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BRIEF REPORT

REVISED Power concentration and political dynamics in liquid democracy: a temporal analysis of LiquidFeedback in Germany's Pirate Party

[version 2; peer review: 1 approved]

Gema Sanchez Medero

Department of Political Science and Administration, Faculty of Political Science and Sociology, Complutense University of Madrid, Campus de Somosaguas s/n, Pozuelo de Alarcón, Madrid, 28223, Spain

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Abstract

Background

Liquid democracy platforms have been proposed as tools for genuine intra-party democratisation, yet empirical evidence on their power dynamics remains scarce. Existing analyses of the most extensively documented case — the German Pirate Party's LiquidFeedback platform (2010–2013) — have not systematically examined how power concentration interacted with the party's internal political trajectory.

Methods

This research note presents a temporally disaggregated secondary analysis of aggregate statistics reported by Kling et al. (2015) for the complete LiquidFeedback dataset (499,009 votes, 6,517 initiatives, 1,200 days). Power concentration is examined through the Gini coefficient of delegation distribution and network structure metrics (including reciprocity and connectedness) across three analytically distinct phases of the party's organisational trajectory. The analysis is framed as theory-driven reinterpretation rather than causal identification; preferential attachment is acknowledged as a concurrent endogenous mechanism.

Results

Concentration tracks three politically distinct phases rather than a linear technological gradient. The Berlin electoral breakthrough of

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1. **Sergio Pérez-Castaños**, Universidad de Burgos, Burgos, Spain

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September 2011 constitutes a quasi-exogenous compositional shock temporally preceding measurable network changes, without any platform parameter change. Phase 3 instantiates the Hirschman Exit mechanism: selective disengagement by dissatisfied members consolidated concentration at its maximum precisely as the platform was under active democratic contestation. These findings support a multiplier thesis — digital governance tools amplify pre-existing organisational conditions rather than determining outcomes independently.

Conclusions

Observable network metrics provide technically feasible early warning indicators that party statutes could use to trigger automatic review mechanisms during Phase 1, before self-reinforcing oligarchisation consolidates. A provisional Digital Oligarchy Hypothesis is advanced as an agenda for comparative research across contemporary digital party governance platforms.

Keywords
liquid democracy; intra-party democracy; power concentration; LiquidFeedback; party organisation; digital governance; multiplier thesis; algorithmic politics

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REVISED **Amendments from Version 1**

This revised version responds to the peer review by Dr Sergio Pérez-Castaños. The argument and empirical basis are unchanged; the revisions sharpen the distinction between empirical findings, plausible interpretations, and normative proposals throughout. Section 5 now flags each of its three concluding claims by register (interpretive conclusion, empirical premise supporting a normative proposal, and research agenda), and Section 4.3 has been reframed to state explicitly that it contains no empirical claims and should be read as hypothesis-generating, with the AI-governance material presented as candidate mechanisms and testable predictions rather than established effects. We thank the reviewer for feedback that improved the manuscript.

Any further responses from the reviewers can be found at the end of the article

1. Introduction

Liquid democracy — a hybrid voting system combining direct participation with delegable representation — has attracted growing interest as a mechanism for genuine intra-party democratisation (Paulin, 2020; Gerbaudo, 2019). Unlike conventional representative structures, liquid democracy platforms allow members to vote directly on any issue or delegate their vote to a trusted peer, with the option to revoke that delegation at any time. This flexibility is theorised to lower participation barriers, reflect preference intensity across membership, and reduce the concentration of decision-making power characteristic of traditional party hierarchies (Mooers et al., 2024). The democratic potential of liquid democracy has been theorised extensively, with proponents arguing that delegable voting can reconcile scale with direct participation (Blum & Zuber, 2016) and critics pointing to structural concentration risks inherent in unconstrained delegation architectures (Brill, 2018).

The most extensively documented real-world implementation of liquid democracy in a party context is the German Pirate Party's adoption of LiquidFeedback between 2010 and 2013 — the largest delegative democracy platform ever operated by a political party, with 13,836 registered users and 499,009 votes cast across 6,517 initiatives over 1,200 days (Kling et al., 2015). This dataset represents a unique empirical resource for evaluating the democratic performance of liquid democracy under real political conditions, yet its analysis has remained largely confined to technical questions of power index measurement (Kling et al., 2015) and network structure (Paulin, 2020), without systematic examination of how the platform's power dynamics interacted with the party's internal political trajectory.

