rationally revise their position. Moreover, by representing these relations *in mathematical, exact terms*, we get a grip on the complex dynamics that result from deliberation. Formalization inevitably leads to abstraction, but it comes with the benefit of solid results that can guide philosophical discussion and institutional design.

Table 2: principles and subprojects

individual rationality	SP1
argumentation	
higher-order rationality	
pluralism	SP2
consensus	
completeness	
mutual understanding	
relevance	SP3
equality	
truthfulness	

This hypothesis will be put to work in ENCODE's four subprojects (SP1-SP4). The first three of these subprojects deal with specific principles that regulate collective deliberation (cf. Table 2). SP1 concerns the position of a single, rational agent in a debate. The resulting **theory of positions** provides the fundament for SP2-SP4, and will be continuously revised in view of the other subprojects' needs. SP2 deals with norms for **position profiles**, i.e., tuples that associate a position with every agent in a group. SP3 concerns norms for the way agents can **communicate and update** their position throughout a debate. SP4, finally, brings the conceptual and formal tools and results of SP1-SP3 together in order to tackle the high-level aim of ENCODE.

SP1: A Theory of Positions (PI)

The aim of SP1 is to develop a normative theory of positions that provides the foundation for the formal study of collective deliberation. My starting point is that an agents' views about a collective decision problem must be seen as a combination of two components (cf. [31, 32]):

    (a) *factive*: which alternatives exist, what (relevant) properties they have

    (b) *normative*: what properties are required of alternatives, which properties are preferred to which

In effect, arguing about the decision problem boils down to arguing about these two components. In order to make the rational revision of an agent's views possible, both components must moreover be (partly) based on *defeasible information*: information that can be overridden by other, conflicting information. For (a), this information consists of fallible evidential cues; (b) is likewise based on soft, potentially conflicting normative constraints. As a first step in SP1, I will specify the argumentative relation between the defeasible information of an agent and the views based on it, in terms that make it amenable for formal treatment. Here I will build on my long-standing expertise with formal logics

for defeasible reasoning and conflict-tolerant deontic logics [Van De Putte and Strasser 2013a, 2013b, 2014, Van De Putte 2013, Strasser and Van De Putte 2016, Van De Putte et al. 2020].

Second, I will study *rationality requirements* concerning (a) and (b) and the way they are grounded in defeasible information. Examples of such requirements are: "an alternative either has, or does not have a given property"; "at least one available alternative has all the required properties"; "preferences derive from the soft constraints". My aim here is to critically assess such requirements in view of the literature on reason-based preferences and preference change [25, 28, 32, 67, 74].

Third, I will investigate the logical implications of these requirements and higher-order variants of them (governing one agent's beliefs about another agent's position). This will be done by translating the theory of positions into modal logics. More specifically, I will combine two frameworks that have so far been developed independently:

- *Evidence Logic*: epistemic-doxastic logics that allow for the explicit representation of evidence in their object language [84, 13, 11, 80].
- Choice-theoretic semantics for deontic logics, in particular models in the tradition of STIT logic [18, 54], models featuring *coarse-grained alternatives* [Van De Putte 2018], and the choice-theoretic deontic logic from [33].

SP2: Position Profiles (PI)

The aim of SP2 is to specify and formalize norms that concern position profiles. These norms can be divided into three main categories.

Pluralism and *consensus* both concern the attitudes on which the agents (dis)agree. For the theory of deliberation, a crucial distinction is that between *basic agreement*, e.g. having identical preferences, and *meta-agreement*, e.g. common endorsement of values that underlie those preferences [72, 37]. I will investigate such distinctions in terms of the models from SP1, establishing semantic and axiomatic characterizations of agreement types. Secondly, I will establish links between such agreement types and specific classes of preference profiles that have been studied in social choice theory [22, 72, 36], in order to pinpoint when meta-agreement suffices to avoid social choice theoretic impossibility results.

Completeness requires that information that is distributed, i.e. scattered across a society of agents, is made public by deliberation. In order to specify this norm, we need to go beyond the standard notions of distributed knowledge and belief [39, 3], since we also want to accommodate information that consists of (possibly conflicting) evidence and constraints. Here I will build on my recent work on pointwise intersection or "pooling" of non-normal propositional attitudes [Van De Putte and Klein 2018].

Finally, *mutual understanding* concerns the relation between the agents' higher-order beliefs (i.e. their beliefs about other agents' information state) and the actual information states of those other agents. It is here in particular that the modal logic account of positions from SP1 is promising, since it allows for a natural way to represent higher-order attitudes. Likewise, building on SP1, we can make sense of the idea that agents understand each other's motivations without fully agreeing, e.g. because they attach different priorities to certain pieces of defeasible information.

