Stability and Diversity of Party Coherence as Indicators for Potential Party Splits: Introducing and Testing a New Measure with Data from Switzerland and the United States

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Abstract

The paper revives a theoretical definition of party coherence as being composed of two basic elements, cohesion and factionalism, to propose and apply a novel empirical measure. The proposed measure of party coherence is based on spin physics and builds on the intuition that coherence includes both a structural component (diversity of sub-groups in the organization) and a dynamic component (stability of the organization under stress). The simultaneous analysis of both components using a single measurement concept allows for the detection and assessment of party organizations being at risk of splitting. Its application to data representing the political beliefs of candidates in the Swiss general elections of 2003 and 2007 reveals two different mechanisms of party splits: bottom-up and top-down. The application to data of U.S. House elections in 2004 and 2010 confirms the characterization of Tea Party supporters as cohesive sub-group within the Republican Party; but they are no mavericks since their political beliefs fit very well together with conventional core Republicanism. In this way, we are able to turn the intuition of coherence into a defined quantitative concept that, furthermore, offers a methodological basis for comparative research of party coherence.

Keywords: Factionalism, Party Splits, Coherence Analysis, Measurement Methods, Swiss and U.S. Parties

Introduction: Toward a New Intuition of Party Coherence

Parties are non-unitary entities (Daalder 1983; Laver and Shepsle 1990, 1996; Katz and Mair 1992). They only "behave 'as if' they were unitary actors when they have to, in situations where undisciplined behavior will impose high collective costs" (Mitchell 1999: 281). However, aside from such 'imperative' moments, daily intra-party politics involves internal struggles over policies, strategies, or offices (Daalder 1983; Laver and Schofield 1990; Lewis 2000). Thus, the emergence of factions, wings, and sub-groups is a fact of life in most party organizations (Hine 1982; Harmel et al. 1995), as it is a manifestation of internal diversity (Duverger 1954). In sum, party organizations constitute "collections of individuals or coalitions of sub-party groups with common but also divergent preferences and interests and with competing claims on party resources" (Boucek 2003: 56) rather than monolithic units.

Contrary to the prevalent view that internally fragmented parties are alien to the parliamentary regime type because they send mixed signals to their voters about the policies they pursue, prove to be less effective in parliament, and are doubtful partners in government coalitions (Laver and Shofield 1990; Laver and Shepsle 1996; Bowler et al. 1999; Carey 2007), recent research has shown that factions take up different and positive functions for parties. Boucek (2009) recognizes three forms ('faces') of factionalism – cooperative, competitive, and degenerative – of which only the latter produces exclusively negative effects and outcomes for the party organization (collapses or splits[1]). In contrast, *cooperative factionalism* has a consensus-building function and preserves sub-group identities, particularly in heterogeneous umbrella parties. The aim is internal consolidation and integration to avoid open conflicts that would increase the risk of a break-up. *Competitive factionalism* manages existing intra-party conflicts through diffusion strategies. The factions are opposed to each other, but the party provides for the institutional mechanisms (intra-party democracy, balance of power) to channel internal rivalries. Internal competition can be beneficial since it activates the rank and file and broadens the choice for the electorate. Still, it is a balancing act for a party since, "[w]ithout adequate safeguards, factional competition can become excessive. Hence, to keep factional pressures under control, leaders need to be vigilant to this risk (...)" (Boucek 2009: 476).

[1] With 'party split', we refer both to the formation of a new party and switching to an existing party by a substantial portion of the party members.

Boucek's functional perspective on factionalism followed a criticism by Belloni and Beller (1978) that investigations of the issue had engaged mainly in the development of classification schemes for different types of factions (e.g., by Duverger 1954; Sartori 1976; Janda 1980; Hine 1982) that fail to account for factional dynamics and their consequences for the overarching organization (see also Boucek 2009: 468). On the conceptual level, Boucek's contribution marks an important step forward. However, the study of factionalism (still) suffers from an underdeveloped methodological level that complements the theoretical concepts with empirical measures of party factionalism. To do justice to the advanced state of the theoretical debate, the challenge is to find a measure that not only takes into account the number and size of party sub-groups but also considers the cohesion within and between these sub-groups. This calls for an integrated measure of *party coherence*, which is defined as the "degree of congruence in the attitudes and behavior of party members" (Janda 1980: 118) and composed of two elements: cohesion and factionalism (Janda 1980, 1993).

Single indices such as the effective number of factions (Boucek 2003), derived from the famous effective number of parties developed by Taagepera and Shugart 1989, or widely-used legislative party unity measures such as the Rice index and its modified versions (Rice 1925; Attinà 1990; Hix et al. 2005; Desposato 2005; Carey 2009), which basically measure the extent to which a parliamentary party group votes in unison, regularly fail to capture more than one dimension of the whole picture. Also, alternative analytical methods that visualize intra-party heterogeneity on one or more ideological dimensions and interpret the distances between the estimated ideal points as a measure for ideological dissimilarity (e.g. Poole and Rosenthal 1997; Heckman and Snyder 1997; Clinton et al. 2004; Poole 2005) are of no avail in this context. While all these measures – single indices and spatial approaches – prove to be adequate for the needs of legislative scholars who are interested in the number and size of factions or the extent of party unity and ideological heterogeneity, they are insufficient for research on intra-party factionalism. This is immediately obvious in the case of Boucek's own index of the effective number of factions since this index does not provide any useful information about the dynamics and interactions between the factions (e.g. the three forms of factionalism proposed by Boucek 2009). Party unity indices are problematic, too, mainly because the average unity score does not tell much about the internal factional structure of a party. For instance, a Rice index value of 90.0 might indicate either that the party is highly cohesive and the remaining five percent of the MPs who, on average, vote against the party line is, in itself, a heterogeneous group, or that the dissenting five percent are on the verge of

defection.[2] Moreover, analyses based on legislative votes in parliamentary systems usually overestimate party unity because of peer pressure and disciplinary measures (Bowler et al. 1999; Hazan 2006) and, thus, are generally bad predictors of party splits.[3] All this adds to the puzzling impression that it is not necessarily the heterogeneous parties that suffer from most party splits. Only the visualization of the dispersion of MPs' ideal points in the ideological space may be of some help if we are interested in assessing intra-party sub-group patterns. However, spatial analysis provides information about the ideological distance between MPs (and groups of like-minded MPs), but nothing can be deduced from it regarding cohesion within and between them.