The analytical relevance of the LiquidFeedback case extends beyond its historical specificity. Contemporary parties deploying digital participation platforms face structurally comparable challenges: Decidim-based platforms in Spain, Rousseau in Italy's M5S, and emerging AI-assisted deliberation tools in parties across Europe operate within comparable organisational constraints that LiquidFeedback instantiated early and in a particularly transparent form (Sandri et al., 2024; Gerbaudo, 2019). Notably, the concentration dynamics documented here are not necessarily attributable solely to political conditioning: preferential attachment — the well-documented tendency of scale-free networks to concentrate weight in already highly connected nodes (Barabási & Albert, 1999) — constitutes a plausible concurrent endogenous mechanism. Distinguishing between these two explanations is a central analytical challenge that the available aggregate data cannot fully resolve, and one that future research with access to micro-level data should address directly.

We argue that the concentration of formal voting power in super-delegates is not a linear technological artifact of the delegation mechanism but a phenomenon that tracks the Pirate Party's organisational trajectory through three politically distinct phases: initial adoption and membership growth, electoral mobilisation and peak activity, and internal crisis and platform abandonment. Section 2 describes the data and methodology, Section 3 presents the temporal analysis across three phases, and Section 4 discusses the implications for intra-party democratic governance and party organisation research.

2. Data and methodology

2.1 Data source

This research note draws exclusively on the quantitative results reported in Kling et al. (2015), which analysed the complete voting history and delegation network of the German Pirate Party's LiquidFeedback installation from August 2010 to November 2013. The dataset comprises 499,009 single votes for 6,517 initiatives belonging to 3,565 issues, with 14,964 delegations made across global, area and issue levels. The number of registered users over the observation period is 13,836, with active user counts fluctuating substantially in response to political events within the party.

The dataset is the most comprehensive empirical record of liquid democracy in operation in a real political party context available in the academic literature. Crucially, Kling et al. report not only aggregate statistics but temporal evolution of

key network metrics — including the Gini coefficient of the delegation network's indegree distribution, network reciprocity, clustering coefficient, and the largest connected component — over the full 1,200-day observation period. These temporal statistics provide the empirical basis for the phased analysis developed in Section 3.

2.2 Analytical approach

The analysis operates at two levels. At the aggregate level, we draw on the power concentration metrics reported by Kling et al. — specifically the power law exponent of voting weight distribution (1.38), the Gini coefficient trajectory (0.64 → 0.68), and the ratio of exercised to theoretical power (0.34, $\rho = -0.26$, $p < 0.05$) — to characterise the overall distribution of formal power within the platform. At the temporal level, we map the evolution of these metrics against three politically significant events documented in the party's history and referenced in Kling et al.'s own data presentation: the Berlin electoral success of September 2011, the federal party congress of 2011, and the internal crisis over the future role of delegative democracy that accelerated platform abandonment from 2012 onwards. Table 1 synthesises this correspondence, reconstructing the available metrics by phase to summarise the correspondence between political events and available network metrics as reported in Kling et al. (2015).

The three-phase periodisation is constructed from two sources. First, Kling et al. explicitly identify these events as explanatory factors for the fluctuations in active user counts visible in their Figure 1(b), providing a party-internal validation of their political significance. Second, the temporal evolution of the Gini coefficient and network reciprocity reported in their Figure 5 shows inflection points that correspond to these events, enabling the phased narrative developed here.

This approach constitutes a secondary analysis in the strict methodological sense: we do not access the raw dataset but derive new analytical conclusions from the reported statistics through a theoretically informed reinterpretation of the temporal patterns Kling et al. document. A critical epistemological boundary must be stated here and maintained throughout: the evidence is consistent with the politically conditioned interpretation advanced, but does not causally identify it. The analysis cannot discriminate between politically induced concentration dynamics and endogenous network processes — in particular, preferential attachment (Barabási & Albert, 1999) constitutes a plausible concurrent mechanism. The three-phase narrative is advanced as the theoretically better-specified interpretation, not as a causally identified finding.

The contribution relative to the original paper is interpretive rather than empirical: it connects the reported network metrics to organisational incentives through a theoretically informed temporal reinterpretation. This re-specification integrates three analytical layers in explicit hierarchical relation: the multiplier thesis as meta-framework, Hirschman's (1970) Exit, Voice, and Loyalty mechanism as the micro-level explanation for Phase 3 dynamics, and the literature on digital affordances in party organisation (Evans et al., 2023) as the contextual frame establishing why platform properties matter without being determinative.

2.3 Theoretical framework

The analysis is grounded in the multiplier thesis developed in the broader framework paper of which this research note is a companion piece: AI and digital governance tools are likely to function as multipliers of pre-existing political conditions rather than as autonomous democratising forces. Applied to liquid democracy, this thesis predicts that power

Table 1. Network metrics and political events across three phases of LiquidFeedback deployment.

