

Once an e-voter always an e-voter: “stickiness” of e-voting*

Mihkel Solvak[†]
Kristjan Vassil[‡]
R. Michael Alvarez[§]

April 16, 2015

Abstract

Recent evidence shows that e-voting in Estonia has diffused widely. Typical traits distinguishing early e-voters from regular voters, such as age and computer literacy, have lost their explanatory power over the ten years of e-enabled elections. The original motivations that drove enthusiasts to pick up this voting mode seem to have ebbed suggesting e-voting has become essentially random. Yet randomness of behavior is a difficult hypothesis to accept. An alternative suggestion is that e-voting, as voting itself, might be habit forming. People might keep on doing it simply because they have done so in the past. We examine to what degree has e-voting become “sticky” or habitual, i.e. self-reinforced behavior detached from its original motivations, using survey data from a total of 5 e-enabled consecutive nationwide elections in Estonia in 2009 to 2015. The results suggest e-voting to be very “sticky”, a first time e-voter is very likely to stay e-voting in subsequent elections. The results have implications for the mechanism of spread of e-voting among the voter population.

Paper prepared for the 73rd Annual Midwest Political Science Association Conference, April 16-19, 2015, Chicago

*Research for this paper has been funded by the EU Regional Development Fund grant: “Verifiable Internet Voting - Event Analysis and Social Impact”

[†]Institute of Government and Politics, University of Tartu, Tartu, Estonia

[‡]Institute of Government and Politics, University of Tartu, Tartu, Estonia

[§]California Institute of Technology, USA

1 Introduction

Estonia is one of the few countries in the world with binding remote internet voting. The first election with this possibility was a statewide local election in 2005 and since then voters have been able to cast a vote online in two more local elections, two national elections, and two European Parliament election. The share of e-votes out of all votes cast in the first e-enabled election was 1.85% and now, after the latest national election in 2015, stands at 30.5%. The growth in remote internet voting has been substantial, with every third vote now cast online. The growth has also been constant with increasing shares voting online in each election.

Though the discussion on the pros and cons of electronic voting is still ongoing, the growth of e-voting in Estonia stands in marked contrast to the scepticism regarding the inclusiveness of this new voting mode. Oponents argue that innovations in voting technologies might run the risk of enhancing the divisions between the haves and have nots, between those already facing no hurdles to effective participation and those still on the margins of electoral democracy ([Alvarez and Nagler, 2000](#); [van Dijk, 2000, 2005](#); [Margolis and Resnick, 2000](#); [Putnam, 2001](#); [Wilhelm, 2000](#)). Proponents, on the other hand see a positive potential of e-voting in reducing the physical voting costs and lowering participation hurdles for people who have mobility problems. It seems to a certain level that the latter has been realized in Estonia.

The process of diffusion in e-voting has not been fully linear though. It was assumed that online participation will most likely positively affect young tech savvy citizens ([Alvarez and Nagler, 2000](#)). The latest empirical evidence on e-voting does confirm this during the initial stages of implementing the e-voting practice. E-voters indeed formed a non-random and distinct subgroup characterized by higher socio-economic status and better PC skills. Crucially however, this no longer applies.

After a latency period of three elections diffusion among the general voter population has taken place with voters regardless of their socio-demographic background now voting online and voters casting their choice remotely over the internet being no longer distinguishable on a range of traits initially associated with online participation (Vassil et al., 2014).

Given that the initial predictors of using this mode of voting no longer apply we have to options to explain why every third vote is now cast online. First, it might be the usage of this voting mode has become essentially random, which is a hard hypothesis to believe. Second, it might be that the usage of this mode was and is still non-random, it simply is another mechanism that is now driving the usage of this voting mode. It might be that this mechanism is habit, i.e. e-voting has become self-reinforced, akin to the practice of voting itself. Anecdotal evidence does suggest e-voting to be “sticky”, e-voting once seems to make a voter very likely to keep on e-voting in subsequent elections. The habit formation of this participation mode has however not been examined in detail and this is something which this paper will proceed to do.