SP3: Communication and Position Change (PhD)

The aim of SP3 is to formalize norms that govern the way agents communicate and update their position in a debate. This will be achieved by applying tools from Dynamic Epistemic Logic, i.c. *action models* [12, 43, 16]. Content-wise, SP3 will be informed by relevant work in various disciplines: the study of deliberation dialogues in argumentation theory and in pragma-dialectics [71, 59, 21, 88, 1]; procedural criteria from political theory [27, 4]; and procedural criteria used in empirical studies of deliberation [10, 81].

Roughly, an *action model* specifies under what conditions a communicative action with propositional content X can take place (precondition), and what happens as the result of that action (postcondition). Applying such an action to a given model of the agents' information states results in an *updated* model. A well-known example is *public announcement* of X, which requires that X is true and results in common knowledge of X. Baltag and Smets [14, 15] have investigated when sequences of updates induce full agreement, focusing on *persuasive* actions: all the agents believe X after the update.

From the viewpoint of deliberative democracy, full agreement and the persuasiveness condition are too demanding. We will hence develop and study other types of updates, using the fine-grained distinctions introduced in SP1 in order to specify the pre- and postconditions of deliberative communication. For instance, after an agent announced that it has *evidence for* X (cf. SP1), other agents may be required to accept that evidence (without thereby believing X). Also, agents may only be required to accept announced propositions when they are compatible with their current position, or if these propositions resolve conflicts between their current evidence or norms. We will investigate

when such weakly persuasive actions result in specific forms of meta-agreement or mutual understanding (cf. SP2). In this context, recent accounts of (single-agent) evidence dynamics [84] will also be studied from the viewpoint of group deliberation.

An important norm that is largely absent in the study of action models is *relevance*. Communicative actions cannot be random: they should (a) help resolve known conflicts among the participants, and (b) relate to the issue that is currently focal [59, 88, 71]. Both these preconditions will be specified in terms of specific aspects of the model. For (a), we will draw on the theory of *propositional relevance* in belief revision [76, 60, Van De Putte and Verdée 2012, Van De Putte 2016] to spell out when new information is relevant to current, commonly known disagreements among the agents. For (b), we will enrich the model from (SP1) with agent-relative awareness contents [85, 50].

In order to formalize the notion of *equality*, we need to move to the level of *communication protocols*, which specify (permissible) *sequences* of updates. For instance, on one reading, equality requires that all agents can share their arguments before communication terminates [59]. Alternatively, equality can be implemented by allowing simultaneous forms of communication using concurrent updates [86], a topic that has been largely ignored in the literature on dynamic epistemic logic [83].

SP4: Collective Deliberation in Action (PI, postdoc)

SP4 brings the results and tools of SP1–SP3 together in order to achieve the high-level aim of ENCODE. I will employ two different methods in this subproject.

First, I will investigate the formalized norms *analytically*, using the tools developed in SP1-SP3. This work consists in establishing formal (im)possibility results concerning specific combinations of norms for collective deliberation. I will focus on two specific combinations in particular:

(1) *individual rationality*, *pluralism*, *equality*, and *meta-agreement*

(2) *individual* and *higher-order rationality*, *completeness*, *mutual understanding*, and *pluralism*

The focus on (1) is motivated by debates in social choice theory, concerning the question whether deliberation induces (specific types of) meta-agreement [72, 58, 36, 75]. One central question here is whether the form of meta-agreement that is reached (if at all) depends on the order in which agents get to speak, thus creating an "anchoring effect" [82].

The focus on (2) is motivated by *agreement theorems* in game theory [6, 42]. I will thus investigate which conditions have to be in place in order for deliberation to promote mutual understanding, without requiring full agreement among all the agents when deliberation terminates.

Second, together with a postdoctoral researcher, I will use *agent-based models* in order to study norms for collective deliberation *empirically*. Agent-based modelling is used in the social sciences in order to discern patterns and verify general hypotheses about the evolution of a society of diverse agents, as a result of complex, non-linear dynamics [49]. We will draw on this method following two strategies:
- Top-down: we will start from the concepts and distinctions studied in SP1–SP3 to investigate if and how they can be implemented in agent-based models, and next whether such models shed light on specific combinations of norms from Table 1.
- Bottom-up: we will review existing agent-based models of deliberation [19, 21, 77, 26]. The aim here is to provide a general comparative study of the existing work against desiderata (D1)-(D5), and to see where and how these models need to be changed to satisfy them.

<u>Innovative Character and Challenges</u>

The crucial innovation of ENCODE consists in the formal study of deliberative democracy, using state of the art tools from philosophical logic, in order to represent and investigate the norms that guide it.[2] As argued above, all frameworks developed so far fall short from the viewpoint of this aim. **With the framework I will develop, we can not only clarify what proponents of deliberative democracy want, but we can also check whether it can be had at all.** This way, the project contributes significantly to our understanding of democracy.