Phase	Period	Key political event	Gini coefficient	Network reciprocity	Largest connected component	Active users
Phase 1	Aug 2010 – Sep 2011	Platform launch; early adoption	~0.64 (baseline)	Highest	Small; clustered	Low; stable
Phase 2	Sep 2011 – mid-2012	Berlin electoral success (8.9%); federal party congress	Rising (0.64 → 0.67)	Declining	Expanding rapidly	Peak influx
Phase 3	Mid-2012 – Nov 2013	Internal crisis; platform abandonment	~0.68 (maximum)	Minimum	Large; hierarchical	Sustained decline

Note: All metrics reconstructed from aggregate statistics and figures reported in Kling et al. (2015). Raw data were not accessed. Phase boundaries correspond to political events identified by Kling et al. as explanatory factors for fluctuations in active user counts (their Figure 1b). Gini values are approximate, derived from their reported trajectory.

concentration dynamics will reflect the organisational incentives and political conditions of the party deploying the platform rather than following a technologically determined trajectory. The three-phase analysis in Section 3 constitutes a direct empirical test of this prediction in the most extensively documented case available.

3. Power concentration across three political phases

The temporal evolution of power concentration in the Pirate Party's LiquidFeedback platform cannot be understood independently of the party's internal political trajectory. This section does not argue that concentration is exclusively political rather than technological — the delegation mechanism's structural properties define the space within which concentration is possible — but rather that the trajectory observed within that space reflects the organisational conditions of deployment at each phase. Kling et al. (2015) document three distinct inflection points in platform activity corresponding to politically significant events: the Berlin electoral success of September 2011, the federal party congress of late 2011, and the internal crisis that accelerated platform abandonment from 2012 onwards. Table 1 summarises the correspondence between these events and the available network metrics. The three phases are analytically motivated constructions rather than causally identified discrete periods: they organise the available evidence around a theoretically coherent narrative rather than claiming to identify precise temporal boundaries or to exclude endogenous network dynamics as concurrent explanations.

3.1 Phase 1: Adoption and distributed participation (August 2010 – September 2011)

The first phase spans the initial adoption of LiquidFeedback by the Pirate Party following its introduction in May 2010 through to the Berlin state election of September 2011. During this period, the platform attracted a growing but relatively committed user base — members who actively sought out the new participatory mechanism rather than joining a mass influx driven by external political events. Kling et al. report that activity during this phase was characterised by relatively small, mutually interconnected delegation groups: the network reciprocity measure was at its highest during this period, indicating that users were delegating to each other in small clusters rather than concentrating delegations in a small number of nodes. The Gini coefficient of the delegation network's indegree distribution was at its lowest point, approximately 0.64, reflecting a more distributed — though not equal — allocation of formal voting weight.

This phase corresponds to the theoretical prediction of the multiplier thesis for contexts where the early adopter profile and low-stakes voting conditions favour distributed participation. When the user base consists primarily of committed members who actively sought out the platform — a profile that plausibly includes higher motivation, greater familiarity with digital tools, and stronger individual autonomy norms — the delegation mechanism functions closer to its democratising potential. Super-voters exist — the power law distribution with exponent 1.38 is already characteristic of concentrated systems — but their accumulated weight is constrained by the relatively small and interconnected nature of the delegation network. The stabilising dynamic that Kling et al. document, whereby super-voters tend to vote with the majority, is most pronounced during this phase. Member autonomy in delegation behaviour is treated here as a theoretically motivated latent variable — not directly observable in the dataset — that generates empirically testable expectations: parties with higher member autonomy should exhibit shorter delegation chains, higher revocation rates, and greater participation diversity across issue areas, all of which are approximable from delegation network data in future research.

3.2 Phase 2: Electoral mobilisation and concentration acceleration (September 2011 – mid-2012)

Phase 2 is defined by the electoral breakthrough that transformed the party's membership composition and, consequently, its delegation network structure. The Berlin electoral success of September 2011 — in which the Pirate Party obtained 8.9% of the vote and entered the state parliament — constitutes the analytically most significant event for the multiplier thesis. It provides the closest available approximation to a quasi-exogenous political shock to the party's membership composition: the electoral result was determined by the broader Berlin electorate rather than by dynamics internal to the LiquidFeedback platform, and it preceded the measurable changes in network structure that followed. The temporal sequence — new member influx after September 2011, followed by observable increases in the Gini coefficient and declines in network reciprocity — is temporally consistent with an organisational conditioning interpretation, since the shock's timing is independent of the platform's technical parameters by construction. This temporal consistency does not establish causal identification, and preferential attachment remains a concurrent candidate: new members delegating to already-prominent nodes would generate the same network pattern under either mechanism. The partial discrimination available is this: preferential attachment, in the absence of compositional shocks, predicts roughly constant concentration growth throughout the observation period; the observable acceleration following September 2011 fits a compositional shock better than a smooth endogenous process, even if both mechanisms operated simultaneously.