We examine how persistent are patterns in e-voting and whether it can be considered to be habitual. We use cross-sectional survey data from five e-enabled elections over a six year period and path analysis to examine repeated e-voting. The results show e-voting to be strongly persistent, with clear evidence of habit formation present. The findings indicate once more the potential of e-voting to be widely used by the voting population (Vassil et al., 2014) and due to its self-reinforcing character being able to if not raise turnout, then at least to arrest its continuing decline in Western democracies.

2 Theory

Recent evidence shows that e-voting is strongly determined by socio-demographics during a couple of first e-enabled elections after which the usage of this mode diffuses and the socio-demographics lose their associations with it (Vassil et al., 2014). This suggests that factors other than the social status or immediate professional background drive a certain voter segment to persistently choose this mode of participation. Given the apparent similarity to the persistence of voting behavior the prospect of e-voting as a habitual mode of behavior suggests itself as one possible explanation.

Remote internet voting is still not widely used so studies on whether it might be habit forming are completely lacking. We will therefore utilize studies on “voting habit” and online participation to arrive at testable hypotheses on the habitual nature of e-voting which is after all nothing else than one particular mode of voting.

The classical definition of habit in social psychology, according to Aldrich, sees habit as “responding based on learned associations between context and responses without necessarily holding supporting intentions and attitudes” (Aldrich et al., 2011, p. 540). A habit is *automated behavior* and not *motivated decision making*, unlike when the initial decision to vote online is made.

The simplest understanding of habit is a behavioral strategy that simplifies decision making. Repetition means to a certain degree automation. Applied to voting or the selection of the mode of voting suggest a cost saving strategy where the initial calculations made when this particular decision was first made are no longer applied once automation takes over. This indicates the first central premise that the growing body of literature on voting as a habit shares, namely repetitive behavior. People who vote in one election are very likely to do so also in subsequent elections (Denny

and Doyle, 2009; Aldrich et al., 2011; Gerber et al., 2003; Green and Shachar, 2000; Cutts et al., 2009; Nickerson, 2008; Plutzer, 2002; Dinas, 2012), to a certain degree regardless of the type of the subsequent election (Gerber et al., 2003). Repeated behavior is the first precondition of a habit in voting so our first hypothesis is simple, but no less important:

H1: Past e-voting is strongly associated with current e-voting

Individuals who engage in repetitive behavior might however do so not out of automaticity, but following a reasoned decision every time. It needs to be stressed that repetition is necessarily but not yet sufficient for a habit. Voters e-voting repeatedly *might* but do not necessarily have to have a habit. It does however suggest that ignoring the potential habitual nature of repetitive e-voting would lead to inflated estimates of the usual covariates associated with online participation such as wealth, young age and better education (Norris, 2001; Alvarez and Nagler, 2000; Solop, 2002; Mossberger et al., 2003).

These same associations with socio-demographics usually associated with online participation form part of our second assumption. Akin to the prominent resource theory of political participation (see Geys (2006); Smets and van Ham (2013)), studies on online participation and engagement also refer to a set of resources acting as enablers or preconditions of participation (Alvarez and Nagler, 2000; van Dijk, 2000, 2005; Margolis and Resnick, 2000; Putnam, 2001; Wilhelm, 2000). These resources are both cognitive and material with the motivation to participate, mostly in the form of interest, tending to arise from the former. Choosing the particular mode of participation, i.e. voting at the polling station or casting a vote remotely over the internet has been demonstrated to also, at least initially, be we quite well explain-

able by the resources someone commands. E-voting used to be more likely among younger, better educated, higher income voters, i.e. people who have the cognitive as well as the material and technical means of voting over the internet (Vassil et al., 2014). This gives a second suggestion on what should be observable if e-voting is habit forming. The resources explaining initial mobilization to do so should lose their explanatory power over time and current e-voting should instead simply be driven by prior e-voting.