Group deliberation is a rich and complex phenomenon. As a result, models of it tend to be either too abstract to do justice to their target, or too rich to ground any robust conclusions. ENCODE will overcome this dilemma in the

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[2] An attempt to model deliberation using dynamic epistemic logic was undertaken very recently, in [44]. However, Goldbach's proposal cannot explicitly account for the role of justifications in deliberation and it represents deliberation as a single, all-at-once update. As a result, her model is much closer to aggregation than to deliberation. To the best of my knowledge, no one further pursued this research line since then.

following way. First, I start from minimally rich models that satisfy desiderata (D1)-(D5). Thus, in line with the theoretical aims of the project, I focus on the *logical and conceptual possibility* of rational deliberation and revision. Second, following the methodology of social choice theory, I zoom in on *specific combinations* of norms, instead of aiming at a grand theory from the start. Successfully identifying tensions and possible trade-offs at this partial level already constitutes an important contribution to our understanding of deliberation. Third and last, this project does not start with empty hands. We draw upon a broad range of formal tools, many of which I have been working extensively with in past research.

ENCODE contributes substantially to science in various other ways. By representing the reasons for norms and preferences explicitly and grounding them in defeasible information (SP1), I will contribute to recent work in decision theory on reason-based preferences and make formal logic applicable to the booming, but mostly informal philosophy of rationality and reasoning [25, 34]. My project sheds new light on debates in political science concerning (meta)agreement and its relation to (im)possibility results in social choice theory (SP2). It builds bridges between Dynamic Epistemic Logic and political theory, using the former to investigate principles of deliberative democracy (SP3). Finally, it provides a critical study of agent-based models from the viewpoint of democratic theory, enhancing the further development of these models and enlarging their application potential (SP4).

Research plan

Table 3 below shows the envisioned timing of each subproject and expected output in terms of conference papers (C) and journal articles (J). Towards the end of the project I will write a monograph (M) based on SP4.

I will organize various project-related events: (i) weekly reading groups (cf. infra); (ii) a monthly, interdisciplinary research seminar; (iii) bi-annual project workshops; (iv) two editions of "Democracy Fest", aimed at a lay audience (cf. 2b, "Knowledge utilization"). Finally, I plan two research stays at the London School of Economics (LSE), in order to collaborate with Christian List and other experts in decision and social choice theory: a two-month visit of myself (year 1) and a three-month visit of the PhD student (year 3).

year	1	2	3	4	5	output
subprojects	SP1 (PI)					(C),(C),(J),(J)
	SP2 (PI)					(C),(C),(J),(J)
		SP3 (PhD)				(C),(C),(J)
			SP4 (PI, postdoc)			(J),(J),(M)
PhD						
postdoc						
events		Democracy Fest		Democracy Fest		
research stays (LSE)	PI		PhD			
project management	select PhD	select postdoc	Midterm evaluation		PhD defense	

Table 3: timetable

Collaborations

Local: see (2a3) for collaborations at Erasmus University of Rotterdam. As explained in Section (2b) I will also collaborate with the organization LOKAAL in Rotterdam.

National: I will cooperate with various scholars in Dutch universities, with whom I am in close contact and who expressed their interest in the project: Martin van Hees and Catarina Dutilh-Novaes (VU), Jan Broersen (Utrecht), Sonja Smets, Alexandru Baltag, and Ulle Endriss (UvA), Rineke Verbrugge, Davide Grossi, and Marc Pauly (Groningen). The project seminars and workshops will be open to colleagues and students from the respective universities. For the reading groups I foresee three different tracks:
- *democracy and argumentation* (with VU)
- *formal models of opinion and preference dynamics* (with Utrecht, UvA, and Groningen)
- *social choice and deliberative democracy* (MA and PhD students in Rotterdam)

<u>International</u>: Several scholars have expressed their support for the project and will share their expertise on relevant topics: logics of rational interaction (1), social choice and judgement aggregation (2), deliberative democracy (3), argumentation (4), and agent-based modeling (5). These *cooperation partners* (Table 4) will be invited to participate to the project workshops and will contribute to a mid-term evaluation of the project.

Leon van der Torre	1,2,4	Luxemburg
Gabriela Pigozzi	1,2,4,5	Paris
Christian List	2,3	LSE
Peter McBurney	4,5	London (King's College)
Hannes Leitgeb	1	Munich
Olivier Roy	1,2,3	Bayreuth
Johannes Marx	2,5	Bamberg
John Horty	1,4	Maryland
Fenrong Liu	1,2,4	Beijing

Table 4: cooperation partners

Choice of host institute

The Erasmus Institute for Philosophy and Economics (EIPE) at Erasmus University of Rotterdam (EUR) provides an excellent environment for this project. **Within the EIPE**, I aim at cooperation with Constanze Binder and Conrad Heilmann (decision and social choice theory), Jack Vromen (evolutionary game theory), Stefan Wintein (logic, social choice), and Francesco Guala (philosophy of the social sciences, cooperative game theory). There is common ground in the application of formal models to philosophy and ethics, but ENCODE also complements current research at the EIPE, given the project's focus on democratic theory.