The federal party congress of late 2011 amplified this dynamic. As Kling et al. note, the platform was used intensively to prepare proposals for the congress, creating high-stakes voting contexts that incentivised strategic delegation behaviour.

The Gini coefficient began its upward trajectory during this period, and network reciprocity started to decline — indicating a shift from distributed mutual-delegation clusters towards a more hierarchical structure in which delegation chains flowed increasingly towards a small number of highly connected intermediaries. The largest connected component of the delegation network grew substantially, reflecting the emergence of a centralised delegation architecture connecting most active users through a relatively small number of super-voter nodes.

3.3 Phase 3: Internal crisis and concentration consolidation (mid-2012 – November 2013)

The third phase is defined by a critical internal debate within the Pirate Party over the democratic legitimacy of LiquidFeedback itself. As Kling et al. document, 180 days after the 2011 federal party congress a significant drop in active users occurred, followed by a sustained decline as the party's internal discussion on super-voters drove many members to disengage from the platform entirely.

The selective nature of this exit is analytically significant and is well-accounted for by the Exit mechanism in Hirschman's (1970) Exit, Voice, and Loyalty framework, though not exclusively determined by it. Members who perceived the platform as having failed to deliver genuine democratic participation appear to have chosen Exit — withdrawal from engagement — rather than Voice — organised internal contestation through counter-mobilisation or rule change proposals. This pattern is consistent with a broader dynamic documented across voluntary associations and political organisations: when formal accountability mechanisms are absent or ineffective, dissatisfied members disengage rather than mobilise, leaving accumulated structural advantages with those who remain. Alternative mechanisms — including simple fatigue following electoral cycle decline or technological disenchantment independent of democratic concerns — cannot be ruled out with aggregate data alone. The Hirschman framework is retained as the theoretically best-specified account of the available evidence, not as its only possible explanation.

The consequence of this selective exit was a consolidation of concentration at precisely the moment when the platform was being most actively contested as oligarchical. The Gini coefficient reached its maximum value of approximately 0.68 — an increase of approximately 6% over the baseline — while network reciprocity reached its minimum and clustering declined to its lowest point. The delegation network had evolved into a clearly bipartite structure: a small core of super-voters connected to a large periphery of passive delegators, with minimal horizontal delegation among peripheral users.

The ratio of exercised to theoretical power remained at 0.34 throughout all three phases, with the negative correlation between accumulated power and propensity to exercise it ($\rho = -0.26$, $p < 0.05$) persisting consistently. This finding does not imply that the observed concentration is democratically benign. The normative concern is structural rather than behavioural: a system in which a small stratum controls disproportionate formal voting weight creates preconditions for democratic failure under adverse organisational conditions, regardless of current behavioural restraint. Under modal cartel party conditions — strong leadership control, organised factional pressure, weak member accountability — the same structural concentration would be expected to produce qualitatively different outcomes. The Hirschman Exit dynamic compounds this risk: once dissatisfied members have disengaged, the internal constituency for redistribution shrinks precisely as concentration consolidates, creating a self-reinforcing oligarchisation dynamic that late governance intervention cannot easily reverse.

4. Discussion: liquid democracy as a multiplier of organisational conditions

The three-phase analysis of LiquidFeedback in Germany's Pirate Party generates three findings that carry direct implications for how liquid democracy should be theorised, designed and regulated in the context of intra-party democratic governance.

4.1 Concentration is organisationally conditioned, not technologically determined

The three-phase analysis generates a central finding: power concentration in liquid democracy does not follow a linear technological trajectory but varies with the organisational conditions of the party deploying the platform. During Phase 1, committed early adopters and low-stakes voting contexts kept concentration moderate. During Phase 2, a quasi-exogenous electoral shock altered membership composition and high-stakes congress preparation incentivised strategic delegation, accelerating concentration. During Phase 3, the Hirschman Exit of less engaged members consolidated concentration at its maximum.