H2: Associations between past e-voting with current e-voting increase over time, while associations between resources and current e-voting decrease over time

Meaning we expect to see increased direct and indirect effects of prior behavior and reduced effects of socio-demographics.

This does not still provide for a strict test of the habit hypothesis. Besides commanding the resources needed to submit a vote over the internet the e-voting voter subgroup is also more likely to hold intentions and attitudes supportive of e-voting. This last factor is key in examining if and to what degree could the usage of this particular voting mode be considered habit forming.

H3: Supportive attitudes are not associated with a higher likelihood of repetitive e-voting

Only if individuals engaging in repeated behavior no longer hold or are distinguishable from others in the supporting attitudes initially associated with this mode of behavior can we talk about a habit in a strict sense.

To sum up, if e-voting is clearly habit forming we should see the following. First, the behavior needs to be repetitive, i.e. people who have e-voted should do so also

in subsequent elections.

Second, this behavior should not be associated with the traits usually associated with casting a vote online in the first place.

And third, repeated e-voting should not have strong associations with attitudes supporting e-voting. Only then could we talk about this particular mode of voting becoming habitual.

3 Data, measurement and models

We acknowledge that experimental or panel data would be best for examining habit formation, but like multiple studies on “voting as habit” (see [Aldrich et al. \(2011\)](#)) we have to settle for cross-sectional data and recall questions on prior behavior.

We are aware that cross-sectional data somewhat limits our ability to test the habit forming mechanism.

First, the observed socio-demographic characteristics associated with previous e-voting (time $t - 1$) also affect current e-voting (time t), the same applies for unobserved characteristics leading to a “fixed effects unobserved heterogeneity” problem ([Denny and Doyle, 2009](#), p. 19) which is not fully addressed with simply using e-voting at $t - 1$ as an explanatory variable. We will try to remedy this problem by looking also at the intrinsic motivations to e-vote, i.e. the supporting attitudes referred to by [Aldrich et al. \(2011\)](#), that as a rule are also correlated with the socio-demographic factors associated with online participation and are also presumably constant over time. We will return to this when examining consecutive e-voters in the second part of the empirical analysis.

Second, as all studies on habit we face a “initial conditions problem” ([Denny and Doyle, 2009](#), p. 19-20) as the individual might have started e-voting before our

first observation. This problem plagues most voting habit studies and cannot be fully addressed with the data we have at hand. It needs to be stressed that we will not examine whether *first time e-voting* influences subsequent e-voting, but simply whether *prior e-voting* affects the likelihood to subsequently e-vote.

Keeping these two issues in mind we use five post-election cross-sectional surveys conducted in Estonia after the 2009 local, 2011 parliamentary, 2013 local, 2014 European Parliament and 2015 national elections. The sample size in all studies is roughly 1000 respondents. Respondents reported their behavior in the current election (t) and were also asked to recall their participation and the mode of it in the previous ($t - 1$) and second to previous ($t - 2$) election. Due to the relatively packed election calendar this meant recalling behavior in elections 1 to 3 years ago. The distribution of the recall questions according to participation mode is shown as a dendrogram in Figure 1

It shows that the most popular option among respondents who reported to have paper voted, e-voted or non-voted is to keep to that respective mode of behavior in subsequent elections. Comparing reported behavior in elections $t - 2$ and $t - 1$ shows, however, that e-voting is clearly more persistent than other modes. People who e-voted in $election_{t-2}$ did so also in 81.9% of the cases in $election_{t-1}$, while only 73.0% and 70.4% did the same in case of paper and non-voting respectively. We also see that if the respondent has decided to switch to e-voting in $election_{t-1}$ after paper or non-voting in $election_{t-2}$ then she will overwhelmingly stay e-voting in $election_t$ rather than switch back to either paper or non-voting. Finally, when comparing the mode of behavior over three elections 68.1% of respondents kept on e-voting while only 53.1% did so for paper and 50.5% for non-voting.