To overcome these longstanding shortcomings of existing measurement techniques and to catch up with recent theoretical contributions in the field, this paper proposes a new *measure of party coherence* based on the integrated concept of cohesion and factionalism developed by Janda (1980, 1993). Our innovative measure adapts the concept of superparamagnetic clustering to the study of party coherence.

The paper proceeds as follows: The next two sections further introduce and operationalize the measure of party coherence based on the superparamagnetic clustering procedure (the mathematical aspects of the clustering algorithm are outlined in the appendix). Afterwards, we will test this novel concept using survey data regarding the political positions of candidates in Switzerland and the United States (which avoids the aforementioned pitfalls of measuring based on legislative votes). In the last section, the paper briefly discusses the results addresses some underexplored aspects and open questions.

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[2] Illustrative is the case of the German Social-democrats (SPD), often regarded as the most disciplined legislative party in the German parliament with Rice index scores of almost 100.0 (Schindler 1999). The SPD still went through a severe internal crisis and eventually suffered a party split at the grassroots level in 2004.

[3] Furthermore, the analysis of legislative votes is affected by data validity problems, especially in comparative settings (Saalfeld 1995; Owens 2006; Carrubba et al. 2006; Carey 2009; Hug 2010).

Physics Meets Politics: Superparamagnetic Clustering as a Measurement of Party Coherence

The paper suggests the adaption of the concept of superparamagnetic clustering (Blatt et al. 1996; Ott et al. 2005) to analyze the internal organization of parties. Superparamagnetic clustering is a nonparametric method suitable for detecting and characterizing group structures in data without imposing a prior bias. The algorithm is inspired by a self-organization phenomenon in magnetic spin systems. The related story from physics is the following: In an inhomogeneous spin system, clusters of correlated (or coherent) spins can emerge, corresponding to groups of spins with strong couplings. Upon an increase in temperature, i.e. an increase in stress on the system, these clusters decay into smaller units in a cascade of (pseudo-)phase transitions. Hence, the physical properties ('coherence') of the spin system are contingent on two factors: stability under stress (the dynamic component of coherence) and diversity of the clusters (the structural component of coherence). A translation of this picture into the world of political science yields the following correspondent: the spin system is the party organization, the single spins are the party members (i.e. their belief systems[4]), the spin couplings reflect the similarity of their belief systems, and the clusters stand for the internal factions (or sub-groups) of a party. At this point, it seems important to recall the purpose of resorting to physics: we use the spin model to introduce a measurement for the coherence of political beliefs. It is an analytical instrument, and, as such, it is intended neither to describe nor to explain the behavioral dynamics of party splits. Our measure claims only that it catches the *state* of the internal coherence of parties in two important dimensions as a prerequisite for a *possible* split.[5]

Coherence, being composed of two numeric values, allows for the identification of four exemplary states of a party (Figure 1): (1) coherence stability and coherence diversity may be low. The members of such a party are only loosely associated and do not form cohesive sub-groups. The party constantly runs a risk of losing individual members as soon as stress increases ('opportunists') but, due to the fragmented internal structure, there is no reason to fear that an organized rebellion of any strong sub-group will cause a major split in the party. (2) If coherence diversity is high and coherence stability is low, the party exhibits a high

[4] In Converse's classical definition, a belief system is a "configuration of ideas and attitudes in which the elements are bound together by some form of constraint or functional interdependence" (1964: 207).

[5] Thus, it is also irrelevant what the exact meaning of the physical temperature in a political context would be.

plurality of sub-groups and lacks a strong and stable core ('plurality zone'). However, the cohesion between the sub-groups seems strong enough, which prevents splits. (3) Low-coherence diversity and high-coherence stability may indicate a party with a high degree of unity. All members are concentrated around a strong core ('unity zone'). (4) For any party, the most disquieting state is the combination of high-coherence diversity and stability. The structure of the members' belief systems makes the party vulnerable to a split, as several strong sub-groups exist that are inherently stable and mutually incohesive ('schism zone').

[Figure 1 here]

Coherence: Exposition of the Measure and Operationalization

Our measure of coherence is based on superparamagnetic clustering (SPC, Blatt et al. 1996) and sequential superparamagnetic clustering (SSC, Ott et al. 2005) – two algorithms whose technical details are outlined in the appendix. Based on these algorithms, we have defined a measure of coherence that captures both the dynamic and the static component of coherence (Christen et al. 2009). The dynamic component of coherence $C_{stability}$ is calculated in the SPC framework. It is evaluated with respect to the disintegration of the largest cluster $\bar{c}$ for increasing temperature T until the system's order completely breaks apart, where T is the parameter that models the stress on the system. This involves the assumption that the largest cluster represents the 'core' of the party that disintegrates under stress.

Let $CS(t)$ be the size of the largest cluster for $T = t$. We assume that $CS(0) = n$, where n stands for the total number of data points (i.e., all the party members); i.e., without stress, all the members are in the same cluster. Upon an increase in stress, $CS(t)$ decreases until $CS(t) = 1$ for some $t = T_{end}$. The average decay curve serves as a measure of coherence stability.

$$C_{stability} = \frac{1}{T_{end}} \int_0^{T_{end}} \frac{CS(t)}{n} dt$$

The measure is normalized to the interval [0,1]. $C_{stability}$ is close to 1 if the largest cluster remains intact for a long time and then disintegrates rapidly for high T, whereas $C_{stability}$ is

close to 0 if the largest cluster disintegrates rapidly and only a small core is stable over a longer interval.

In the actual analysis, *CS(t)* is calculated in $l+1$ discrete steps $t = 0, \Delta T, 2\Delta T, ..., T_{end} = l\Delta T$. For the approximate calculation of the integral, the trapezoidal rule, known from basic calculus, is used.

$$C_{stability} = \sum_{i=0}^{l-1} \frac{CS(i\Delta T) + CS((i+1)\Delta T)}{2nl}$$

Coherence diversity $C_{diversity}$ is calculated using SSC, yielding a binary tree in which the size of each of the k sub-clusters is evaluated. Again, we consider the largest cluster $\bar{c}$ as the 'core' of the system. $C_{diversity}$ is calculated as the sum of the distance of each cluster c_i from the largest cluster in the tree diagram weighted with its size $|c_i|$. The 'tree distance' $\bar{d}_i$ is the number of bifurcation points in the tree between $\bar{c}$ and c_i. Both the maximal tree distance $\bar{d}_{\max}$ and the size of the largest cluster serve as calibration factors, leading to the definition:

$$C_{diversity} = \sum_{i=1}^{k} \frac{\bar{d}_i}{\bar{d}_{\max}} \cdot \frac{|c_i|}{|\bar{c}|}$$

$C_{diversity}$ is not normalized to 1 according to the current definition. Its value is 0 if SSC does not reveal any sub-clusters, and it is close to 0 if only small clusters emerge. However, many large clusters that have a large tree distance from the largest cluster lead to an increase in $C_{diversity}$. Since $C_{diversity}$ is typically far below the maximally possible value, the normalization was skipped to simplify the calculation.