This pattern supports the multiplier thesis: liquid democracy defines the structural space within which concentration can occur, but the trajectory within that space reflects the organisational conditions of deployment. This formulation avoids two symmetrical errors: technological determinism, which would attribute concentration solely to the delegation architecture, and organisational determinism, which would treat the platform as inert. As Evans et al. (2023) argue,

platforms possess material properties that constrain and enable action independently of user intentions, while simultaneously being appropriated in ways that reflect the organisational logics of their deployers. The LiquidFeedback case illustrates both dynamics simultaneously.

The implication for party organisation research connects directly to Gauja's (2017) documentation of how participatory reforms produce outcomes shaped more by pre-existing distributions of organisational power than by reform mechanism design, and to Michels' (1911) iron law of oligarchy: the technology does not escape the organisational logic it is embedded in but multiplies it.

Although comparative data across platforms remain sparse, available evidence is broadly consistent with this reading. Gerbaudo (2019) documents that Rousseau, the M5S's digital platform, exhibited a marked tendency towards centralisation around party leadership despite its formally participatory architecture — a pattern that fits the multiplier thesis insofar as the M5S's organisational culture preceded and shaped the platform's use rather than the reverse. For Decidim-based implementations, Sandri et al. (2024) note substantial variation in participation intensity and governance outcomes across parties, suggesting that platform design alone does not determine democratic performance. These observations do not constitute systematic comparative evidence — the data are not equivalent, and the cases are not matched — but they are consistent with the prediction that organisational conditions, rather than technical architecture, drive concentration outcomes. Systematic comparative research across these platforms, using the network metrics proposed in Section 4.2 as a common measurement framework, is the logical next step.

4.2 The timing of governance intervention: the central practical contribution

The three-phase pattern and the Hirschman Exit dynamic together generate the central practical contribution of this research note: governance interventions designed to prevent oligarchisation in liquid democracy are most effective when applied during Phase 1, before self-reinforcing concentration dynamics have consolidated. The Exit mechanism documented in Phase 3 illustrates why late intervention is structurally difficult: once dissatisfied members have disengaged, the remaining user base consists disproportionately of those who have benefited from concentration, creating internal resistance to redistribution that was absent during Phase 1.

It is important to separate what the data support from what the governance proposal adds normatively. Empirically, the Kling et al. data establish that observable network metrics — declining reciprocity, growing largest connected component, rising Gini coefficient — changed in a pattern consistent with the phase transitions described here, and that these changes preceded the period subsequently interpreted as the platform's democratic crisis. This is the empirical foundation. Normatively, the governance proposal draws on this foundation to argue that party statutes could specify automatic review mechanisms triggered by convergent changes in these metrics, enabling intervention before the Hirschman Exit dynamic removes the internal constituency capable of demanding correction. This is a design recommendation, not an empirical finding, and it should be evaluated as such.

The data from Kling et al. allow a preliminary identification of observable indicators that could serve as governance triggers. The transition from Phase 1 to Phase 2 corresponds to a measurable shift in three network metrics simultaneously: declining reciprocity, growing largest connected component, and rising Gini coefficient. The convergence of these three indicators provides a more robust governance signal than any single metric, and all three are calculable from platform data in real time. A composite trigger based on simultaneous movement in all three metrics is both technically feasible and more resistant to gaming than any single threshold.

A minimally operational specification of such a trigger would require three design decisions. First, whether to monitor relative changes (Δ) rather than absolute levels — relative changes are preferable given that baseline values will vary across party contexts. Second, the temporal window over which convergent movement must be observed: a window of 60–90 days is consistent with the inflection dynamics documented in the Kling et al. data, though this should be calibrated empirically for each deployment context. Third, whether a single observation of convergent movement or a persistent trend suffices to activate review: persistent movement across at least two consecutive measurement periods reduces false positives while maintaining the early warning character of the mechanism. These parameters are offered as illustrative rather than prescriptive; their precise calibration requires platform-specific empirical work that the single-case evidence base here cannot supply.

One important limitation bears explicit acknowledgement: the specific metric values documented here are properties of a single organisationally atypical case. The Pirate Party was not a cartel party, a mass party, or a cadre party in the conventional sense; its membership profile, platform adoption context, and organisational trajectory were specific to an early-2010s German flash party. Any attempt to transfer specific numerical thresholds to other party contexts without

empirical calibration would be methodologically unjustified. The governance design implication is accordingly more robust than any specific number: the principle of composite early warning triggers is transferable; the thresholds and parameters require case-specific calibration. Comparative research across parties deploying Decidim, Rousseau, or similar platforms would be necessary to establish generalised values.