The descriptive statistics therefore indicate that while a paper voter, e-voter or

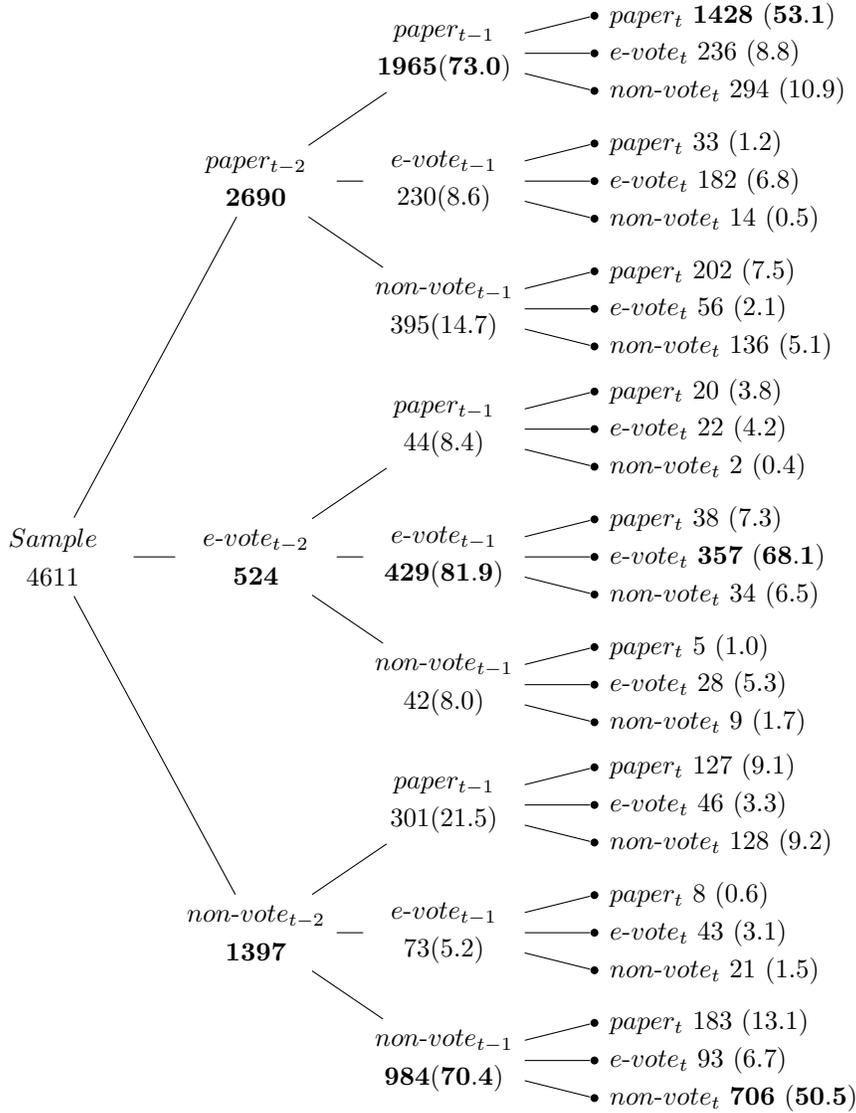


Figure 1: Participation modes over three elections: $t-2$, $t-1$ and t . Share compared to election $t-2$ in parentheses. Most frequent mode of behavior in bold.

non-voter will most frequently behave in a similar manner in subsequent elections, the actual share of people doing so is clearly largest among e-voters. We can already conclude that e-voting is very persistent, confirming the first hypothesis. The problem is obviously that e-voters are a non-random subgroup of the voter population. It might simply be that they are prone to keep on participating in a similar manner regardless of the nature of the mode. This will be taken into account in the multivariate models elaborated in the next subsections. The look at Figure 1 also indicates the need to take into account not only behavior at the previous, but second to previous election due to strong persistence in e-voting.