In this way, the measure consisting of the two components $C_{stability}$ and $C_{diversity}$ is able to capture the intuition of coherence outlined in Figure 1. The concept was tested extensively and approved on the basis of toy data (Christen et al. 2009). We now apply the measure using data that approximates the political beliefs of members of Swiss parties.

Application to the Swiss General Elections 2003/07

Data, Context, and Hypothetical Expectations

The following sections focus on the analysis of two recent party splits in Switzerland: In 2004, shortly after the 2003 general elections, center-turned members of the Green Party (GP) seceded and founded the Green-Liberal Party (GLP) as a new political force positioned in the moderate left-to-center region of the political landscape. Similarly, and as a consequence of a regrouping within the bourgeois party camp, moderate members of the increasingly national-conservative Swiss People's Party (SVP) separated in 2008 and formed the Bourgeois-Democratic Party (BDP).

Our data originate from the smartvote project, a Swiss vote advice application (Thurman and Gasser 2009).[6] As a part of the project, all political candidates in the run-up to the Swiss general elections in 2003 and 2007 were invited to take part in a survey of about 70 questions designed to elicit the candidates' political positions on a broad range of issues.[7] The response rate was higher in 2007 than in 2003, which points to the increasing relevance of the project since its launch (see Table 1).[8] The mutual comparison among all candidates of a party both in 2003 and 2007 results in a distance matrix that serves as input for the clustering algorithms.[9]

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[6] Smartvote is a widely used Web-based vote advice application in Switzerland (http://www.smartvote.ch). The system was developed and is operated by the non-partisan, non-profit association Politools in Berne, Switzerland. The project is based on the idea of preference matching; i.e., any smartvote user (voter) may answer the same set of questions as the candidates and then gets a list of candidates that indicates the political distance between the user and the candidates.

[7] The survey comprised 70 questions in 2003 and 73 in 2007. In 2003, the smartvote tool was operational only in the German- and French-speaking parts of the country. It was extended to the Italian-speaking part in 2007.

[8] The use of candidate survey data that are made public in the run-up to elections may raise methodological concerns in two respects: first is data validity since the responses might be endogenous to party affiliations or voter preferences (see, e.g., Griffin 2008), and second is the completeness of the data (coverage of all relevant party sub-groups). While most survey data are prone to such problems, previous research with smartvote data may alleviate at least some of these concerns. E.g., Schwarz et al. (2010) show that, on average, 85% of the answers given by elected MPs in the pre-election survey correspond to their real legislative behavior. Moreover, the main reason that MPs deviate from their pre-election positions is incompatibility with the position of their legislative party group. Thus, endogeneity problems do not seem particularly worrying. Likewise, various inspections of the 2003 and 2007 data have shown that, of the five parties included in our analysis, all relevant sub-groups (party wings) are sufficiently covered.

[Include Table 1]

The smartvote project collects data at the level of individual candidates, which seems appropriate for several reasons: First, Swiss parties are organized along Switzerland's federalistic structure; i.e., they constitute bottom-up organizations on the basis of local and cantonal parties (Ladner 2007) that are solely and exhaustively responsible for the nomination of candidates within their district. This fragmented structure cultivates regional disparities within the parties. Second, the voting system for the National Council follows open-list proportional representation in 20 of the 26 electoral districts (the remaining six are single-member districts that apply a first-past-the-post system). Voters are allowed to split their votes freely between candidates of different party lists; approximately 60% of the ballots cast are modified (Linder 2005). Third, Swiss legislators enjoy a considerable amount of political leeway since the executive-legislative relations follow, to a large extent, the logic of a separation-of-powers system (Hertig 1978; Lanfranchi and Lüthi 1999; Sciarini 2007; Schwarz et al. 2011). This, altogether, promotes the cultivation of personal, party-independent candidate profiles, which, in turn, causes party disunity. For the two "old" parties under scrutiny here, Sciarini (2006: 508) reports for the legislative term 1999-2003 the following Rice Index scores: SVP: 88.0, GP: 95.0.

The aforementioned splits within the two parties should have reduced their coherence diversity and increased their coherence stability. Political observers, however, see a distinct quality in each party split. While the secession of the Green-Liberals can be traced back to marked differences in ideological attitudes at the grass-roots level regarding the role of the

[9] Following the multiple-choice structure of the questionnaire (the answer options are strongly agree, agree, disagree, and strongly disagree), the distance between two candidates X and Y of the same party is calculated as follows: the possible answers are coded with 1 to 4. If both agreed to a question, the resulting value is 0, whereas the maximal value is 3 (strongly agree vs. strongly disagree, |1-4|). (The 2007 survey contained ten questions related to public spending in various policy fields. These questions have only three answer options [more spending, as-is state, less spending]; the maximum distance per question in these cases is 3.) The sum of the absolute values for each question normalized with the number of answered questions is the distance between X and Y (Manhattan distance metric; while several distance metrics have been investigated, the Manhattan distance proved to be the simplest measure that revealed the most stable results).

state in environmental, economic, and welfare issues[10] (Seitz 2008), the SVP-BDP split is regarded as a consequence of widening discrepancies among party elites with respect to questions of political conduct (gentle vs. offensive conservatives) rather than of deep-rooted ideological disagreement (Ladner and Fivaz 2008). Thus, the Green Party split can be characterized as a 'bottom-up' split, while the SVP split is more 'top-down'. The distinct quality of the two party splits leads to the expectation that coherence between the belief systems among the pre-split SVP members is generally higher than that among pre-split GP members. Furthermore, we expect a difference when we restrict the coherence analysis to the elected MPs as representatives of the 'true' party elite. There, we expect greater agreement among the GP elites than among the SVP elites before the splits.