4.3 Theoretical implications for AI governance: a research agenda

This section contains no empirical claims. It extends the multiplier thesis to intra-party AI governance in the form of conjectures and testable predictions, offered as an agenda for future research rather than as results derived from the LiquidFeedback data. The domain boundary must be explicit: LiquidFeedback is a proto-AI delegative platform, not a generative or agentic AI system, and none of the dynamics documented in Sections 3 and 4.1–4.2 can be transferred to AI deployment without empirical validation in AI-specific contexts. The material that follows should therefore be read as hypothesis-generating, not as an extension of the evidence base.

Within these limits, the multiplier thesis generates a falsifiable prediction: parties with Phase 1 organisational characteristics — committed early adopters, low factional pressure, strong individual autonomy norms — should experience more distributed AI governance outcomes than parties with Phase 3 characteristics, regardless of the specific AI tool deployed. This prediction is stated so that it can be refuted by future data; it is not corroborated by the present single-case analysis, which concerns a pre-AI platform.

Four properties plausibly distinguish AI systems from LiquidFeedback in ways that may amplify concentration risks. These are proposed as candidate mechanisms to be tested, not as established effects: opacity of process (AI aggregation is not legible to members without specialist capacity); aggregation at scale (volumes that make real-time democratic monitoring structurally difficult); the social authority of computational objectivity (AI-reported preference aggregations may carry an authority that a visible, contested delegation network did not); and automated delegation (AI recommendation systems that assign preferences without explicit member choice, representing the logical endpoint of the passive delegation dynamic observed in Phases 2 and 3). Whether each property operates as conjectured, and in which direction, is an open empirical question.

Testing whether these properties produce the concentration amplification the multiplier thesis predicts — and whether Phase 1 governance mechanisms of the kind proposed in Section 4.2 can mitigate them — constitutes the primary agenda for future empirical research in this area. The present analysis motivates this agenda; it does not adjudicate it.

5. Conclusions

This research note has examined power concentration dynamics in Germany's Pirate Party's LiquidFeedback platform through a temporally disaggregated secondary analysis of the Kling et al. (2015) dataset. Two constraints bound all conclusions: the analysis relies on reported aggregate statistics rather than raw data, and it examines a single organisationally atypical case — a flash party, early technology adoption, eventual organisational collapse — that limits direct extrapolation to modal party contexts. Throughout, three registers should be kept distinct: what the reported statistics empirically establish, how those patterns are interpreted here, and what the governance proposals add normatively. The three conclusions below are flagged accordingly.

First — an interpretive conclusion — power concentration is organisationally conditioned rather than technologically determined, though the two mechanisms are not mutually exclusive. The empirical component is limited and specific: the Gini coefficient rose from 0.64 to 0.68 over 1,200 days, and its inflection points, together with those of network reciprocity and the largest connected component, are temporally aligned with three politically distinct phases of the party's trajectory (Table 1). The organisational-conditioning reading of that alignment is an interpretation, not a causally identified result. Phase 2 offers the most temporally consistent evidence: the Berlin electoral breakthrough of September 2011 altered membership composition without any change in platform parameters, and the temporal ordering — shock preceding network changes — satisfies a necessary, though not sufficient, condition for organisational conditioning, while preferential attachment remains a plausible concurrent mechanism that future research with micro-level data could formally discriminate. Phase 3 is likewise interpreted, not demonstrated, through the Hirschman Exit mechanism (Section 3.3): selective disengagement by dissatisfied members is the best-specified account of the consolidation of concentration observed at its maximum precisely as the platform was under active democratic contestation, but aggregate data cannot exclude alternatives such as electoral-cycle fatigue.

Second — an empirical premise supporting a normative proposal — governance intervention is likely to be most effective during Phase 1, before the Hirschman Exit dynamic depletes the internal constituency for democratic correction. The

empirical premise is that observable network metrics — declining reciprocity, growing largest connected component, rising Gini coefficient — changed convergently and did so ahead of the platform's subsequent democratic crisis; these metrics are technically feasible early warning indicators, and their composite movement is more robust than any single threshold. The recommendation that party statutes translate these indicators into automatic review triggers is a design proposal, not a finding, and the transferable element is the logic of composite early warning triggers, not the specific numerical thresholds, which require case-specific calibration. Evidence from analogous platforms — Rousseau's documented centralisation tendencies (Gerbaudo, 2019) and the variation in Decidim-based outcomes across parties (Sandri et al., 2024) — points in the same direction, though systematic comparative research remains necessary to establish generalised values.