The **research master in Philosophy and Economics** and the multidisciplinary **Erasmus Graduate School of the Social Sciences and Humanities** at EUR provide a unique chance to interact with top level MA and PhD students. I will seize this occasion by inviting those students to participate to the project-related reading groups and seminars. There is moreover potential for cooperation with the **Research Section "Public Administration"**, which hosts highly relevant expertise on the study of democratic innovation, citizen initiatives, and collaborative government.

Knowledge utilization ⓘ

The ENCODE project is both relevant to society as well as to other fields besides logic and analytic philosophy. As a result there are ample possibilities for knowledge utilization. At the same time, the project's central aims and methods are theoretical and the resources and time will be limited. Therefore, it is important to strike the right balance between knowledge utilization and (pure) research, both in terms of budget and time investment. My approach here is to go for a number of well-chosen actions aimed at specific target groups, that make use of existing tools, networks, and practices.

Interaction with organizations that promote deliberative democracy

As explained in Section (2a1), **we are witnessing a growing dissatisfaction with traditional representative democracy, motivating the search for alternative forms of governance such as deliberative democracy and liquid democracy.** At this turning point, philosophy plays a crucial societal role. First, philosophers can provide critical feedback, i.c. by helping to make the main actors of this trend aware of limitations, tensions, and trade-offs in the alternatives they propose. Second, philosophers can also provide constructive input, by providing the conceptual and argumentative tools that allow political actors to specify what they want a given innovation to achieve, and why they want this. Here,

my aim is to show how tools from philosophical logic and social choice theory are relevant for our understanding of deliberative democracy, and to evaluate and develop those tools with that application context in mind.

To achieve this aim, I will connect with organizations that promote new (deliberative) forms of democracy: LOKAAL (Rotterdam), the AGORA party (Brussels), and G1000 (Belgium). The aim here is to achieve a two-way communication with this target group:

- From the organizations to ENCODE: How do these pioneering organizations and their representatives perceive deliberative democracy as an ideal? What norms are crucial for them, how do they look at specific trade-offs and tensions? How do they look at the classical ideal of deliberative democracy and where does their practice abandon it?
- From ENCODE to the organizations: we will communicate the main aims and findings of the project and related research in philosophy and social choice theory. More generally, we will contribute to a critical, scientifically informed perspective on democratic innovation and the ideals of deliberative democracy.

This interaction will be achieved by the following concrete actions:

- Project staff will participate in and contribute to "masterclasses" and summer schools on deliberative democracy, democratic innovation, and argumentation techniques, organized by LOKAAL and G1000.
- I will organize two editions of "Democracy Fest", in collaboration with these organizations. These events are aimed at a broad public and will be widely advertised. They will consist of interactive workshops on collective decision making, presentations on the science of democratic innovation, and lectures by well-known philosophers, policy-makers, and journalists.
- Prominent members of these organizations will be asked to contribute to the bi-annual project workshops, in order to ensure that perspectives from practice are taken into account.

I am currently already in contact with LOKAAL, who expressed their interest in the ENCODE project. I am also co-chair of the first Democracy Fest (25/04/2020, Brussels), on the theme of democratic innovation and representation. This event will feature i.a. workshops and presentations by AGORA and G1000, with whom I am in close contact. Other co-chairs of this event are political scientists Anna Kern and Bram Wauters (Ghent University) and Karen Celis (Free University of Brussels).

Contribution to other Scientific Areas: Political Science and AI

As explained above, ENCODE has important repercussions for other sciences, most notably political science and Artificial Intelligence (AI). We will interact with these fields in the following ways:

- At the project seminars and bi-annual project workshops, I will invite prominent scholars from these two fields with whom I have good connections, such as i.a. Johannes Marx, David Stadelmann, and Marc Pauly (for political science); Rineke Verbrugge, Peter McBurney, Davide Grossi, and Leon van der Torre (for AI).
- Political theorists and computer scientists are also included in the cooperation board that will provide a midterm evaluation of the project (cf. Section 2a2, "Research plan").
- The project staff will present their work at international conferences in both fields (at least three presentations at conferences in each field). For political science, we will aim at the conferences of the *International Political Science Association*, the *American Political Science Association*, and the *European Consortium for Political Research*. For AI and computer science, we aim at the *International Joint Conference on Artificial Intelligence*, the conference of the *Association for the Advancement of Artificial Intelligence*, and the international conference on *Autonomous Agents and Multi-Agents Systems*.
- We will organize at least one symposium or thematic session at such a conference: one on "formal models of collective deliberation" (in political science), and one on "norms for e-democracy" (in computer science/AI).