Results of the Coherence Analysis in Switzerland

a) Stability analysis

As most data sets showed, compared to other types of classification problems (Ott et al. 2004), there is no definite structure in terms of clear-cut, distinguishable sub-groups, so a stability analysis was necessary to assess the parameter space spanned by the calibration parameters of the clustering algorithm (these parameters allow for controlling the clustering sensitivity; see the appendix for details). The stability analysis revealed a parameter (*NT_steps*, a number that controls the resolution of the T-axis into steps ΔT) that is suited to characterize the statistical properties of the coherence measure, as a variation led to quasi-stable intervals (with respect to non-zero values of $C_{diversity}$) in the parameter space for each data set. Based on samples of parameter values from these intervals, $C_{stability}$ and $C_{diversity}$ have been calculated for each party, leading to statistics for which the mean and standard deviation are displayed. The variability of $C_{diversity}$ was, in all cases, larger than the variability of $C_{stability}$ (see Figure 3). A direct comparison of all the parties under equal parameter settings for the algorithm is possible for, e.g., *NT_steps* = 220 since this value was located in all the quasi-stable intervals.

[10] The GP stands on the ground of a leftist, trade union-oriented ideology, while the GLP is based on moderate liberalism.

b) Overall party coherence

The coherence analysis (Figure 2) comparing the parties for the 2003 and 2007 elections reveals some interesting developments with regard to the focus cases of the analysis: first, the largest change in terms of coherence stability and coherence diversity can be observed within the GP. In 2003, the party was located around the schism zone but left it for the opportunism zone in 2007, mainly due to a distinct reduction in the diversity dimension of the coherence measure. Second, the candidates of the SVP tended in 2003 toward the plurality zone; i.e., the party was characterized by internally cohesive sub-groups. The number and strength of these sub-groups decreased until 2007. Consequently, the SVP moved into the opportunism zone, quite close to the border area of the unity zone.

In the face of the splits that have occurred within the GP and SVP the results in Figure 2 are not unexpected and will be further scrutinized below with regard to differences between the coherence of the belief systems among all candidates (rank and file) and the coherence within the selection of elected MPs (top elite of the party).

[Figure 2 here]

c) Comparing candidates with elected MPs

In the second step, we compared the $C_{stability}$ and $C_{diversity}$ of the parties with the corresponding values of the elected MPs of each party.[11] In this way, we can investigate the extent to which the coherence of the elected MPs (representing the 'elite' of each party) reflects the coherence in the field of all candidates (representing the rank and file). Figure 3 reveals two distinct patterns. First, in both 2003 and 2007, the SVP elite was closer to the schism zone than the party's rank and file, which confirms the characterization of a 'top-down' split of the party in 2008. In contrast, the coherence analysis of all SVP candidates would not have led to the conclusion that a party split was imminent. Second, the analysis of the Green Party depicts a marked difference from the other parties. The GP elite in 2003 is

[11] For $C_{stability}$, we investigated the values of temperature *T* at which the elected candidates 'left' the main cluster for increasing *T*, leading to a value of $C_{stability}$ for the elected candidates in relation to the decay behavior of all party members. For $C_{diversity}$, we took the binary tree of the whole party as the structure of the tree and determined where in the tree the elected candidates are located, leading to a value of $C_{stability}$ for the elected candidates in relation to the tree structure of the whole party.

clearly located in the unity zone, while the coherence analysis of the party's rank and file signals an imminent party split at the grass-roots level (which, indeed, materialized in 2004). The ideological diversity among party members obviously had no equivalent representation in the party elite. In 2007, after the party split, the situation completely reversed. Now, the party elite (which also increased from 13 MPs in 2003 to 22 in 2007) is much closer to the schism zone, while another 'bottom-up' split coming from the rank and file seems unlikely.

[Figure 3 here]

The differences between the Green Party and the SVP regarding the coherence of all party candidates versus their elites are analyzed in more detail by referring to the tree structures (Figure 4). The aim is to see whether we find additional evidence for the qualitatively distinct party splits of GP and SVP, especially regarding the claim that the GP-GLP split in 2004 was based on deep-rooted ideological differences while the SVP-BDP split in 2008 occurred due to disagreement regarding questions of political conduct among party elites. In 2003, the Green Party (*NT_steps* = 220) displayed five clusters in the SSC paradigm. The largest cluster is represented by 8 elected candidates, and two additional candidates emerge from the cluster with the closest tree distance from the largest cluster.[12] The second-largest cluster, however, not only has the largest tree distance from the main cluster but also contains the elected MP Martin Bäumle, who was the driving force behind the breakup of the Green Party in 2004. The tree analysis, thus, reveals that a significant portion of the party candidates had different opinions than the elite but was represented by only one person at the elite level. This explains the large differences in $C_{stability}$ and $C_{diversity}$ for the party candidates versus the elected candidates in Figure 3.

For the SVP, the situation is different: in 2007, the tree topology is similar to that of the GP but, in quantitative terms, the tree distances between the large clusters are much smaller. Furthermore, all five elected candidates who left the party during the split of 2008 were part of the main cluster; i.e., they did not differ significantly from the ideological core of the party. This indicates that the SVP indeed experienced a different type of party split than the Green Party: While, in the latter case, the defecting elite members showed a distinct belief system, the party split in the former case cannot be explained by incompatible belief systems.

[12] For two elected candidates, no smartvote data were available, so they were excluded from the analysis.

[Figure 4 here]

Application to the U.S. House Elections 2004/10

The following analysis of the U.S. party system concentrates on recent developments within the Republican Party (Rep). Using data from the 'Political Courage Test' (PCT) of Project Vote Smart[13] of the 2004 and 2010 House elections, i.e. four years before and two years after the election of President Obama, the starting point for the Tea Party movement. Other than third-party flare-ups like Ross Perot's movement in the beginning of the 1990s, Tea Partiers are a much more cohesive group (Balz 2010). Moreover, they can be clearly located as part of the conservative wing of the Republican Party, i.e. they rather want to adjust the position of mainstream Republicanism than form a new third party. This is also what Gallup surveys in 2010 found (Jones 2010; Newport 2010). The Gallup pollsters call the Tea Party "more a rebranding of core Republicanism than a new or distinct entity on the American political scene" (Newport 2010: 1). For James (2010) "they are the opposite of the Republicans In Name Only or the RINOs many Tea Partiers revile. They are Republicans Under Another Name (…)."

The aim of the party coherence analysis is to test our new measure and see if the results can be related to the aforementioned appraisals and characterizations of the Tea Party movement – or if we have to draw other conclusions. To do this, we analyze and compare the situation in 2004 and 2010. For the latter we were able to identify Tea Party supporters among the Republican candidates who participated in the PCT survey by comparing the list of PCT participants with the signees of the 'Contract From America'[14] and a list of Tea Party politicians published online[15]. This enables us to conduct separate analyses for all Republican candidates and Tea Partiers only.[16]

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[13] See http://www.votesmart.org/official_five_categories.php?dist=npat.php. The data was delivered by PCT Director Kate McElroy in January 2011. The basic principle of the PCT survey is identical to the Swiss smartvote survey. There are two main differences: First, the PCT survey is much longer, at least in its 2004 version (2004: 197 questions with predefined answer options; 2010: 88 questions). Second, PCT participants do not have to answer all questions, or can be undecided or ambivalent in their answers. Thus, we recoded omitted questions as 'undecided'.