Third — a research agenda, not a result — the case motivates, but does not test, an agenda for AI governance. The multiplier thesis predicts that parties with Phase 1 characteristics should experience more distributed AI governance outcomes than parties with Phase 3 characteristics, regardless of the specific tool deployed. The four properties that may distinguish AI systems from transparent delegative platforms — opacity, scale, computational authority, and automated delegation — are conjectured to amplify concentration risks and reduce the visibility of the process, making early governance intervention structurally more necessary. Whether these properties systematically accelerate oligarchic consolidation is an empirical question the LiquidFeedback case motivates but cannot resolve.

Together, these conclusions support a *provisional Digital Oligarchy Hypothesis*: digital governance tools may amplify the oligarchic tendency Michels (1911) identified while simultaneously reducing its visibility. The hypothesis is explicitly provisional and conjectural — it rests on a single case and requires comparative validation. Michels identified the structural tendency; Hirschman explained why exit may prevail over correction; the multiplier thesis specifies how digital technology may interact with both — a dynamic whose generality the comparative research agenda outlined here is designed to test, not one this study establishes. The democratic correction remains possible, but on the interpretation advanced here it requires intervention during Phase 1, before the structural space the technology defines is filled by the organisational conditions that make correction progressively harder to demand.

Ethics and consent

Ethical approval and consent were not required for this study. The analysis draws exclusively on previously published aggregate statistics (Kling et al., 2015) and does not involve human participants, personal data, or identifiable information.

AI Tool disclosure

No AI-assisted writing or revision tools were used at any stage in the preparation of this manuscript. All drafting, analysis, interpretation, and editorial decisions were carried out exclusively by the author.

Data availability

The data that support the findings of this research are freely available from a third party: Kling et al. (2015). These are available in the AAAI Digital Library at https://doi.org/10.1609/icwsm.v9i1.14618, [Kling et al., 2015].

Underlying data

No primary dataset was generated or analysed in this study. All quantitative evidence is derived from aggregate statistics reported in:

Kling CC, Kunegis J, Hartmann H, Strohmaier M, Staab S. Voting behaviour and power in online democracy: A study of LiquidFeedback in Germany's Pirate Party. *Proceedings of the Ninth International AAAI Conference on Web and Social Media.* 2015; 9(1): 208–217. https://doi.org/10.1609/icwsm.v9i1.14618 [Kling et al., 2015].

The original LiquidFeedback dataset was not accessed by the author. Readers wishing to access the underlying data should contact the corresponding author of Kling et al. (2015) directly.

Extended data

No extended data files were generated for this study. Table 1, which reconstructs network metrics by phase from the aggregate statistics reported in Kling et al. (2015), is included in the main manuscript file and does not constitute a separate dataset.

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✔ **Sergio Pérez-Castaños**
[1] Universidad de Burgos, Burgos, Castile and León, Spain
[2] Universidad de Burgos, Burgos, Castile and León, Spain

This Brief Report,"Power concentration and political dynamics in liquid democracy: a temporal analysis of LiquidFeedback in Germany's Pirate Party", reinterprets the dataset originally analyzed by Kling and colleagues on the LiquidFeedback platform used by the German Pirate Party between 2010 and 2013. The author does not conduct a new analysis of the raw data but instead offers a theory-driven secondary analysis of published aggregate statistics, focusing on the temporal evolution of power concentration across three phases: (1) adoption and early participation, (2) electoral breakthrough and organizational expansion, and (3) internal crisis and platform decline. The article argues that observed concentration dynamics are better understood as being conditioned by organizational and political developments within the party rather than being solely attributable to the technological properties of liquid democracy. The manuscript further develops a "multiplier thesis," proposes governance implications based on network indicators, and concludes by advancing a provisional "Digital Oligarchy Hypothesis" relevant to future research on AI-supported political participation.
The paper is clearly written, well structured, and appropriately situated within the literature on liquid democracy, party organization, digital participation, and political sociology. The discussion is intellectually stimulating and the limitations of the available evidence are acknowledged throughout the manuscript.
However, the paper's central contribution is interpretive rather than empirical. Several conclusions rely on theoretical inference from aggregate statistics that cannot directly test the proposed mechanisms. While this does not invalidate the contribution as a Brief Report, it does require greater caution in some formulations and a clearer distinction between empirical findings, plausible interpretations, and normative proposals.

Expanding responses to reviewer questions
Is the work clearly and accurately presented and does it engage with the current literature? The manuscript is clearly written and logically organized. The research question, theoretical framework, methodology, findings, and implications are presented in a transparent manner. The

article engages both foundational and contemporary literature, including work on liquid democracy, network dynamics, party organization, digital governance, and democratic participation. The author also cites recent work on digital parties and emerging governance technologies, demonstrating familiarity with current scholarly debates.