Broader outreach and dissemination

In addition to the above-mentioned targeted activities, I will also address a broader audience, consisting of anyone who is interested in philosophical and ethical issues related to democracy and democratic innovation:

- I will create a project page on my ResearchGate profile, that will be regularly updated and report on the latest work resulting from the project. ResearchGate is a web tool that is commonly used in academia to share publications, data, and other research-related information in a uniform and highly accessible format. As a kind of "facebook for academics", it has a bigger visibility than personal or project-specific webpages for academics.
- I will invite master students from philosophy, political science, computer science, and AI (in Rotterdam, Amsterdam, Utrecht, Groningen) to participate in the project-related reading groups and monthly seminars.

Students from EUR's Research Master in Philosophy and Economics will be stimulated in particular to actively contribute to these events.
- All publications resulting from the project will be made freely available for download (in their preprint form, but with all the required bibliographic data), both at my ResearchGate webpage and on Arxiv.org.

Literature references

Cited works with the PI as (co-)author

Strasser, Christian and Van De Putte, Frederik. (2016) Adaptive Strategies and Finite-Conditional Premise Sets. *Journal of Logic and Computation* 26(5): 1517-1539.

Van De Putte, Frederik. (2013) "Default Assumptions and Selection Functions: a Generic Framework for Non-monotonic Logics." In: F. Castro, A. Gelbukh, A. & M. Gonzalez, (eds.), *Advances in Artificial Intelligence and Its Applications. Proceedings of the 12th Mexican international conference on artificial intelligence (MICAI2014)*, LNCS 8265: 54-67.

Van De Putte, F. (2016) "Splitting and Relevance: Broadening the Scope of Parikh's Concepts." *Logique et Analyse* 59(234): 173-205.

Van De Putte, F. (2018) "Coarse Deontic Logic". *Journal of Logic and Computation* 29(2): 285–317.

Van De Putte, Frederik, Beirlaen, Mathieu and Meheus, Joke. (2020) "Adaptive Deontic Logics". Accepted for publication in: Dov Gabbay, John Horty, Xavier Parent, Ron van der Meyden and Leon van der Torre (eds.), *Handbook of Deontic Logic and Normative Systems* Vol. 2, College Publications.

Van De Putte, F. and Klein, D. (2018) "Pointwise Intersection in Neighbourhood Modal Logic." In G. Bezhanishvili and G. D'Agostino (eds.). *Advances in Modal Logic* (AiML 12), 591-610. London: College Publications.

Van De Putte, Frederik and Strasser, Christian. (2013a) "**A Logic For Prioritized Normative Reasoning**", *Journal of Logic and Computation* 3: 563-583.

Van De Putte, Frederik and Strasser, Christian. (2013b) "Three Formats of Prioritized Adaptive Logics: A Comparative Study." *Logic Journal of the IGPL* 21: 127-159.

Van De Putte, Frederik and Strasser, Christian. (2014) Adaptive Logics: a Parametric Framework. *Logic Journal of the IGPL* 22(6): 905-932.

Van De Putte, F. and Verdée, P. (2012) "**The Dynamics of Relevance: Adaptive Belief Revision**." *Synthese* 187: 1-42.

Other cited works

[1]   Aakhus, M. and Lewiński, M. (2011) "Argument Analysis in Large-Scale Deliberation." In: E. Feteris, B. Garssen and F. Snoeck Henkemans (eds.). *Keeping in Touch with Pragma-Dialectics: In Honor of Frans H. van Eemeren*, 165-183. Amsterdam/Philadelphia: John Benjamins Publishing Company.
[2]   Ackerman, B. and Fishkin, J. (2004) *Deliberation Day.* New Haven and London: Yale University Press.
[3]   Agotnes, T. and Wang, Y.N. (2017) "Resolving Distributed Knowledge." *Artificial Intelligence* 252: 1-21.
[4]   Alexy, R. (1990) "A Theory of Practical Discourse." In: Benhabib, S. and Dallmayr, F. (eds.). *The Communicative Ethics Controversy, Studies in Contemporary German Social Thought*, 151-190. Cambridge, MA: MIT Press.
[5]   Arrow, K. (1951) *Social Choice and Individual Values*. New York: Wiley.
[6]   Aumann, R. (1976) "Agreeing to Disagree." *The Annals of Statistics* 4(6): 1236-1239.
[7]   Austen-Smith, D. (1992) "Strategic Models of Talk in Political Decision-Making." *International Political Science Review* 13(1): 45-58.
[8]   Austen-Smith, D. and Banks, J. S. (2000) *Positive Political Theory I: Collective Preference*. Ann Arbor: University of Michigan Press.

[9]   Austen-Smith, D. and Banks, J. S. (2005) *Positive Political Theory II: Strategy and Structure*. Ann Arbor: University of Michigan Press.

[10]   Bächtiger, A., Niemeyer, S., Neblo, M., Steenbergen, M. R., and Steiner, J. (2010) "Symposium: Toward More Realistic Models of Deliberative Democracy Disentangling Diversity in Deliberative Democracy: Competing Theories, Their Blind Spots and Complementarities." *The Journal of Political Philosophy* 18(1): 32-63.

