How many Dimensions underlie Political Attitudes? An Exploratory Graph Analysis Approach

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Abstract

Manifold different constructs have been discussed in the context of political attitudes. However, the multivariate relations between these concepts remain unknown. The present study, therefore, aimed at examining the underlying network and dimensionality of various constructs related to political attitudes.

In an online survey, German individuals ($N = 724$) provided information on socio-demographic variables, voting intentions, and ideological orientation/ideology measures. Moreover, participants filled in questionnaires on Right-Wing Authoritarianism and Social Dominance Orientation as well as on personal values known to relate to political attitudes, and on their attitudes towards refugees. Data-driven bootstrapped Exploratory Graph Analyses were conducted.

Five (scale-level) to seven (item-level) dimensions emerged. The scale-level dimensions were labeled *Self-Enhancement Values*, *Openness to Change Values*, *Social Liberalism vs Conservatism/Traditionalism and Conformity with Authorities*, *Economic Left vs Right Ideological Orientation*, and *Preference for Social Equality/Welfare vs Inequality*.

These findings support a deeper understanding of the complex structure of political attitudes.

Keywords: Political Attitudes, Exploratory Graph Analysis, Voting Intention, Political Ideology, Ideological Attitudes, Values, Attitudes towards Refugees

Introduction

Assessing political attitudes is important in many fields of research. Experts from political science and psychology do it, for example, to examine mechanisms underlying such attitudes. For such investigations and the accurate interpretation of findings across studies, it is important to understand how different concepts related to the broad construct of political attitudes relate to each other. However, literature on political attitudes reveals that many different terms are used and that many different theoretical models as well as various measures are applied to examine political attitudes. In order to gain clarity concerning the relations between different theories, the present study assessed several of the concepts related to political attitudes in one sample and examined their underlying dimensionality. Importantly, the present study focuses on the German context, but results might be applicable to other countries as well. Moreover, the term *political attitudes* is used as an umbrella term subsuming constructs such as voting intentions for a specific party, political orientation/ideology, ideological attitudes, and attitudes towards refugees.

In the following, we will present and explain various theories and concepts, which are related to political attitudes and/or which were used previously to assess political attitudes of individuals. Moreover, we will give an overview on the bivariate relations between them according to theory and empirical findings. Their associations with each other built the rationale to include all of the mentioned constructs in the present analyses.

Voting for Specific Parties

The first concept related to political attitudes we would like to introduce is the intention/decision to vote for a specific party. Jost et al. (2009) describe voting as most obvious consequence of political orientation/ideology (described in more detail in the next paragraph). Thus, to learn about one's political attitudes it seems reasonable to investigate which party a person prefers and/or votes for (or would vote for).

At the time of data collection for the present study, six major party alliances/parties were represented in the *Bundestag*, the German Federal Parliament. These were (ordered on a continuum from politically “left” to “right”): DIE LINKE (The Left), SPD (Social Democratic Party of Germany), Bündnis 90/Die Grünen (Alliance 90/The Greens), FDP (Free Democratic Party), the parliamentary group of CDU/CSU (Christian Democratic Union of Germany/Christian Social Union in Bavaria), and the AfD (Alternative for Germany) (Bundeszentrale für politische Bildung, 2017, 2020d, 2020c, 2020b, 2020a, 2021b, 2021a; Volkens et al., 2020).

Political Orientation/Ideology

Next to voting intentions for a specific party, political orientation/ideology is a concept often applied in order to understand political attitudes. According to Erikson and Tedin, “[...] a person’s ideology is any set of beliefs about the proper order of society and how it can be achieved.” (Erikson & Tedin, 2015, p. 70). Broadly, individuals’ political orientation/ideology is often described as liberal vs conservative or left vs right.

To assess political orientation/ideology on one dimension (liberal vs conservative or left vs right), many authors use one item asking individuals to place themselves with regard to their political attitudes on a scale ranging from politically liberal to conservative or from politically left to right (Caprara et al., 2017; Feldman & Johnston, 2014; Krieger et al., 2019; Sibley et al., 2012). Next to the assessment of political orientation/ideology on one-dimension based on one item, some authors use more items to assess the left-right-orientation of individuals. For example, a scale on the degree of one’s left political orientation/ideology developed by Evans et al. (1996) comprises five items mostly dealing with attitudes towards (in-)equality and exploitation.

Next to the unidimensional structure of political orientation/ideology, many researchers use, prefer, and/or suggest using a two-dimensional conceptualization assessing social and

economic political attitudes, also labeled social and economic dimensions of ideology or social and economic policy preferences (Fatke, 2017; Feldman & Johnston, 2014; Gerber et al., 2010; Jost et al., 2009; Treier & Hillygus, 2009). Oftentimes, the economic dimension of ideology includes attitudes towards income equality vs inequality, private vs government ownership of businesses, the government's role in providing for everyone, or on the government's role in health care and raising taxes on the rich (Fatke, 2017; Gerber et al., 2010; Napier & Jost, 2008). The social dimension of ideology comprises attitudes on homosexuality, divorce, abortion, and civil unions (Fatke, 2017; Gerber et al., 2010; Napier & Jost, 2008).

In sum, political orientation/ideology can be investigated based on one or more items and based on a one-dimensional and a multi-dimensional model. Studies on political orientation/ideology report positive associations between a more right-leaning self-placement on a one-dimensional political orientation/ideology scale and economic conservative political attitudes in samples from various democratic countries (de Vries et al., 2013; Napier & Jost, 2008); effect sizes were in the small to moderate area. The study by Napier and Jost (2008) across 19 countries additionally reports a small positive association between a more right-leaning self-placement and moral intolerance (as the authors call it), which reflects more conservative attitudes on the social dimension of ideology as defined above. Moreover, some studies report positive associations between a more right-leaning self-placement (measured on one dimension) and preferences for more right-leaning German parties (Caprara et al., 2017; Hansen & Olsen, 2019; Krieger et al., 2019).