3.1 Dependent variable

Our central variable of interest is a binary indicator on the mode in current election (at time t) coded 1 if the respondent e-voted and 0 if she voted on paper at the polling station.

Figure 1 showed that the usage of e-voting is very persistent. Switching back to either paper voting or non-voting after one has e-voted is very rare. This suggests we need to take into account not only the previous mode at time $t - 1$ but also the second to previous mode at time $t - 2$.

We will therefore estimate a model that takes into account e-voting at $t - 1$ and all modes at $t - 2$. To do so we employ a path model assuming that part of the effect of behavior at time $t - 2$ on e-voting at time t is also mediated by behavior at time $t - 1$. Figure 2 shows how these effects are decomposed. If e-voting is strongly habit forming then e-voting at the second to previous election ($t - 2$) should have both strong direct effects on e-voting at the current election (t) (a in Fig. 2) and indirect effects through e-voting at the previous election ($t - 1$) on e-voting at t ($b \times c$

in Fig. 2). Note that the variable on the second to previous election, $mode_{t-2}$, is a nominal variable contrasting paper and e-voters with non-voters while $evote_{t-1}$ and $evote_t$ are binary variables contrasting paper and e-voters.

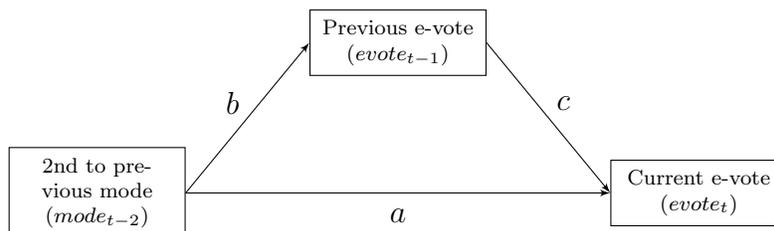


Figure 2: Expected direct and indirect effects of prior e-voting on current e-voting

In addition to the setup in Figure 2 we will examine repeated e-voting more closely to evaluate the third hypothesis. We will do so by constructing a separate indicator coded as 1 if the respondent self-reported to have e-voted consecutively in two or three elections counting back from the current election and 0 if not or when the respondent paper voted.

3.2 Main path model

The path diagram in Figure 2 is part of a generalized structural equation model outlined in Figure 3. It includes as predictors the main socio-demographic traits, proxies for resources, which are usually associated with a higher likelihood of online participation. First the squared age of the respondents. Second the education level of the respondent in the form of dummies on higher and secondary education with basic education as the reference category. Thirdly the income level of the respondent in the form of the income decile the respondent's household falls into. And finally three dummies on the self-reported PC literacy of the respondent with poor computer skills serving as the reference category.

We will estimate this model for each election we have data on and are specifically interested if the impact of socio-demographics (d_1 to d_4) on the current mode choice decreases while the decomposed effects of prior e-voting (a and $b \times c$) increase over time.¹ This will confirm or disconfirm H2.

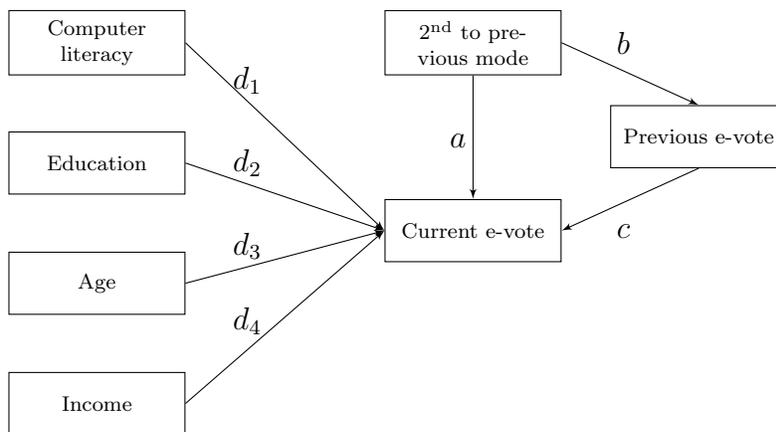


Figure 3: Path model of associations between prior e-voting and current e-voting (a - direct effect of second to previous mode on current e-vote; $b \times c$ - indirect effect through previous mode on current e-vote).