[14] See http://www.contractfromamerica.com/Idea.aspx.

[15] See http://en.wikipedia.org/wiki/List_of_Tea_Party_politicians [accessed March 9, 2011].

[16] In this way we have identified 53 of 146 Republican candidates taking part in the PCT survey in 2010 as Tea Party supporters.

The result of the coherence analysis is shown in Figure 5. For comparative reasons, and partly as validity test, the candidates of the Democratic Party (Dem) are included, too (see Table 2 for the number of candidates included). The analysis confirms that Tea Party supporters among Republican candidates constitute a non-diverse and relatively stable group, i.e. they exhibit high internal coherence. Rather unexpected comes the shift of the Republican Party as a whole (including Tea Partiers in 2010); according to our data, the Republicans encountered a higher risk of internal splitting in 2004, when President George W. Bush was reelected, than in 2010. Conventional wisdom would have been that the new anti-establishment force increased internal diversity. Instead, both coherence stability and diversity have decreased over the six years under scrutiny. The comparison between Tea Party Republicans and non-Tea Party Republicans in 2010 further reveals that only the former come with a stable opinion cluster while the latter are in a similarly heterogeneous state than the overall party ('all Rep').

[Figure 5 here]

[Table 2 here]

One can conclude that the Tea Party movement has contributed to the realignment of the Republican Party, and that this process was largely completed in November 2010 already. This is not surprising if we recall the results of the Gallup polls presented above: first and foremost, the Tea Party constitutes a mere rebranding of core Republicanism. Thus the political ideas of the Tea Party supporters fell on fertile ground in an increasingly disorientated Republican Party, whereas their activists' highly mediatized political style was not everyone's cup of tea.

Discussion and Conclusions

Based on recent progress in the theoretical and case study-based research on party factionalism and the finding that the methodological tools to catch up with the current state of theoretical research are still lacking, we introduced a novel measure of party coherence that expands the classic conceptions of party unity and factionalism on two dimensions and allows additional insights into transitions that affect party structure. This *measure of party coherence* is inspired by a self-organization phenomenon in magnetic spin systems and adapts the

methodological concept of superparamagnetic clustering to political science. Taking the examples of Switzerland between 2003 and 2007, and the United States between 2004 and 2010, the paper conducted a plausibility test of the new measure.

The results of our analyses are encouraging. In the Swiss case the measure showed its analytical potential since we could disentangle distinct types of party splits: 'bottom-up' splits driven by divisions among the rank and file and 'top-down' splits driven by divisions among the party elites.

The measure of party coherence, furthermore, revealed some prediction potentials since the results of our analysis correctly located the rank and file of the Green Party in 2003 as well as the SVP party elites in 2003 and 2007 in the schisma zone of the two-dimensional measure. According to our analysis, another split within the Green Party could be imminent, this time in the form of top-down split because of high values of coherence stability and coherence diversity among the party's elites.

Regarding the U.S. case, the coherence analysis plausibly classifies the Tea Party supporters as cohesive group while they do not constitute a real threat to the unity of the Republican Party as a whole. Quite the contrary, the movement's ideas fell on fertile soil within a disorientated party and advanced internal unity rather than destroying it – at least in terms of their political beliefs, maybe not in terms of political style.

The purpose of the paper was to introduce and apply a new measure of party coherence. It did so by using the data from two broad-based surveys about the issue positions of candidates in the run-up to general elections. The surveys analyzed in each country are not completely equivalent. However, this is not decisive for the coherence analysis, as it is not the survey data itself that is compared over time but the inner coherence of the beliefs that the party members hold relative to each survey. As the surveys for both years capture similar political topics (although sometimes with different questions), it is reasonable to state that a comparison of the coherence values between the years is valid.

Still, the application of the party coherence measure suffers from a number of underexplored aspects. There are two main questions that should be addressed next: First, the effects of different survey response rates. In our analysis we just assumed that the relevant subgroups in

each party are adequately captured by the participating candidates, which could be problematic if we face systematic non-response by any such group. Second, the effect of a great difference in the number of questions, particularly in the U.S. case, where the number of questions in 2010 was less than half the amount of 2004.

And last but not least, the measure is highly demanding with regard to the availability of individual-level data about the political positions of candidates (or party members more broadly). For comparisons of more than just two or three countries, the use of the Comparative Candidate Survey (CCS)[17] could be a viable alternative for the future.

Appendix

Superparamagnetic clustering

The superparamagnetic clustering algorithm (Blatt et al. 1996) SPC was inspired by a self-organization phenomenon in magnetic spin systems: in an inhomogeneous spin system, clusters of correlated spins can emerge, corresponding to groups of spins with strong couplings. Upon an increase in temperature, i.e. an increase in pressure on the system, these clusters decay into smaller units in a cascade of (pseudo-)phase transitions. For data clustering, we map a data set onto a spin system as follows: Each data item is represented by a Potts spin variable s_i with possible values in $\{1,...,q\}$. Each spin is coupled to its k nearest neighbors, where, for given distances $d_{ij} = d_{ji}$ between spins, the couplings are determined according to:

$$J_{ij} = J_{ji} = \frac{1}{k}\exp\left(\frac{-d_{ij}^2}{2a^2}\right)$$

a is the average distance between neighbors. Each spin configuration s is associated with the probability:

$$p(s) = \frac{1}{Z(T)}\exp\left(\frac{-H(s)}{T}\right)$$

with the Hamiltonian $H(s) = \sum J_{ij}(1-\delta_{s_i s_j})$ and the normalization constant $Z(T)$. The parameter T represents the system temperature. At a given T, clusters are detected by means

[17] http://www.comparativecandidates.org

of the pair correlation $G_{ij} = \sum p(s)\delta_{s_i s_j}$, approximately calculated by a Monte Carlo procedure. If $G_{ij} > \Theta$, then s_i and s_j belong to the same cluster. This formalism reveals several parameters that must be defined in a clustering procedure: the number of possible Potts spin values q, the number of nearest neighbors k, and the threshold Θ. The choice of these parameters is too large to extend arbitrarily and does not influence the results substantially if a data set exhibits clear cluster structures (Ott et al. 2005).