Ideological Attitudes

Next to one's voting intentions and one's political orientation/ideology, also ideological attitudes have been investigated in order to examine political attitudes in previous works. By ideological attitudes we refer to Right-Wing Authoritarianism (RWA) and Social Dominance

Orientation (SDO), originally introduced by Altemeyer (1981) and Pratto et al. (1994), respectively. RWA can be described based on three dimensions labeled authoritarian aggression, authoritarian submission, and conventionalism (Altemeyer, 1996; Beierlein et al., 2014). SDO deals with the extent to which an individual prefers hierarchy in society over equality (Pratto et al., 1994).

Across various countries including Germany, RWA and SDO seem to be closely positively related to cultural/social and economic dimensions of ideology, respectively; RWA seems to be linked more strongly to the social and SDO more strongly to the economic dimension (Beierlein et al., 2014; Duckitt, 2001; Duckitt et al., 2002; Duriez et al., 2005; Everett, 2013; Feldman & Johnston, 2014; van Hiel et al., 2004). Moreover, both RWA and SDO have been associated with a more right-leaning political orientation/ideology as assessed by an 1-item self-placement (Beierlein et al., 2014; Cohrs et al., 2005; Mirisola et al., 2007), and with voting intentions for the right-wing AfD in Germany (Mayer et al., 2020; Sindermann et al., 2020). Even though associations of RWA and of SDO with other measures assessing political attitudes are often quite similar (in their direction but not necessarily in size), RWA and SDO are distinct constructs (Beierlein et al., 2014; Duckitt, 2001; Duckitt & Sibley, 2010; Mayer et al., 2020; Roccato & Ricolfi, 2005).

The Schwartz Value Theory

At first glance, personal values might not obviously be linked to political attitudes. However, the Schwartz Value Theory (Schwartz, 1992, 2012) has repeatedly been brought into association with political attitudes (see explanations below; Caprara et al., 2017; Schwartz et al., 2010). Already in an early publication of the value theory, Schwartz (1992) explicitly mentioned that one aim of his investigations of personal values was to examine how personal values related to ideologies and attitudes in the political context. He also presented possible associations between each value and political attitudes in this early work. Later on he

reported that personal values serve as anchors for political values, which in turn influence political voting behavior (Schwartz et al., 2010). Therefore, we also take this theory into account in the present work.

More specifically, the theory by Schwartz constitutes ten values. These are labeled self-direction, stimulation, hedonism, achievement, power, security, conformity, tradition, benevolence, and universalism. These values are ordered in a circumplex and spanned upon two dimensions labeled Openness to Change (comprising self-direction, stimulation, hedonism) vs Conservation (comprising security, conformity, tradition) and Self-Enhancement (comprising hedonism, achievement, power) vs Self-Transcendence (comprising benevolence, universalism) according to the theory (Schwartz, 1992, 2012).

As mentioned above: several studies link these values to voting intentions, political orientation/ideology, and ideological attitudes. These studies report associations, i) between voting for more right-leaning parties and security (positively) and universalism (negatively) (Caprara et al., 2009), ii) between a more right-leaning ideological self-placement and the values security, tradition, and the dimensions Conservation vs Openness to Change and Self-Enhancement vs Self-Transcendence (positively) as well as the universalism value (negatively) (Aspelund et al., 2013; Caprara et al., 2017), iii) between higher scores in RWA and the values tradition, conformity, security, power, and achievement (positively) as well as hedonism, stimulation, self-direction, universalism, and benevolence (negatively) (Beierlein et al., 2014; Cohrs et al., 2005), iv) between SDO and the conformity, security, power, achievement (positively) as well as self-direction, universalism, and benevolence (negatively) values (Cohrs et al., 2005).

Attitudes towards Refugees

Finally, also attitudes towards refugees build an interesting construct in light of political attitudes. Although one's attitude towards refugees is only a very narrow attitude and might

not reflect political attitudes in broad, we decided to include it in our analysis. This decision is based on the importance of the topic in Germany, which is underlined by the election programs of all major German parties dealing with this topic (AfD, 2021; Bündnis 90/Die Grünen, 2021; CDU/CSU, 2017; FDP, 2021; Partei DIE LINKE, 2021; SPD, 2021) as well as re-occurring media reports on refugees.

Moreover, various previous studies report associations of attitudes towards refugees with other concepts related to political attitudes. As such, RWA and SDO both have been positively associated with negative attitudes towards refugees and asylum seekers in a recent meta-analysis (Cowling et al., 2019). Also, compared to (putative) voters of other German parties, (prospective) voters of the AfD showed i) low agreement with statements on accepting refugees, ii) negative attitudes towards accepting refugees, iii) high anxiety due to the refugee crisis in Germany, iv) low satisfaction with handling the refugee crisis (Hambauer & Mays, 2018) as well as high fear of the refugee crisis (Dilling, 2018). Moreover, anxiety about the refugee crisis has been positively associated with a more right-leaning ideology in the Netherlands (van Prooijen et al., 2018) and negative attitudes towards refugees have been associated with a more right-leaning ideology in Germany (Igarashi, 2020). Moreover, the universalism value (positively) and the higher-order Conservation dimension (negatively) of the Schwartz Value Theory have been found to associate to attitudes towards refugees (Eisentraut, 2019).

Aims of the Present Study

The present study aims at investigating the multivariate relations between, and the underlying dimensionality of, concepts related to political attitudes presented above. Several of the constructs under investigation in this study have been associated with each other before. However, effect sizes of associations differ between studies. Moreover, to the best of our

knowledge, no previous study has investigated all of them and their underlying dimensionality in one sample. Thus, the present work is the first work on this topic.

While we acknowledge the different theoretical backgrounds (e.g., attitudes vs values), we aim for a more in-depth understanding of whether and to what extent individual scores in the different constructs are associated. As a simplified overview, the following scores should align with a more left-leaning attitude: voting for DIE LINKE, Bündnis 90/Die Grünen, the SPD, low scores in an 1-item left-right self-placement, low scores in an 1-item liberal-conservative self-placement, high scores in a scale assessing left-leaning orientations, low scores in social and an economic conservatism, low scores in RWA and SDO, low scores in Conservation (security, conformity, tradition) and Self-Enhancement (achievement, power) values, high scores in Openness to Change (self-direction, stimulation) and Self-Transcendence (benevolence, universalism) values, and a positive attitude towards refugees. The opposite scores and voting for the FDP, CDU/CSU, and the AfD should be positively related to a more right-leaning political orientation/ideology.