[11]   Baltag, A, Bezhanishvili, N., Özgun, A, and Smets, S. (2016) "Justified Belief and the Topology of Evidence", Väänänen, J.; Hirvonen, Å. & de Queiroz, R. *(Eds.)*, *Logic, Language, Information, and Computation* (WOLLIC), LNCS 9803: 83-103.

[12]   Baltag, A., Moss, L.S., and Solecki, S. (1998) "The logic of public announcements, common knowledge, and private suspicions", in Gilboa, I. (ed.), *Proceedings of the 7th Conference on Theoretical Aspects of Rationality and Knowledge (TARK VII):* 43–56.

[13]   Baltag, A, Renne, B, and Smets, S. (2014) "The Logic of Justified Belief, Explicit Knowledge and Conclusive Evidence", *Annals of Pure and Applied Logic* 165(1): 49-81.

[14]   Baltag, A. and Smets, S. (2009) "Talking Your Way into Agreement: Belief Merge by Persuasive Communication", *Proceedings of the Second Multi- Agent Logics, Languages, and Organisations Federated Workshops Turin* (CEUR Workshop Proceedings 494): 129-141.

[15]   Baltag, A. and Smets, S. (2013) "Protocols for Belief Merge: Reaching Agreement via Communication", *Logic Journal of the IGPL* 21(3): 468-487.

[16]   Baltag, A. and Smets, S. (2016) "A Qualitative Theory of Dynamic Interactive Belief Revision" In Arló-Costa, H.; Hendricks, V. F. & van Benthem, J. (eds.) *Readings in Formal Epistemology: Sourcebook,* Springer International Publishing, 813-858.

[17]   Barisione, M. (2012) "Framing a Deliberation. Deliberative Democracy and the Challenge of Framing Processes." Journal of Public Deliberation 8(1): article 1.

[18]   Belnap, N., Perloff, M., Xu, M., and Bartha, P. (2001) *Facing the Future: Agents and Choice in Our Indeterminist World.* Oxford University Press.

[19]   Betz, G. (2012) *Debate Dynamics: How Controversy Improves our Beliefs*. Dordrecht: Springer Science & Business Media.

[20]   Bohman, J. and Rehg W. (eds.). (1997) *Deliberative Democracy: Essays on Reason and Politics*. Cambridge, MA: MIT Press.

[21]   Black, E. and Bentley, K. (2012) "An Empirical Study of a Deliberation Dialogue System" In Modgil, S.; Oren, N., and Toni, F. *(Eds.) Theorie and Applications of Formal Argumentation,* 132-146.

[22]   Black, D. (1958) *The Theory of Committees and Elections.* Cambridge: Cambridge University Press.

[23]   Brandt, F., Conitzer, V., Endriss, U., Lang, J., and Procaccia, A.D. (2016) *Handbook of Computational Social Choice.* Cambridge: Cambridge University Press.

[24]   Brennan, Jason. (2017) *Against Democracy.* New Jersey: Princeton University Press.

[25]   Broome, J. (2013) *Rationality Through Reasoning.* Oxford: Oxford University Press.

[26]   Butler, G., Pigozzi, G., and Rouchier, J. (2019) "Mixing Dyadic and Deliberative Opinion Dynamics in an Agent-Based Model of Group Decision-Making", Complexity 2019, Article ID 3758159.

[27]   Cohen, J. (l989) "Deliberation and Democratic Legitimacy." In: A. P. Hamlin and P. Phillip (eds.). *The* Good Polity: Normative Analysis of the State. Oxford: Blackwell.

[28]   Cullity, G. (2016) Describing rationality, Philosophical Studies 173: 3399-3411.

[29]   Curato, N., Dryzek, J. S., Ercan, S. A., Hendriks, C. M. and Niemeyer, S. (2017) "Twelve Key Findings in Deliberative Democracy Research." *Daedalus*, 146(3): 28-38.

[30]   DeGroot, M. (1974) "Reaching a Consensus." *Journal of the American Statistical Association* 69(345): 118-121.

[31]   Dietrich, F. and List, C. (2011) "A Model of Non-Informational Preference Change." *Journal of Theoretical Politics* 23(2): 145-164.

[32]   Dietrich, F. and List, C. (2017) "What Matters and How it Matters: a choice-theoretic representation of moral theories." *The Philosophical Review* 126(4): 421-479.

[33]   Dietrich, F. and List, C. (unpublished) *Choice-theoretic deontic logic* (unpublished manuscript).

[34]   Dietrich, F., Staras, A., and Sugden, R. (in press) A Broomean model of rationality and reasoning. Forthcoming in the *Journal of Philosophy*.