Natural clusters, i.e., clusters with strong homogeneous couplings, become manifest in their stability over a substantial range of T. Hence, the T-stability provides a natural measure of cluster coherence. This fact is exploited by the sequential superparamagnetic clustering algorithm SSC (Ott et al. 2005). In this approach, the most stable cluster is extracted and it, as well as the residual set, is reclustered. The procedure is repeated, providing a natural binary tree with a cluster hierarchy.

The couplings between spins and, hence, the clustering results critically depend on the distances d_{ij} between the data points. The choice of the distance function is guided by the type of problem that one wants to solve and usually relies on the methodology of the scientific discipline in which one operates. It need not necessarily fulfill all axioms of a mathematical distance.

Using the framework of SPC and SSC for defining the coherence of belief systems requires in the first step a definition of the data points and their mutual distance. For n data points, the application of the distance measure leads to an $n \times n$ distance matrix that serves as input for the clustering algorithm.

Stability Analysis

The SPC and SCC clustering algorithms have been implemented by us in a platform-independent tool (freeware)[18]. It goes along with a manual that describes the various parameters that can be defined when a specific clustering problem has to be solved. Besides the aforementioned parameters q, k, Θ, there are a couple of tool-dependent parameters that

[18] The SP/SS-tool is freely available on the following Web sites: http://stoop.ini.uzh.ch/research/clustering and http://www.ias.zhaw.ch/de/science/ias/forschung/datenanalyse-statistik/sequential-clustering-software.html.

allow for controlling the clustering resolution or clustering sensitivity in different ways. Generally, for high sensitivity, marginally stable (fluctuative) clusters can be detected and, as a consequence, the number of clusters increases. However, marginally stable clusters are not robust against small changes in the parameters.

For data with no clear inherent structure, a stability analysis, thus, must be performed to identify the robustness of the results for changing parameter conditions. In particular, one has to determine whether the system behaves (quasi)-monotonously with respect to $C_{dynamic}$ and C_{static}. Due to the stochastic nature of the algorithm and the non-linear dependence of $C_{dynamic}$ and C_{static} on the calibration parameters, monotony is not guaranteed. For our data set, an extensive exploration of the parameter space revealed that *NT_steps* is the main parameter that shows a quasi-monotonous behavior; i.e., there is an interval [*a,b*] where $C_{static} = 0$ *NT_steps* < *a* and C_{static} becomes very large for *NT_steps* > *b* as the number of clusters in the binary tree 'explodes'.

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Figure 1. Four ideal types of party coherence (the overlapping clusters indicate that these categories are not strictly defined and quantified)

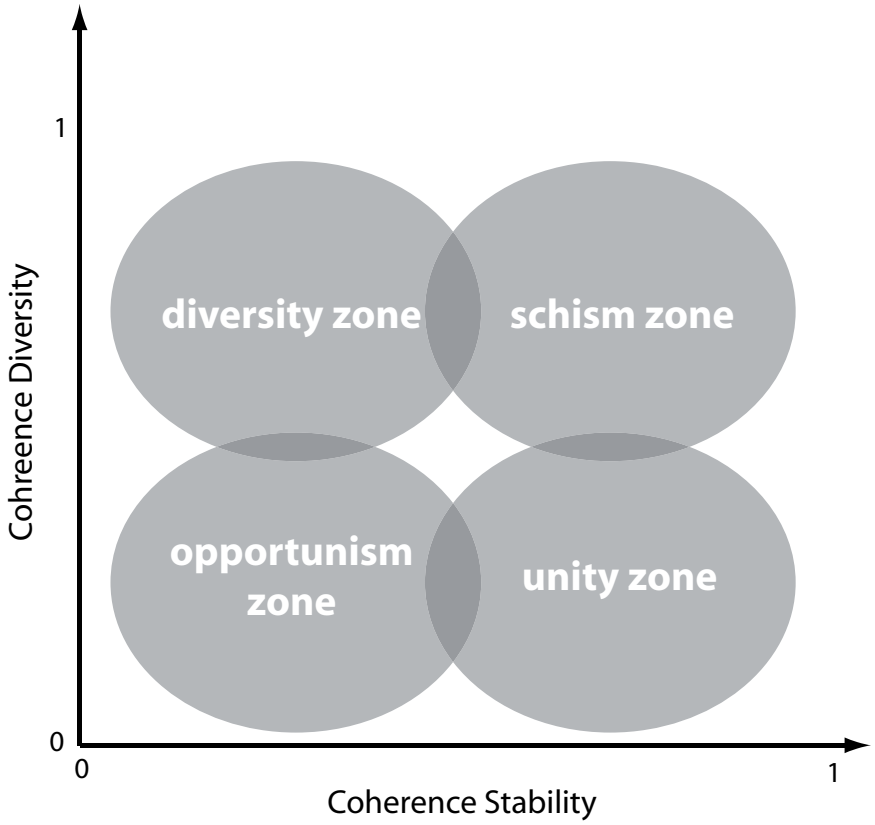

Table 1. Response rate to the smartvote questionnaire by (elected) candidates, 2003 and 2007: Number of candidates/elected MPs for which smartvote data was available, and percentage of total number of candidates/elected MPs

	2003		2007	
	all candidates n (%)	elected candidates n (%)	all candidates n (%)	elected candidates n (%)
GP	140 (51.1)	11 (84.6)	372 (87.3)	21 (95.5)
GLP	-	-	45 (95.7)	4 (100.0)
SVP	184 (46.5)	34 (54.0)	343 (81.7)	57 (82.6)

Figure 2. Coherence analysis for GP (light green) and SVP (dark green) based on the candidates of national elections 2003 and 2007