Is the study design appropriate and is the work technically sound? The design is appropriate for a secondary analysis and the author is commendably transparent about not having access to the original dataset. The manuscript repeatedly states that it provides a theory-driven reinterpretation rather than a causal analysis.

Are sufficient details of methods and analysis provided to allow replication by others? The author carefully explains the source of the data, the use of aggregate statistics from Kling et al. (2015), and the logic behind the temporal reinterpretation.

Are all the source data and materials underlying the results available? The manuscript is transparent regarding data availability and clearly states that no new dataset was generated.

Are the conclusions drawn adequately supported by the results? The main conclusions regarding the coexistence of concentration dynamics and organizational developments are broadly supported by the evidence presented. Importantly, the author repeatedly acknowledges limitations and alternative explanations. I recommend to clearly distinguish evidence-based conclusions from speculative extrapolations, particularly in Sections 4.3 and 5.

If applicable, is the statistical analysis and its interpretation appropriate? No new statistical analysis is conducted. The article relies entirely on previously published statistics and network measures. The interpretation is generally careful and transparent, and limitations are explicitly discussed.

Is the work clearly and accurately presented and does it engage with the current literature?
Yes

Is the study design appropriate and is the work technically sound?
Partly

Are sufficient details of methods and analysis provided to allow replication by others?
Not applicable

Are all the source data and materials underlying the results available?
Not applicable

Are the conclusions drawn adequately supported by the results?
Partly

If applicable, is the statistical analysis and its interpretation appropriate?
Not applicable

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Political Communication, Political Behaviour, Methodology in Social Sciences.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Author Response 18 Sep 2026

gema Sanchez Medero

We thank Dr Pérez-Castaños for a careful, constructive and generous review, and for recognising that the manuscript is clearly written, logically organised, and well situated within the literatures on liquid democracy, party organisation, network dynamics and digital governance. We are especially grateful for the central observation that the note's contribution is interpretive rather than empirical, and that this calls for greater caution in some formulations and a clearer distinction between empirical findings, plausible interpretations, and normative proposals. We agree, and we have revised the manuscript accordingly. The specific changes are set out below.

1. Distinguishing empirical findings, plausible interpretations, and normative proposals (transversal comment). We have made this three-way distinction explicit rather than implicit. The Conclusions (Section 5) now state at the outset that three registers must be kept distinct — what the reported statistics empirically establish, how those patterns are interpreted here, and what the governance proposals add normatively — and each of the three concluding claims is now explicitly flagged as, respectively, an interpretive conclusion, an empirical premise supporting a normative proposal, and a research agenda. This extends to the concluding claims the same discipline we had already applied in Section 4.2 ("It is important to separate what the data support from what the governance proposal adds normatively").

2. Sections 4.3 and 5: distinguishing evidence-based conclusions from speculative extrapolation. Following the reviewer's specific recommendation, we have strengthened both sections. Section 4.3 now opens by stating plainly that it contains no empirical claims and should be read as hypothesis-generating; the falsifiable prediction is explicitly marked as not corroborated by the present single-case analysis, the four distinguishing properties of AI systems are presented as candidate mechanisms to be tested rather than established effects, and the section closes by reiterating that the analysis motivates this agenda but does not adjudicate it. Section 5, beyond the register-tagging noted above, now states for each conclusion which part rests on the reported statistics and which is interpretive or normative — for example, Phase 3 is described as "interpreted, not demonstrated," and the Digital Oligarchy Hypothesis as "explicitly provisional and conjectural … not one this study establishes."

3. Study design (rated "Partly") and conclusions adequately supported (rated "Partly"). We read both ratings as reflecting the interpretive nature of a theory-driven secondary analysis, which the reviewer rightly accepts as a legitimate contribution for a Brief Report while asking for greater caution. The revisions above address exactly this: they narrow the empirical claims to what the aggregate statistics can bear, foreground preferential attachment as a concurrent mechanism the data cannot discriminate and relocate the more

speculative material to explicitly labelled predictive and agenda-setting registers. We have removed any residual phrasing that could read a normative proposal or an AI-domain conjecture as an empirical finding.

4. Replication, data availability, and statistical analysis (rated "Not applicable").
We note these ratings and have made no changes, as they follow from the design: no new dataset was generated, the aggregate source (Kling et al., 2015) is fully cited and openly available, and no new statistical analysis was performed. The Data Availability statement documents this. We believe these revisions preserve the note's argument and readability while meeting the reviewer's call for a clearer separation of evidence, interpretation and normative recommendation.

We thank the reviewer again for feedback that has improved the manuscript.

Competing Interests: No competing interests were disclosed.