However, we want to clearly state that the present investigation of the underlying dimensionality, including the number of underlying dimensions, is exploratory.¹ In fact, we decided to use the fully data-driven approach called (bootstrapped) Exploratory Graph Analysis (EGA). This procedure allows not only examination of a network model on associations between many variables. Besides, it allows to estimate the underlying dimensionality. Moreover and compared to more traditional methods (e.g., principal component analysis, PCA), EGA has several advantages: Firstly, the visualization of results in a network makes results easy to interpret (Bringmann & Eronen, 2018; Golino et al., 2020). Secondly, EGA is fully data-driven (in PCA, for example, a rotation method must be set by the researchers (Christensen & Golino, 2021; Golino et al., 2020)). Thirdly, EGA only implements one step rather than a two-step approach in order to examine dimensionality (in

PCAs, for example, the number of components is investigated first and the loadings of each variable on each component afterwards). The latter two advantages of EGA minimize the researchers' degrees of freedom in the analysis (Golino et al., 2020). Finally, EGA has been found to be as accurate or even more accurate than other more traditional methods (Golino et al., 2020).

Methods

Procedure

The present work including sample size estimation, its exploratory nature, procedure, and statistical analyses was preregistered at the Open Science Framework (OSF:

<https://osf.io/qdwe9>) and data is available at the OSF, as well (<https://osf.io/36nju/>).

Individuals were asked to participate in a cross-sectional online survey; the possibility to participate in a longitudinal investigation was given but longitudinal data are not of interest for the present work. Other research questions aside from the present one will also be investigated using data from this larger project; see other preregistrations presented under the same project (<https://osf.io/dr2pq/>). The online survey was advertised via various offline and online channels. Everyone with access to the Internet could participate provided that he/she was at least 18 years old, was eligible to vote in the general German elections in 2021, and gave informed electronic consent prior to participation. The study was approved by the local ethics committee of Ulm University, Ulm, Germany.

Sample

A total of $N = 795$ individuals participated in the survey. Of these participants, data of $n = 14$ individuals were excluded because they were not eligible to vote in the general German elections in 2021 (assessed by a self-report item on the second page of the survey). Because this was an exclusion criterion for participation in the present project, these participants were

not shown further measures and were directly sent to the end of the study. Another $n = 3$ individuals were excluded from analysis due to indicating an age below 18 years. No participant was excluded due to missing data but $n = 51$ were excluded from final analysis due to choosing the wrong response option to an attention check item (this exclusion criterion was not preregistered but deemed important). Furthermore, $n = 3$ individuals were excluded due to choosing the same response option in all items of the SDO scale, the Portraits Value Questionnaire (PVQ), and/or the Socio-Political Attitudes scale (see Supplementary Material III). This led to a final sample size of $N = 724$ individuals ($n = 469$ male, $n = 251$ female, $n = 4$ third gender) with a mean age of 27.08 years ($SD = 10.55$ years; Median = 23 years; range: 18-79 years). Most participants stated “Abitur” (A-level/high school diploma; $n = 317$), “(Fach-)Hochschulabschluss” (university (including a university of applied sciences) degree; $n = 230$), or “Mittlere Reife” (secondary school leaving certificate; $n = 116$) as their highest educational degree. Others stated no ($n = 2$), “Volks-/Hauptschulabschluss” (lower secondary school leaving certificate; $n = 9$) or “Fachabitur” (vocational baccalaureate diploma; $n = 50$) as highest educational degree.

Measures

The questionnaires used for the analyses presented in the main manuscript were presented in randomized order.

In the following, Cronbach’s α ’s and mean inter-item correlations are presented for scales with three or more items. For scales with two items, only inter-item correlations are presented.

Voting Intentions for Specific Parties

We asked participants which party they would vote for if general German elections would be next Sunday. Response options were DIE LINKE, SPD, Bündnis 90/Die Grünen, FDP, CDU/CSU, AfD (ordered from politically left to right according to Volkens et al. (2020)),

“Eine andere Partei” (“another party”/“others”), and “Ich würde nicht zur Wahl gehen” (“I would not vote”). We also assessed party affiliation. However, since $n = 200$ participants indicated to not feel affiliated to any party, we excluded this item from further analyses to not lose that many participants.

Political Orientation/Ideology

We applied various measures assessing political orientation/ideology. Among others, participants were asked to place themselves on an 1-item 10-point rating scale from 1 = “left” to 10 = “right” with regard to their political views (Breyer, 2015).

The left-right self-placement item was re-formulated to the liberal vs conservative context and additionally presented to participants. Thus, the participants’ self-placement on a liberal-conservative dimension was assessed on a 10-point rating scale on a separate page. Higher values indicate more conservative attitudes.

Moreover, the 5-item left-right scale by Evans et al. (1996) was translated into German language by a forward- and backward translation procedure and subsequent discussions and adjustments if necessary by two bilingual speakers. The items were presented in randomized order and responded to on a 5-point rating scale ranging from 1 = “do not agree at all”, to 5 = “do agree completely”. Originally, higher scores on each item indicate a more left-leaning political orientation/ideology. We recoded responses to the five items in order to apply lower values to a more left-leaning political orientation/ideology. Cronbach’s α of this scale was .78; the mean inter-item correlation was $\rho = .41$.

Next, two bilingual speakers translated the items as used in Fatke (2017) to assess social and political dimensions of ideology by a forward- and backward translation procedure and subsequent discussions and adjustments if necessary. The items on the social dimension comprised items on the justifiability of homosexuality, abortion, and divorce, which were answered on a 10-point rating scale from 1 = “never justifiable” to 10 = “always justifiable”

and presented in randomized order. The responses to these items were reverse-coded in order to apply higher values to more conservative social attitudes. Cronbach's α for the three items was .82 and the mean inter-item correlation was $\rho = .48$. The items on the economic dimension of ideology asked participants about their attitude on incomes with response options ranging from 1 = "incomes should be made more equal" to 10 = "we need larger income differences as incentives for individual effort" and on their attitude toward ownership of business and industries with responses ranging from 1 = "private ownership of business and industry should be increased" to 10 = "government ownership of business and industry should be increased" (this item was reverse-coded; higher scores indicated more conservative economic attitudes). The items were presented in randomized order and the inter-item correlation of the two items was $\rho = .37$.