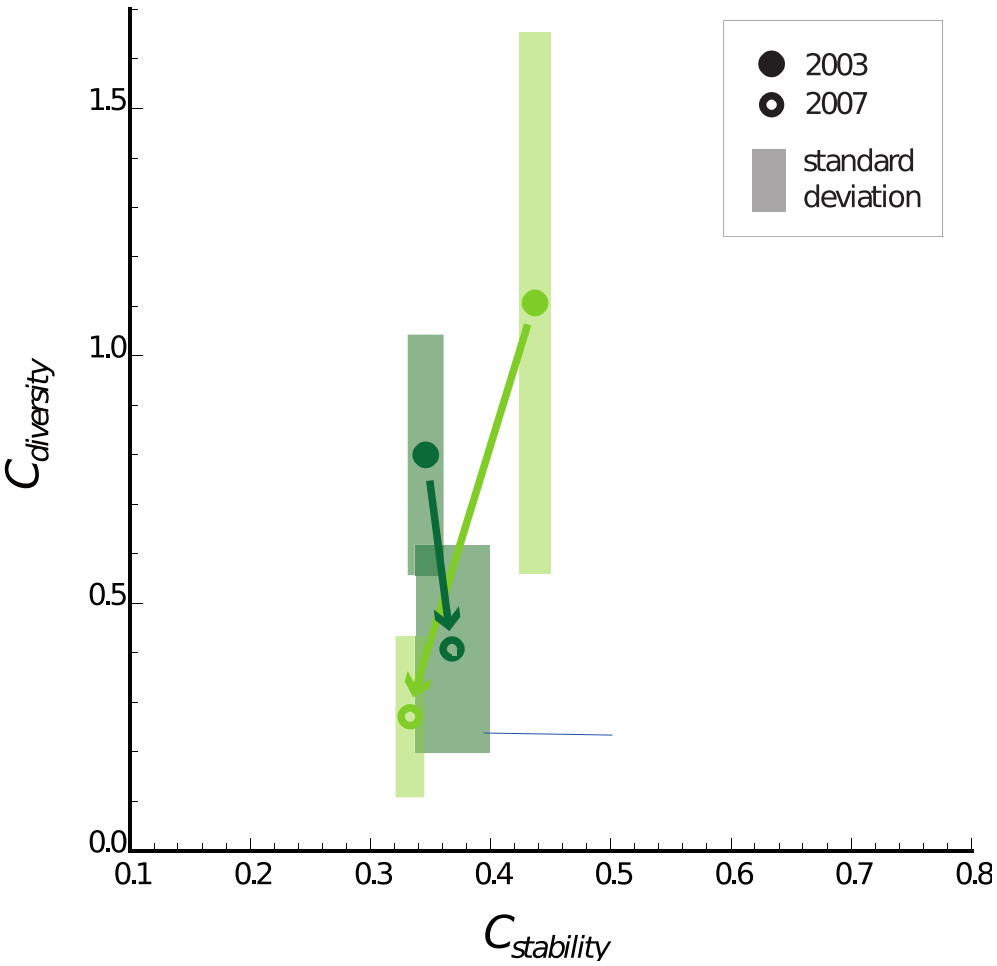

Figure 3. Coherence analysis for GP (light green) / SVP (dark green) candidates and elected MPs

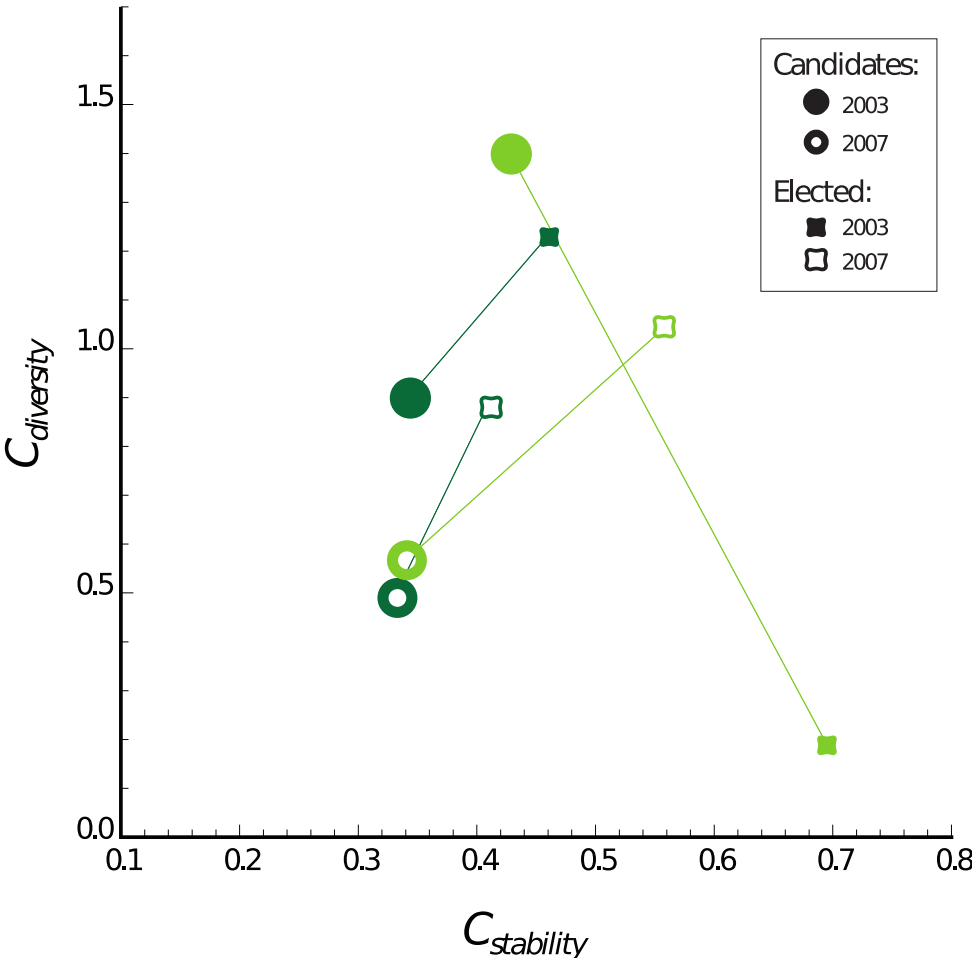

Figure 4. Tree topology for the GP in 2003 and the SVP in 2007 (at NT_steps = 220), indicating the distribution of elected candidates and the location of 'schisma-exponents' (the area of each cluster scales with the number of party members who belong to this cluster)