3.3 Logit model

To properly address the third hypothesis we will examine the subsample of respondents who have e-voted repeatedly with a logit model where the dependent variable is whether the voter is a consecutive e-voter or not. The aim is to see if supporting attitudes towards e-voting are or are not associated with e-voting multiple times consecutively. This model will be estimated for the combined dataset and takes the

¹We use the `gsem` package in Stata 13 with the model specification taking the following generic form:
`gsem (input variable1 -> outcome variable, family(bernoulli) link(logit))`
`(input variable2 -> outcome variable, family(bernoulli) link(logit)),`
`nocapslatent.`

following form:

$$\ln \left\{ \frac{Pr(evote_t = 1)}{1 - Pr(evote_t = 1)} \right\} = \beta_0 + \beta_1 A + \beta_2 B + \\ + \beta_3 C + \beta_4 D + \beta_5 E$$

, where A is a dummy on whether the respondents trust or tends to trust e-voting in general, B is a dummy on whether the respondents trusts or tends to trust internet transactions, C is a dummy on whether the respondent is confident that her e-vote was counted as cast, D is a dummy on whether the respondent is confident that e-votes by other voters were counted as cast and E is a vector of the same sociodemographic variables as included in the path model in Figure 3 acting as controls.

The descriptive statistics of all the variables according to each year and in total are listed in Table A1 in the Appendix.

4 Findings

Table 1 shows the associations between the socio-demographics and e-voting in current elections over time as exponentiated path model coefficients. While the associations with prior e-voting are strong and do not follow a particular pattern over the years, the only clear difference in the socio-demographics is the disappearance of PC literacy as a predictor of e-voting. Though this would be in line with the assumed logic of habit formation we also have to look in more detail at the direct and indirect effect of prior e-voting. This is done in Table 2.

Table 1: Factors associated with e-voting in current election (t). Exponentiated generalized SEM coefficients.

	2009	2011	2013	2014	2015
	E – vote_t < –				
E-vote _{t-1}	47.91*** (25.23)	8.04*** (3.96)	9.42*** (3.5)	50.79*** (30.27)	18.9*** (8.57)
Mode _{t-2} : paper vote (base: non-vote)	0.98 (0.58)	1.09 (0.39)	0.31* (0.15)	0.20* (0.14)	1.55 (1.11)
Mode _{t-2} : e-vote	1.79 (1.69)	7.30** (4.73)	0.82 (0.53)	0.35 (0.31)	2.73 (2.05)
PC literacy: good (base: poor)	45.71* (78.62)	5.97** (4.1)	3.58 (2.94)	25.07* (37.94)	16.36 (705.56)
PC literacy: average	33.9* (58.29)	4.07* (2.61)	3.73 (2.85)	3.23 (4.64)	15.68 (705.56)
PC literacy: basic	23.13 (40.39)	2.51 (1.66)	0.81 (0.8)	3.49 (5.1)	15.26 (705.56)
Education: higher (base: primary)	0.25 (0.25)	0.51 (0.31)	2.51 (2.0)	1.28 (0.72)	1.14 (0.4)
Education: secondary	0.16 (0.16)	0.24* (0.14)	0.96 (0.74)	1.88 (1.14)	0.98 (0.42)
Age	1.1 (0.09)	0.99 (0.06)	0.98 (0.06)	1.02 (0.1)	0.98 (0.06)
Age ²	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)
Income decile	1.08 (0.07)	1.14** (0.05)	1.01 (0.06)	1.05 (0.09)	0.91 (0.06)
Constant	0.01 (0.03)	0.66 (0.91)	0.19 (0.33)	0.01 (0.03)	0.0 (0.0)
	E – vote_{t-1} < –				
Mode _{t-2} : paper vote (base: non-vote)	0.74 (0.23)	0.47* (0.16)	0.48* (0.16)	0.22*** (0.07)	0.2*** (0.08)
Mode _{t-2} : e-vote	25.68*** (14.13)	110.07*** (44.61)	38.61*** (21.47)	15.95*** (6.44)	35.65*** (18.46)
Constant	0.46 (0.13)	0.12 (0.03)	0.28*** (0.08)	0.31*** (0.09)	0.32** (0.12)
AIC	805.41	770.93	764.14	538.04	641.38
BIC	868.42	840.11	830.04	604.17	707.34
Pseudo R ²	0.57	0.56	0.44	0.62	0.47
Observations	493	744	598	607	600