Ideological Attitudes

RWA was assessed by applying the 9-item Short Scale on Authoritarianism (KSA-3; abbreviation based on German name) by Beierlein et al. (2014). Items were responded to on a 5-point rating scale ranging from 1 = "strongly disagree" to 5 = "strongly agree". Higher scores on each item indicate higher RWA. Internal consistency estimates (Cronbach's α 's) / mean inter-item correlations were $\alpha = .80$ / $\rho = .31$ for the total scale.

The 16-item SDO scale originally published by Pratto et al. (1994) was used to assess SDO. More specifically, a German version (Six, Wolfradt, & Zick (2001) as cited in Mortal (2011)) was revised to more closely align with the original English version of the scale (see also Sindermann et al. (2021)). Items were answered on a 7-point rating scale ranging from 1 = "very negative" to 7 = "very positive". Of the 16 items, the last eight items were reverse-coded in order to make sure that higher scores in each item represent higher SDO. Cronbach's α was .89 and the mean inter-item correlation was $\rho = .37$.

Schwartz Value Theory

The ten values according to Schwartz (1992, 2012) were assessed by means of the German version of the 21-item Portraits Value Questionnaire (PVQ) used in the European Social Survey and as published in Schmidt et al. (2007). The items were presented in randomized order and were answered on a 6-point rating scale ranging from 1 = “not like me at all” to 6 = “very much like me”. Higher scores on each item correspond to higher scores in the respective value. The scores of all values were calculated based on two items, except the universalism score, which comprised three items ($\alpha = .51$). Inter-item correlations ranged from .23 (self-direction, universalism) to .61 (stimulation); except for the scale on benevolence, which showed an inter-item correlation of $\rho = -.07$.

Attitudes towards Refugees

Attitudes towards refugees were assessed by asking five questions derived from the Socio-Economic Panel items (The German Socio-Economic Panel at DIW Berlin, 2019).

Specifically, on an 11-point rating scale, participants had to indicate in how far they thought that refugees coming to Germany i) is overall bad or good for the economy, ii) undermines vs enriches cultural life, iii) makes Germany a worse or a better place, iv) shortly bears more risks or chances, v) bears more risks or chances in the long run. Responses to all items were reverse-coded in order to apply higher values to more negative attitudes towards refugees in line with the previous coding of items where higher scores indicate either more right and more conservative political attitudes or lower left and lower liberal political attitudes.

Cronbach's α was .89 and the inter-item correlation was $\rho = .60$.

Statistical Analyses

Statistical analyses were implemented in the R software version 1.4.106 (R Core Team, 2018) and RStudio software version 4.1.0 (RStudio Team, 2020). The packages readxl (Wickham & Bryan, 2019), dplyr (Wickham et al., 2021), psych (Revelle, 2021), careless (Yentes & Wilhelm, 2021), Hmisc (Harrell & with contributions from Charles Dupont and

many others, 2021), performance (Lüdecke et al., 2021) as well as EGAnet (Golino & Christensen, 2021) and qgraph (Epskamp et al., 2012) were used for data cleaning and analyses.

First, descriptive statistics of all variables of interest on scale-, subscale- (if available), and item-level were calculated; see Supplementary Material I. Next, zero-order Spearman correlations were implemented to examine bivariate relations between all main study variables on scale- and subscale-level; see Supplementary Material I.

Finally, Exploratory Graph Analyses (EGA) were conducted to extract the network and underlying dimensionality of the variables on scale-level (voting intention item, 1-item left-right self-placement, 1-item liberal-conservative self-placement, left-right scale, social dimension of ideology, economic dimension of ideology, KSA-3 total, SDO scale, each value scale, attitudes towards refugees scale) and on item-level (including the items of all aforementioned scales).²

EGA is a network psychometrics approach that combines the network analytic approach with subsequent community/cluster detection (here called “dimensions”). To estimate the network, relations between observed variables are estimated based on the Gaussian Graphical Model (GGM), which models the network through the inverse covariance matrix (Golino & Christensen, 2021; Golino & Epskamp, 2017). Thus, each part of this matrix becomes a connection, i.e., an edge, in the network between two variables, i.e., nodes, if the variables have a pairwise connection. In the end, the edges can be interpreted as partial correlation coefficients (when standardized) between two nodes after conditioning on all other variables (Golino & Epskamp, 2017). In order to prevent overfitting of the network model and spurious correlations due to the specific sample under investigation, we further used a penalized maximum likelihood estimation, specifically the *graphical least absolute shrinkage and selection operator* (GLASSO) method (Christensen & Golino, 2021; Golino &

Christensen, 2021; Golino & Epskamp, 2017). This method estimates small connections to be zero in order to represent independence and increase interpretability of the network. The exact tuning parameter is set based on the aim to minimize the extended Bayesian information criterion (Golino & Christensen, 2021). For community/cluster detection, the Louvain walktrap algorithm was used. This algorithm is based on modularity optimization, hence, the aim to optimize the density of relations within a community versus between communities (Blondel et al., 2008). Moreover, it is important to note that the algorithm is a multi-level modularity optimization algorithm and follows a hierarchical approach. In more detail, the algorithm iteratively repeats two phases: 1. Different communities are applied to each node in the network; the gain in modularity achieved by putting each node to another community is estimated for each node; the node is put to the community for which this gain is maximum and positive; this process is repeated for all nodes until no single move can improve the modularity anymore. 2. A new network is built in which the previously detected communities are the nodes. The first phase is then applied to this new network and reiterated (Blondel et al., 2008).