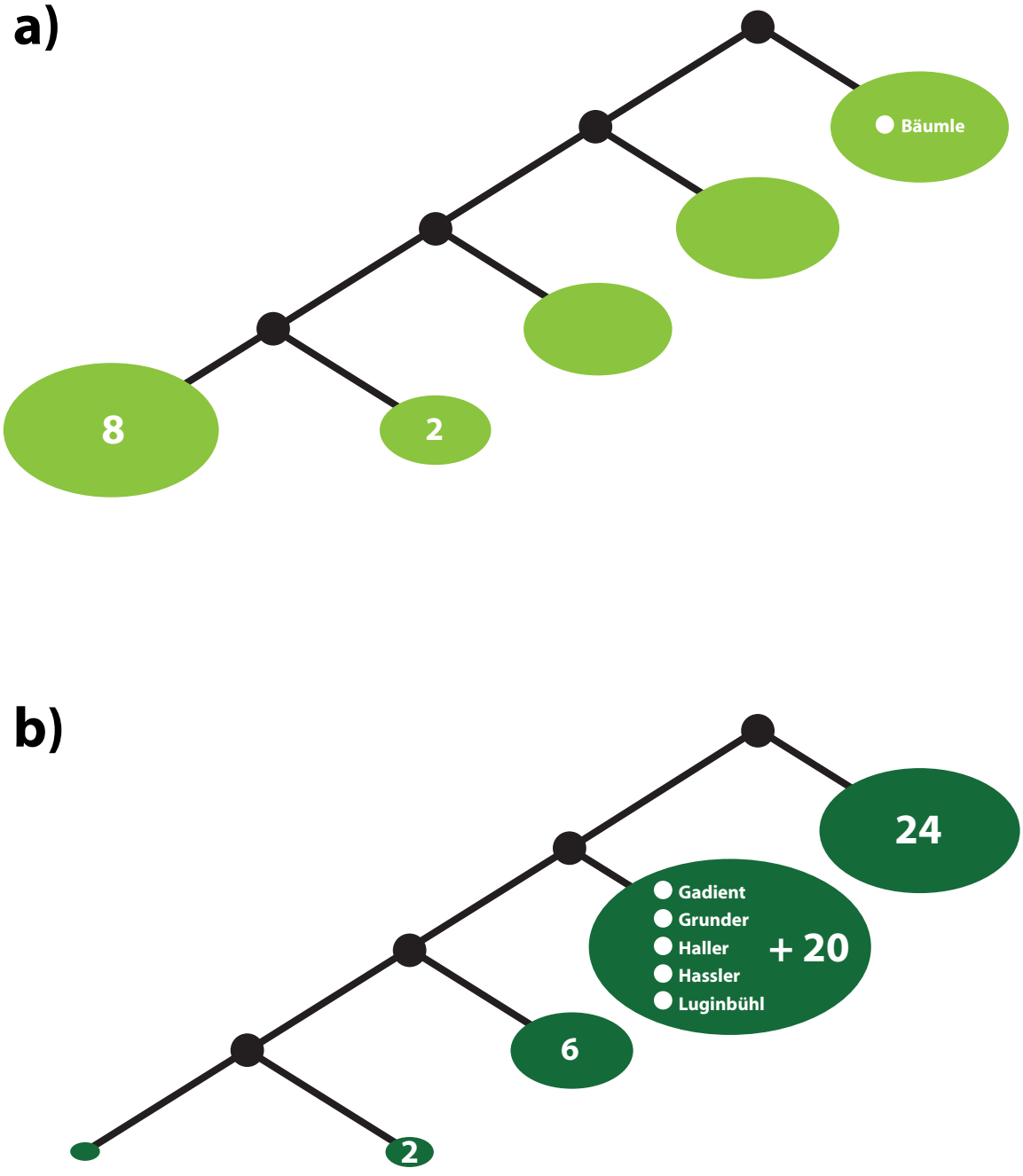

Figure 5. Coherence analysis for Republicans and Democrats based on the candidates of House of Representatives elections 2004 and 2010

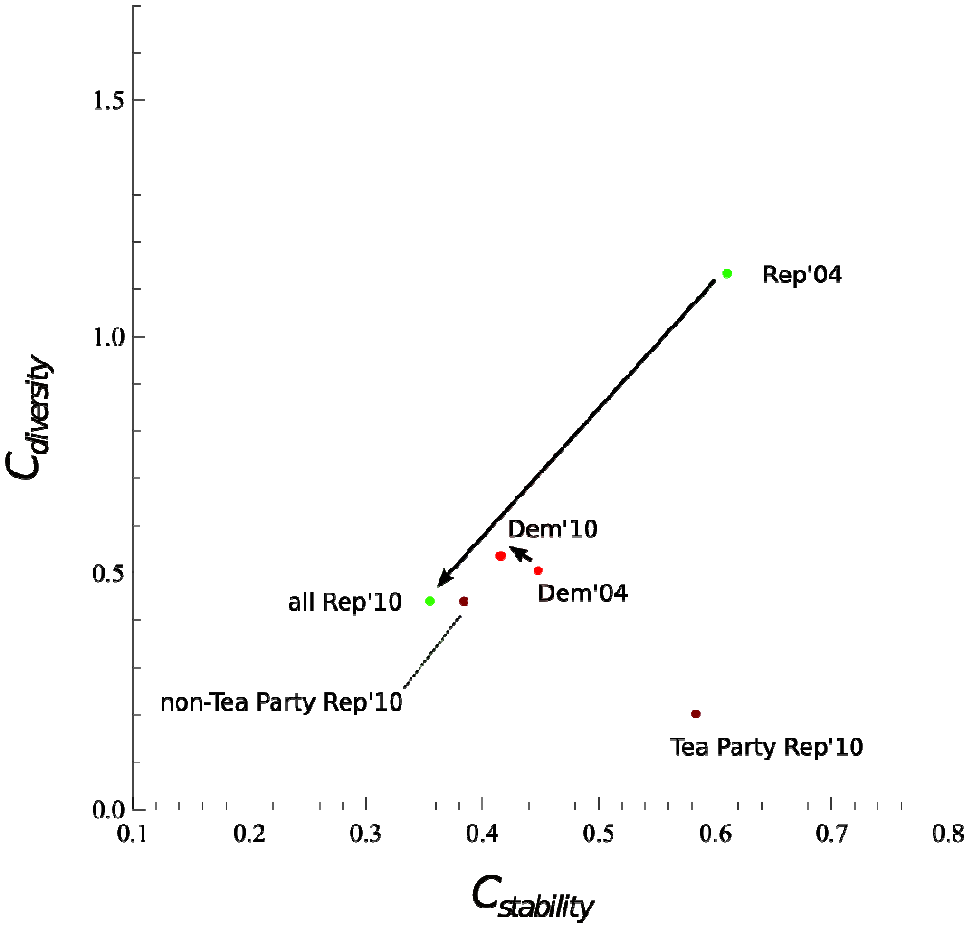

Table 2. Number of candidates participating in the PCT survey 2004 and 2010 (and included in the party coherence analysis)

	2004	2010
all Rep. (incl. Tea Party)	156	146
Tea Party Rep. only	--	53
Dem.	201	144