[35]   Dryzek, J. (2002) *Deliberative Democracy and Beyond: Liberals, Critics, Contestations*. Oxford: Oxford University Press.

[36]   Dryzek, J. and List, C. (2003) "Social Choice Theory and Deliberative Democracy: A Reconciliation." *British Journal of Political Science* 33(1): 1-28.

[37]   Dryzek, J., and Niemeyer, S. (2006) "Reconciling Pluralism and Consensus as Political Ideals." *American Journal of Political Science* 50(3): 634-649.

[38]   Elster, J. (1986) "The Market and the Forum: Three Varieties of Political Theory." In J. Elster and A. Hylland (eds), *Foundations of Social Choice Theory*. Cambridge: Cambridge University Press.

[39]   Fagin, R., Halpern, J., Moses, Y. and Vardi, M. (2004) *Reasoning About Knowledge*. Cambridge, MA: MIT Press.

[40]   Fishkin, J. and Laslett, P. (2003) *Debating Deliberative Democracy.* Oxford: Blackwell.

[41]   Fishkin, J., He, B., Luskin, R. and Siu, A. (2010) "Deliberative Democracy in an Unlikely Place: Deliberative Polling in China." *British Journal for Political Science* 40(2): 1-14.

[42]   Geanakoplos, J. D. and Polemarchakis, H. M. (1982) "We Can't Disagree Forever." *Journal of Economic Theory* 28: 192-200.

[43]   Girard, P., Seligman, J., and Liu, F. (2012). "General Dynamic Dynamic Logic", in Bolander, T., Braüner, T., Ghilardi, S., and Moss, L. (eds.), *Advances in Modal Logic 9,* CSLI Publications: 239-260.

[44]   Goldbach, R. (2015) *Modeling Democratic Deliberation*. Msc Thesis, ILLC, University of Amsterdam.

[45]   Gordon, T. F. and Richter, G. (2002) "Discourse Support Systems for Deliberative Democracy." In: R. Traunmüller and K. Lenk (eds.). *Electronic Government* (EGOV 2002). LNCS 2456: 248-255. Berlin: Springer.

[46]   Gordon, T. F., Prakken, H. and Walton, D. (2007) "The Carneades Model of Argument and Burden of Proof." *Artificial Intelligence* 171(10-15): 875-869.

[47]   Goodin, R.E. (2005) "Sequencing Deliberative Moments." *Acta Politica* 40: 182-196.

[48]   Goodin, R. E. 2008. *Innovating Democracy: Democratic Theory and Practice after the Deliberative Turn*. New York: Oxford University Press.

[49]   Grimm, V. and Railsback, P. (2005) *Individual-Based Modelling and Economy.* Princeton: Princeton University Press.

[50]   Grossi, D. and Velázquez-Quesada, F. (2015) "Syntactic awareness in logical dynamics", *Synthese* 192(12): 4071-4105.

[51]   Habermas, J. (1996) *Between Facts and Norms: Contributions to a Discourse Theory of Law and Democracy.* Cambridge: Polity Press.

[52]   Hansen, P. G., Hendricks, V. F. and Rendsvig, R. K. (2013) "Infostorms." *Metaphiloshophy* 44(3): 301-326.

[53]   Hegselmann, R. and Krause, U. (2002) "Opinion Dynamics and Bounded Confidence Models, Analysis, and Simulation." *Journal of Artificial Societies and Social Simulation* 5(3): 1-33.

[54]   Horty, J. (2001) *Agency and Deontic Logic.* Oxford: Oxford University Press.

[55]   Johnson, C. and Gastil, J. (2015) "Variations of Institutional Design for Empowered Deliberation." *Journal of Public Deliberation* 11(1): Article 2.

[56]   Klein, M. (2012) "Enabling Large-Scale Deliberation Using Attention-Mediation Metrics." *Computer Supported Cooperative Work* (CSCW) 21(4-5): 449-473.

[57]   Klein, M. and Iandoli, L. (2008). "Supporting Collaborative Deliberation Using a Large-Scale Argumentation System: The MIT Collaboratorium." *Directions and Implications of Advanced Computing; Conference on Online Deliberation* (DIAC-2008/OD2008).

[58]   Knight, J. and Johnson, J. (1994) "Aggregation and Deliberation: On the Possibility of Democratic Legitimacy." *Political Theory* 22(2): 277-296.

[59]   Kok, E., Meyer, J., Prakken, H. and Vreeswijk, G. (2011) "A Formal Argumentation Framework for Deliberation Dialogues." *Argumentation in Multi-Agent Systems: 7th International Workshop* (ArgMAS 2010), 31-48. Berlin: Springer.

[60]   Kourousias, G. and Makinson, D. (2007) "Parallel Interpolation, Splitting, and Relevance in Belief Change." *The Journal of Symbolic Logic* 72: 994-1002.

[61]   Lehrer, K. and Wagner, C. (1981) *Rational Consensus in Science and Society.* Dordrecht: Reidel.