Based on these specifications, we firstly ran EGA on the original sample. Afterwards, we ran the same analyses across 1,000 bootstrapped samples (on scale-level: resampling/non-parametric; on item-level: parametric resampling).³ We report the following results from these analyses: 1. Network and dimension statistics from EGA in the original sample, 2. network and dimension statistics from EGA across bootstrapped samples. Moreover, detailed results on the following calculations are presented in Supplementary Material II: 1. The stability of each variable in the dimension it belonged to according to EGA on the original sample across analyses in bootstrapped samples (i.e., how often across bootstrapped samples the variable belonged to the same dimension it belonged to in the original data EGA; e.g. when a variable was found to belong to dimension X in the initial EGA on the original

sample – in how many of the bootstrapped analyses did it belong to this same dimension (in %), as well?) 2. repetitions of variables in different dimensions when implementing bootstrapping (i.e., how often across bootstrapped samples the variable belonged to each dimension), 3. variable loadings on dimensions when implementing bootstrapping.

Importantly, the analyses mentioned above were performed for i) the sample of individuals who indicated to vote for a specific party (thus, did not indicate to not vote or to vote for “another” party; $n = 604$) including all previously mentioned variables on scale- and item-level, ii) the total sample ($N = 724$) including all previously mentioned variables except the voting intention item on scale- as well as on item-level.⁴ Of note, before running item-level EGA, we also implemented redundancy analyses to identify redundant items. However, we decided to include all original items in the EGA to show the underlying dimensionality of all items – as indicated by the aim of the present study.

Results including the socio-political attitudes scales are presented in Supplementary Material III.

Results

Exploratory Graph Analysis on Scale-Level

Examining the dimensionality of all variables including the voting intention item ($N = 604$) on scale-level

Five dimensions underlying all scale-level variables were observed in EGA on the original sample. During bootstrapping three to six dimensions emerged, but most of the times (73.2%) five dimensions were extracted. As can be seen in Figure 1, in both EGA on the original sample and EGA across bootstrapped samples the following variables built one dimension: i) voting intention item, 1-item left-right self-placement, left-right scale, economic dimension of ideology; ii) PVQ achievement, PVQ power; iii) PVQ stimulation, PVQ hedonism, PVQ

self-direction; iv) SDO scale, PVQ universalism, PVQ benevolence, and the attitude towards refugees scale (whereby there is a strong negative relation between the SDO scale and PVQ universalism); v) 1-item liberal-conservative self-placement, social dimension of ideology, KSA-3, PVQ security, PVQ conformity, PVQ tradition.

Stability of all variables on their original dimension was .64 (attitude towards refugees scale) or higher across analyses on bootstrapped samples. Thus, each variable belonged to the same dimension as it did according to EGA in the original sample in at least 64% of bootstrapped samples EGA.

[insert Figure 1 about here]

Examining the dimensionality of all variables except the voting intention item (N = 724) on scale-level

Six underlying dimensions emerged in EGA in the original sample. Across bootstrapped samples, three to six dimensions emerged, but five dimensions emerged more often than other numbers of dimensions (49.3%). Figure 2 shows several differences in the EGA results on the original sample and across bootstrapped samples. While the following dimensions were similar across the analyses: i) PVQ stimulation, PVQ hedonism, PVQ self-direction, ii) PVQ achievement, PVQ power, the other dimensions differed. While the 1-item liberal-conservative self-placement, the social dimension of ideology, and PVQ tradition belonged to the dimension including the 1-item left-right self-placement and the attitudes towards refugees scale in the analysis basing on the original sample, the three items built one dimension with the KSA-3, PVQ security, and PVQ conformity scales in results derived across bootstrapped samples. While in EGA in the original sample, the left-right scale and the economic dimension of ideology built one dimension on their own, they built one dimension

with the 1-item left-right self-placement according to analyses across bootstrapped samples. The attitudes towards refugees scale belonged to the dimension including the 1-item left-right self-placement, the 1-item liberal-conservative self-placement, the social dimension of ideology and the PVQ scale tradition according to analyses on the original sample (see explanation above) but to the dimension comprising the SDO scale, PVQ universalism, PVQ benevolence according to analyses across bootstrapped samples.

Stability of all variables on their original dimension was .41 (attitude towards refugees scale), .43 (1-item left-right self-placement, PVQ conformity and security, and KSA-3 total) or higher. Thus, each variable belonged to the same dimension as it did according to EGA in the original sample in at least 41% of bootstrapped samples EGA.

[insert Figure 2 about here]

Exploratory Graph Analysis on Item-Level

Redundancy Analysis

Results of redundancy analyses (i.e., weighted topological overlap) of items are presented in Figure 3. As can be seen from the plots, in both analyses in- and excluding the voting intention item ($N = 604$ vs $N = 724$), similar items were redundant. A more elaborate description of redundancies including a description of the content of each item can be found in Supplementary Material II. Despite the redundancies we decided to calculate further EGA including all (raw) items.

[insert Figure 3 about here]

Examining the dimensionality of all variables including the voting intention item (N = 604) on item-level

When examining the dimensionality on item-level including the voting intention item, seven dimensions emerged in EGA on the original sample. During bootstrapping six to ten dimensions were observed, but seven dimensions emerged most of the time (59.4%). As can be seen in Figure 4, the results of EGA on the original sample and across bootstrapped samples are quite similar: i) the voting intention item, the 1-item left-right self-placement, the five items of the left-right scale, the two items of the economic dimension of ideology (on income and property), and SDO item 15 built one dimension; ii) all SDO items except SDO item 15 plus PVQ items 03 and 19 (of the universalism scale) built another dimension; iii) PVQ items 02, 04, 13, and 17 (of the scales power and achievement) and PVQ item 09 (tradition scale) built one dimension, iv) KSA-3 items 01, 02, 03, 04, 05, 06 (subscales authoritarian aggression and authoritarian submission), and PVQ items 05, 07, 14, and 16 (security and conformity scales) belonged to another dimension; v) the 1-item liberal-conservative self-placement, the three items on the social dimension of ideology (abortion, divorce, homosexuality), KSA-3 items 07, 08, 09 (subscale conventionalism), and PVQ item 20 (tradition scale) belonged to one dimension; vi) PVQ items 01, 06, 08, 10, 11, 12, 15, 18, and 21 (self-direction, stimulation, universalism, hedonism, benevolence) were one dimension; vii) the five items on one's attitudes towards refugees built one dimension on their own.