Odds ratios with standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2 shows the decomposed effect of prior e-voting with all other covariates held at their mean.

Table 2: Decomposed effects of $mode_{t-2}$ on $evote_t$

	2009	2011	2013	2014	2015
E-vote vs. paper vote					
Direct effect	1.45 (0.88)	5.77** (2.43)	2.5 (1.37)	1.41 (1.22)	1.72 (0.97)
Indirect effect	8.93*** (4.11)	5.83*** (2.43)	5.19*** (1.46)	13.48*** (7.51)	8.78*** (2.18)
Total effect	12.99*** (8.78)	33.62*** (17.76)	12.95*** (7.07)	19.06*** (13.22)	15.13*** (6.77)
E-vote vs. non-vote					
Direct effect	1.44 (1.34)	6.23*** (3.28)	0.83 (0.67)	0.58 (0.42)	2.59 (2.05)
Indirect effect	6.32*** (3.34)	4.85*** (1.95)	3.98*** (1.19)	8.6*** (5.03)	2.62** (0.91)
Total effect	9.09** (7.82)	30.24*** (14.46)	3.31 (2.3)	4.98* (4.02)	6.79* (5.63)
Observations	373	531	447	315	451

The table reports odds ratios with bootstrapped standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The decomposition separating the direct effect of second to previous mode (X) on current mode (Y) and indirect effect of second to previous mode (X) on current mode (Y) through previous mode (Z) works through counterfactuals (Buis, 2010).

Technically, the direct effect of mode at $election_{t-2}$ (X) on e-voting at $election_t$ (Y) is established by comparing the log odds of the e-voters at $election_{t-2}$ against paper voters or non-voters also at $election_{t-2}$ as if they would have the same mode distribution at $election_{t-1}$ (Z) as e-voters had at $election_{t-2}$. According to this scenario the actual and the counterfactual group differ only on the mode at $election_{t-2}$

(X), but not on the mode at $election_{t-1}$ (Z), i.e. controlling for the distribution of Z. This will show the direct effect of the mode at $election_{t-2}$ (X) on the mode at $election_t$ (Y), i.e the path a in Figure 3. In human language this means we treat past paper and non-voters as if they would have acted just as past e-voters did later on.

In the second step log odds of e-voting at $election_t$ (Y) of e-voters at $election_{t-2}$ (X) will be compared with the counterfactual scenario of e-voters at $election_{t-2}$ having the distribution of mode at $election_{t-1}$ (Z) of either paper or non-voters at $election_{t-2}$. As a result the actual and counterfactual scenario differ only in the distribution of mode at $election_{t-1}$ (Z). This will show the indirect effect of the mode at $election_{t-2}$ (X) through the mode at $election_{t-1}$ (Z) on the mode at $election_t$ (Y), i.e the path $b \times c$ in Figure 3. Again in human language this means we treat past e-voters as if they would have acted like past paper or non-voters later on.

The direct (path a) and indirect effect (path $b \times c$) in combination form the total effect of prior behavior ($a \times b \times c$) on current behavior.