[62]   Levitsky, Steven and Ziblatt, Daniel. (2018) *How Democracies Die*. New York: Crown.

[63]   List, C. (2011) "The Logical Space of Democracy", *Philosophy and Public Affairs* 39: 262-297.

[64]   List, C. (2011) "Group Communication and the Transformation of Judgments: An Impossibility Result." *The Journal of Political Philosophy* 19(1): 1-27.

[65]   List, C. (2017) "Democratic Deliberation and Social Choice: A Review." *Oxford Handbook of Deliberative Democracy,* Forthcoming.

[66] List, C., Luskin, R. C., Fishkin, J. S. and McLean, I. (2012) "Deliberation, Single-Peakedness, and the Possibility of Meaningful Democracy: Evidence from Deliberative Polls." *The Journal of Politics* 75(1): 80-95.

[67] Liu, F. (2010) "Von Wright's 'The Logic of Preference' revisited." *Synthese* 175(1): 69-88.

[68] Majo-Wilson, C., Zollman, K. J. S. and Danks, D. (2011) "The Independence Thesis: When Individual and Social Epistemology Diverge." *Philosophy of Science* 78(4): 653-677.

[69] Mansbridge, J., Bohman, J., Chambers, S., Estlund, D., Føllesdal, A., Fung, A., Lafont, C., Manin, B. and Martí, J.L. (2010) "The Place of Self-Interest and the Role of Power in Deliberative Democracy." *Journal of Political Philosophy* 18(1): 64-100.

[70] Mansbridge, J., Hartz-Karp, J., Amenqual, M. and Gastil, J. (2006) "Norms of deliberation: An Inductive Study." *Journal of Public Deliberation* 2(1): 1–47.

[71] McBurney, P., Hitchcock, D. and Parsons S. (2007) "The Eightfold Way of Deliberation Dialogue." *International Journal of Intelligent Systems* 22: 95-132.

[72] Miller, D. (1992) "Deliberative Democracy and Social Choice." *Political Studies* 40: 54-67.

[73] Offe, C. (2017) "Referendum vs. Institutionalized Deliberation: What Democratic Theorists Can Learn from the 2016 Brexit Decision." *Daedalus*, 146(3): 14-27.

[74] Osherson, D. and Weinstein, S. (2012) "Preference Based on Reasons." *The Review of Symbolic Logic* 5(1): 122-147.

[75] Ottonelli, V. and Porello, D. (2013) "On the Elusive Notion of Meta-Agreement." *Politics, Philosophy & Economics* 12(1): 68-92.

[76] Parikh, R. (1999) "Beliefs, Belief Revision, and Splitting Languages." *Logic, Language, and Computation* 2: 266-278.

[77] Perote-Peña, J. and A. Piggins (2015) "A Model of Deliberative and Aggregative Democracy." *Economics and Philosophy* 31: 93-121.

[78] Rawls, J. (1997) "The Idea of Public Reason revisited." *University of Chicago Law Review* 94: 771-772.

[79] Runciman, David. (2018) *How Democracy Ends.* London: Profile Books.

[80] Shi, C., Smets, S, and Velázquez-Quesada,F. (2018) "Beliefs supported by Binary Arguments", *Journal of Applied Non-Classical Logics* 28(2-3): 165-188.

[81] Steenbergen, M. R., Bächtiger, A., Spörndli, M., and Steiner, J. (2003) "Measuring Political Deliberation: A Discourse Quality Index." *Comparative European Politics* 1(1): 21-48.

[82] Tversky, A. and Kahneman, D. (1974) "Judgment under Uncertainty: Heuristics and Biases" *Science*, New Series, 185(4157): 1124-1131.

[83] Van Benthem, J. (2006) "Open Problems in Logical Dynamics", in Gabbay, D. M.; Goncharov, S. S., and Zakharyaschev, M. *(Eds.)*, *Mathematical Problems from Applied Logic I: Logics for the XXIst Century,* Springer, New York, 137-192.

[84] Van Benthem, J. and Pacuit, E. (2011) "Dynamic Logics of Evidence-Based Beliefs." *Studia Logica* 99: 61-92.

[85] Van Benthem, J. and Velázquest-Quesada F. (2010). "The dynamics of awareness", in *Synthese* 177(Supplement 1): 1-23.

[86] Van Ditmarsch, H., van der Hoek, W., and Kooi, B. (2003) "Concurrent Dynamic Epistemic Logic for MAS", in *Proceedings of the International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS '03)*, 201-208.

[87] Van Reybrouck, D. (2013) *Tegen verkiezingen*. Amsterdam: De Bezige Bij.

[88] Walton, D., Toniolo, A. and Norman, T. J. (2016) "Towards a Richer Model of Deliberation Dialogue: Closure Problem and Change of Circumstances." *Argument & Computation* 7(2-3): 155-173.