Stability of all variables on their original dimension was .58 (PVQ item 09) or higher. Thus, each variable belonged to the same dimension as it did according to EGA in the original sample in at least 58% of bootstrapped samples EGA.

[insert Figure 4 about here]

Examining the dimensionality of all variables except the voting intention item (N = 724) on item-level

When examining the dimensionality on item-level excluding the voting intention item, seven dimensions emerged in EGA on the original sample. During bootstrapping six to nine dimensions emerged. However, seven dimensions emerged most of the time (70.6%). Figure 5 shows the networks and dimensions. As can be seen in this figure, the following dimensions were found in analyses in the original and across the bootstrapped samples: i) the 1-item left-right self-placement, the five items of the left-right scale, the two items of the economic dimension of ideology (income, property) and SDO item 15; ii) all SDO items except item 15 plus PVQ item 03 (universalism scale) (and PVQ item 19 (universalism scale) in EGA across bootstrapped samples); iii) KSA-3 items 01 to 06 (subscales authoritarian aggression and authoritarian submission) and PVQ items 05, 07, 14, and 16 (security and conformity scales); iv) PVQ items 02, 04, 13, 17 (power and achievement scales) and item 09 (tradition scale); v) the 1-item liberal-conservative self-placement, the three items on the social dimension of ideology (abortion, divorce, homosexuality), KSA-3 items 07 to 09 (subscale conventionalism), and PVQ item 20 (tradition scale); vi) PVQ items 01, 06, 08, 10, 11, 12, 15, 18, 21 (self-direction (01, 11), stimulation (06, 15), universalism (08), hedonism (10, 21), benevolence (12, 18); and item 19 (universalism) based on EGA on the original sample, which belonged to dimension ii) in analyses across bootstrapped samples); vii) the five items on attitudes towards refugees.

Stability of all variables on their original dimension was .26 (PVQ item 19), .52 (1-item left-right self-placement) or higher. Thus, each variable belonged to the same dimension as it did according to EGA in the original sample in at least 26% of bootstrapped samples EGA.

[insert Figure 5 about here]

Discussion

The aim of the present study was to examine the multivariate associations and underlying dimensionality of various concepts related to political attitudes. Therefore, we assessed voting intentions, single-item and multi-item as well as one-dimensional and two-dimensional measures of political orientation/ideology, the ideological attitudes RWA and SDO, the ten values according to the Schwartz Value Theory, and attitudes towards refugees. When discussing results, we will focus on the results reported in the main manuscript and on the results which were replicated across analyses including different variables (with vs without the voting intention item). In case of discrepancies between EGA results in the original and across bootstrapped samples, we will focus on the bootstrapped results.

In summary, we found some similar dimensions across analyses on scale- and on item-level. For example, we observed one dimension only comprising scales/items of *Self-Enhancement* (achievement, power values). Thus, this dimension perfectly reflects the higher-order dimension of Self-Enhancement according to the Theory by Schwartz (1992, 2012). Moreover, we observed a dimension which might be called *Economic Left vs Right Ideological Orientation* comprising scales/items on one's voting intention, the 1-item left-right self-placement, the left-right scale, and the economic dimension of ideology (and SDO item 15 on item-level). This is, therefore, a dimension comprising one-dimensional left-right measures alongside the economic dimension of ideology, which is based on a two-dimensional model of political orientation/ideology (Fatke, 2017; Feldman & Johnston, 2014; Gerber et al., 2010; Jost et al., 2009).

Next to these two dimensions, we observed a dimension comprising scales subsumed under the higher order value *Openness to Change* (stimulation, hedonism, self-direction) according to Schwartz (1992, 2012) on scale-level. On item-level one universalism item and the two benevolence items additionally belonged to this dimension. The item-level dimensions might therefore be called *Striving for Individual and Group Growth*. Moreover, a dimension which might be labeled *Social Liberalism vs Conservatism/Traditionalism and Conformity with Authorities* on scale-level was split into two dimensions, which might be labeled *Social Liberalism vs Conservatism/Traditionalism* and *Conformity with Authorities*, on item-level. The first of these item-level dimensions, *Social Liberalism vs Conservatism/Traditionalism*, comprised the following items: 1-item liberal-conservative self-placement, the three items on the social dimension of ideology (abortion, divorce, homosexuality), the three RWA items of the conventionalism subscale, and PVQ item 20 (tradition value). The second of the two item-level dimensions, *Authoritarian Conformity*, included items on RWA authoritarian aggression and authoritarian submission as well as items of the security and conformity values. Finally, a dimension which might be called *Preference for Social Equality/Welfare vs Inequality* was found on scale-level and split into an *SDO* dimension, an *Attitudes towards Refugees* dimension, and another dimension which comprised Self-Transcendence values (universalism, benevolence) and Openness to Change values (self-direction, hedonism, stimulation); see description on the dimension *Striving for Individual and Group Growth* above. A summary of dimensions observed in the present work across analyses is also presented in Figure 6.

[insert Figure 6 about here]

With regard to unidimensional measures of political orientation/ideology (1-item left-right self-placement, 1-item liberal-conservative self-placement, left-right scale), it is interesting that the liberal vs conservative measure did not belong to the same dimension as did the other two measures: neither according to scale- nor item-level EGA. This indicates that – at least in German samples – participants do not understand the same when asked to place themselves on a left vs right scale and when asked to place themselves on a liberal vs conservative scale with regard to their political attitudes. This might also be explained by the fact that liberal and conservative are terms often applied in the US and the UK context, whereas left and right are more common in other/European contexts (Caprara et al., 2017; Feldman & Johnston, 2014). However, contrary to the finding of the two items belonging to different dimensions, it must be acknowledged that the two 1-item self-placement measures had a high topological overlap according to redundancy analysis. Moreover, according to bivariate correlational analyses, the association between the two items was $\rho = .56$ (see Supplementary Material I). Taking all the findings on relations between the two 1-item self-placements together indicates, in our opinion, that the two items partly overlap ($0.56 \times 0.56 = 0.31$) but do not assess the same underlying construct. Moreover, it is important to note that previous literature sometimes uses the terms liberal and left and conservative and right interchangeably (Carney et al., 2008; Jost et al., 2009; Krieger et al., 2019). We acknowledge that, from a theoretical point of view, the associations between liberal and left attitudes might be highly positive and that the link between conservative and right attitudes might be highly positive, as well (Jost et al., 2008, 2009). However, the present findings indicate that individuals do not share the exact same understanding of left and liberal and of right and conservative; at least as long as no further description is provided.

Moreover, it must be mentioned that both one-item measures need to be used with caution anyway: studies conducted in Germany and Great Britain by Bauer and colleagues

(2017) and Evans et al. (1996) show that there are inter-individual differences in what individuals associate with left and with right, illustrating an issue with the validity of the 1-item left-right measure. The same issue will most likely be applicable to the 1-item liberal-conservative self-placement. However, given the present results and the fact that both 1-item self-placement measures lay on dimensions with other measures assessing political attitudes, it can be concluded that these measures give at least a rough estimate of certain political attitudes of individuals. The left-right continuum seems to be more strongly associated with economic political attitudes, while the liberal-conservative continuum seems to be more strongly related to social political attitudes.

Regarding the two-dimensional measures of political orientation/ideology (social and economic dimension of ideology), the economic dimension of ideology belonged to the dimension comprising the left vs right divide but not – as theory and research suggest – to the dimension comprising SDO (Duckitt, 2001; Duckitt et al., 2002; Everett, 2013; Feldman & Johnston, 2014; van Hiel et al., 2004); neither on scale nor on item-level. However, in line with theory and previous empirical findings suggesting a link between RWA and the social dimension of ideology, these two constructs belonged to the same dimension on scale-level (Beierlein et al., 2014; Duckitt, 2001; Duckitt et al., 2002; Duriez et al., 2005; Everett, 2013; Feldman & Johnston, 2014; van Hiel et al., 2004). On item-level, only RWA items belonging to the subscale conventionalism lay on the same dimension as did the items assessing the social dimension of ideology.

Moreover, results showed that around half of the values (achievement, power, stimulation, hedonism, self-direction; and universalism and benevolence on item-level, specifically) derived from the Schwartz Value theory belonged to dimensions with other values but not with measures assessing voting intentions, ideological orientation/ideology, ideological attitudes, or attitudes towards refugees. The other values (conformity, tradition,

security) clustered on one dimension with other measures assessing political attitudes aside from personal values. This indicates a stronger connection between these values – as compared to the ones only clustering with other personal values – and the other measures of political attitudes.

Next, two dimensions observed in the present study seem to closely align with the social and the economic dimension of ideology, at least on scale-level. These were labeled *Social Liberalism vs Conservatism/Traditionalism and Conformity with Authorities* (and split into two dimensions on item-level) and *Economic Left vs Right Ideological Orientation*.

Finally, some limitations of the present study must be mentioned. Most importantly, the present study focused on a German sample. Future studies will need to test whether the findings of this work are generalizable to other samples from other countries with different political systems. In this regard it is also important to mention that the present sample was not representative of the general German population (see, for example, distribution of voting intentions presented in Supplementary Material I). Therefore, also future studies in representative German samples will need to replicate the present findings before robust conclusions can be drawn. Next, the voting intention item was included in the analyses as ordinal factor with higher scores indicating the willingness to vote for a more right-leaning party in line with findings of Volkens et al. (2020). However, the response options could also have been ordered, for example, according to economic or social positions of the parties. Such a different ordering (Volkens et al., 2020) might have led to different results with regard to this item. Moreover, it must be kept in mind that the present approach is exploratory, hence, hypotheses free, and therefore completely data-driven. This has several advantages. For example, the findings are not influenced by a priori hypotheses. However, given that the results are data-driven, the generalizability to other samples (see above) and to other measures assessing the same constructs must be tested in future studies. Nevertheless, with

regard to the measures applied in the present study, we want to mention that we decided to use measures, which have been used before and which have been used oftentimes and/or in big data collections, such as the European Social Survey or the World Value Survey.

Conclusion

We found five (scale-level) to seven (item-level) dimensions of political attitudes. This indicates that political attitudes are multi-faceted. Nevertheless, asking a participant for, as an instance, his/her left-right self-placement with one item is cost- and time-efficient. According to our results, this 1-item measure might at least give a rough estimation of one's voting intentions and economic political attitudes. Applying five items, which is still rather cost-effective, in order to assess one's position on a social and economic dimension of ideology separately, seems to give an even more accurate and differentiated estimation of political attitudes of individuals. However, we still think that taking more dimensions into account, for example an additional dimension on one's attitudes towards group (in-)equality as well as specific values is important to gain a more in-depth understanding of political attitudes.

Finally, we ask other researchers to build upon the present work and develop a new theoretically and empirically based overview of political attitudes integrating various different theoretical models to grasp the manifoldness of this important concept. Ultimately, only understanding political attitudes in-depth and with all facets will help to understand why certain individuals vote for a specific party, attend protests, and maybe also implement extreme political acts.

Endnotes

¹ As mentioned in the preregistration, we also assessed socio-political attitudes but did not expect strong relations with other variables. Therefore, theoretical backgrounds, methods, and results associated with socio-political attitudes are presented in a Supplementary Material (see further description below).

² In the preregistration we also mentioned to calculate the analyses on subscale-level. However, since only the KSA-3 scale comprises subscales, we decided to not present these analyses in order to not overload the present manuscript.

³ Usually, we prefer random resampling. However, using the random resampling approach on item-level led to error messages: putatively due to the skewed distribution of responses to some items, in some randomly drawn samples, not each response option of each ordinal variable (i.e., item) was represented at least once. Hence, the calculations did not work. Therefore, we switched to parametric resampling on item-level to resolve this issue.

⁴ When the voting intention item was included, individuals who indicated to not vote or to vote for another party were not included because these two response options cannot be placed on a left-right continuum; the other response options (i.e., voting for a specific party) were coded from left (1) to right (6) (Volkens et al., 2020) and the voting intention item was included in the models as ordinal factor.

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Figure 1

EGA plot in original sample and across bootstrapped samples investigating the dimensionality of all variables (except the socio-political attitudes variables) on scale-level ($N = 604$)

Note. Abbreviations: vot_int = voting intention item, left_right = 1-item left-right self-placement, lib_cons = 1-item liberal-conservative self-placement, lr_scale = left-right scale, soc_id = social dimension of ideology, econ_dim = economic dimension of ideology, rwa_t = KSA-3 (total scale), sdo = SDO scale, ach = PVQ achievement, power = PVQ power, stim = PVQ stimulation, hed = PVQ hedonism, sd = PVQ self-direction, uni = PVQ universalism, ben = PVQ benevolence, sec = PVQ security, conf = PVQ conformity, trad = PVQ tradition, atr = attitude towards refugees scale; green lines indicate positive associations, red lines indicate negative associations between variables.

Figure 2

EGA plot in original sample and across bootstrapped samples investigating the dimensionality of all variables except the voting-intention item (and the socio-political attitudes variables) on scale-level ($N = 724$)

Note. Abbreviations: left_right = 1-item left-right self-placement, lib_cons = 1-item liberal-conservative self-placement, lr_scale = left-right scale, soc_id = social dimension of ideology, econ_dim = economic dimension of ideology, rwa_t = KSA-3 (total scale), sdo = SDO scale, ach = PVQ achievement, power = PVQ power, stim = PVQ stimulation, hed = PVQ hedonism, sd = PVQ self-direction, uni = PVQ universalism, ben = PVQ benevolence, sec = PVQ security, conf = PVQ conformity, trad = PVQ tradition, atr = attitude towards refugees scale; green lines indicate positive associations, red lines indicate negative associations between variables.

Figure 3

Plot of redundancy analyses in the sample including the voting intention item (left-hand side; $N = 604$) and excluding the voting intention item (right-hand side; $N = 724$)

Note. Abbreviations: vot_int = voting intention item, left_right = 1-item left-right self-placement, lib_cons = 1-item liberal-conservative self-placement, pol_lr_01 – pol_lr_05 = Left-right scale items 01 to 05 (ordering of items: see Evans et al. (1996); items were reverse-coded before analyses), income / property = economic dimension of ideology – income / property item (higher scores indicate more conservative ideology), abortion / divorce / homosexuality = social dimension of ideology – abortion / divorce / homosexuality item (reverse-coded; higher values indicate more conservative social attitudes), rwa_01 – rwa_09 = KSA-3 scale items 01 to 09 (ordering of items: see Beierlein et al. (2014)), sdo_01 – sdo_16 = SDO scale items (ordering of items: see Pratto et al. (1994); items 09 to 16 were reverse-coded before analyses), pvq_01 – pvq_21 PVQ items 01 to 21 (ordering of items: see Schmidt (2007)), atr_01 – are_05 = attitudes towards refugees scale items 01 to 05 (ordering of items: see The German Socio-Economic Panel at DIW Berlin (2019); items were reverse-coded before analyses).

Figure 4

EGA plot in original sample and across bootstrapped samples investigating the dimensionality of all variables including the voting-intention item and the socio-political attitudes variables on item-level ($N = 724$)

Note. Abbreviations: vot_int = voting intention item, left_right = 1-item left-right self-placement, lib_cons = 1-item liberal-conservative self-placement, pol_lr_01 – pol_lr_05 = Left-right scale items 01 to 05 (ordering of items: see Evans et al. (1996); items were reverse-coded before analyses: lower scores indicate more left attitudes), income / property = economic dimension of ideology – income / property item (higher scores indicate more conservative ideology), abortion / divorce / homosexuality = social dimension of ideology – abortion / divorce / homosexuality item (reverse-coded; higher values indicate more conservative social attitudes), rwa_01 – rwa_09 = KSA-3 scale items 01 to 09 (ordering of items: see Beierlein et al. (2014)), sdo_01 – sdo_16 = SDO scale items (ordering of items: see Pratto et al. (1994); items 09 to 16 were reverse-coded before analyses: higher scores

indicate higher SDO), pvq_01 – pvq_21 PVQ items 01 to 21 (ordering of items: see Schmidt (2007)), atr_01 – are_05 = attitudes towards refugees scale items 01 to 05 (ordering of items: see The German Socio-Economic Panel at DIW Berlin (2019); items were reverse-coded before analyses: higher scores indicate more negative attitudes towards refugees); green lines indicate positive associations, red lines indicate negative associations between variables.

Figure 5

EGA plot in original sample (A) and across bootstrapped samples (B) investigating the dimensionality of all variables excluding the voting-intention item and the socio-political attitudes variables on item-level ($N = 724$)

Note. Abbreviations: left_right = 1-item left-right self-placement, lib_cons = 1-item liberal-conservative self-placement, pol_lr_01 – pol_lr_05 = Left-right scale items 01 to 05 (ordering of items: see Evans et al. (1996); items were reverse-coded before analyses: lower scores indicate more left attitudes), income / property = economic dimension of ideology – income / property item (higher scores indicate more conservative ideology), abortion / divorce / homosexuality = social dimension of ideology – abortion / divorce / homosexuality item (reverse-coded; higher values indicate more conservative social attitudes), rwa_01 – rwa_09 = KSA-3 scale items 01 to 09 (ordering of items: see Beierlein et al. (2014)), sdo_01 – sdo_16 = SDO scale items (ordering of items: see Pratto et al. (1994); items 09 to 16 were reverse-coded before analyses: higher scores indicate higher SDO), pvq_01 – pvq_21 PVQ

items 01 to 21 (ordering of items: see Schmidt (2007)), atr_01 – are_05 = attitudes towards refugees scale items 01 to 05 (ordering of items: see The German Socio-Economic Panel at DIW Berlin (2019); items were reverse-coded before analyses: higher scores indicate more negative attitudes towards refugees); green lines indicate positive associations, red lines indicate negative associations between variables.

Figure 6

Summary of dimensions observed on scale and on item-level in EGA. Gray items indicate items which did only belong to a certain dimension in some of the analyses