With this knowledge we can now re-examine Table 2. For example, in 2009 the total effect shows that the odds of e-voting in $election_t$ for someone who had e-voted in $election_{t-2}$ are 13 times as large as for a paper ballot voter at $election_{t-2}$. The indirect effect shows that paper ballot voters at $election_{t-2}$ would have a 9 times higher odds of e-voting at $election_t$ if they would have e-voted at $election_{t-1}$. E-voters at $election_{t-2}$ have a 1.5 times higher odds of e-voting at $election_t$ if we keep the mode at $election_{t-1}$ constant at the level of past e-voters, but this difference is not significant. A similar pattern is repeated for all years. The size of the indirect effect relative to the total effect is shown in table 3 and it is considerable in all cases except 2011.

Table 3: Relative size of the indirect effect to total effect (%)

	2009	2011	2013	2014	2015
	E-vote vs. paper vote				
Indirect effect (% of total effect)	85.4	50.2	64.3	88.2	79.98
	E-vote vs. non-vote				
Indirect effect (% of total effect)	83.5	46.3	115.4	134.1	50.28

Turning back to table 2 notice that e-voting at $election_{t-1}$ makes respondents who did not vote in the previous election significantly more likely to cast a e-vote at $election_t$. The table also shows that non-voters at $election_{t-2}$ were clearly more likely to e-vote rather than vote with a paper ballot in $election_t$ if they had e-voted rather than voted on paper in $election_{t-1}$. E-voting therefore seems to have strong impact on habitual non-voters, though this effect is consistently smaller than for paper ballot voters.

The table also suggests that e-voting in subsequent elections does not become more likely if you have e-voted in the more distant past, as shown by the generally insignificant direct effect of mode at $election_{t-2}$. In sum, already one previous e-vote suffices for a high likelihood of e-voting as suggested by the strong and persistent indirect effect. By and large, we can therefore say that prior e-voting has a very strong effect on current e-voting, but this effect is most noticeable indirectly through e-voting in the previous election and not so much directly for behavior in the second to previous election. Evidence on the second hypothesis is therefore somewhat mixed, we do not see a growing association of past behavior at the expense of socio-demographics resources over time, but we do see a persistently strong effect of past behavior while taking the resources into account.

Finally, Table 4 helps to examine if the third hypothesis holds. We expected to see no associations between supporting attitudes and repeated e-voting if e-voting is habitual in a strict sense. This would indicate automated behavior detached from the initial motivations initially associated with this behavior. The table shows that trust towards e-voting has a sizable association with e-voting.

Table 4: Effects on consecutive evoting

	Consecutive e-voting
Trust e-voting	0.21** (0.06)
Trust internet transactions	-0.05 (0.04)
Confident own e-vote was counted as cast	-0.3 (0.2)
Confident other e-votes were counted as cast	0.13 (0.09)
<i>Controls included</i>	—
Sensitivity	99.8%
Specificity	8.82%
Nagelkerke pseudo- R^2	0.07
Observations	600

The table reports average marginal effects with standard errors clustered by election in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

E-voters who generally trust e-voting are 21% more likely to e-vote consecutively. This does not, however, apply for trusting internet transactions nor towards the confidence that her or other e-votes were counted as cast.² In sum, table 4 shows supportive attitudes towards e-voting are not significantly associated with repeated consecutive e-voting. This clearly confirms H3.

²Potential multicollinearity is not problem in this model, VIF values for all variables were clearly below 2.0.

5 Conclusion

E-voting has been discussed as one possible remedy for the continuing turnout decline in Western democracies. Its potential has also been criticized citing fears it will enhance rather than diminish existing social inequalities by setting up participation thresholds for the less well resourced voters. The initial fears have been allayed by the few examples where remote internet voting has been implemented in practice. As a side development to the diffusion process of e-voting noticeable in Estonia anecdotal evidence of the “stickiness” of this voting mode has also been noted. If e-voting indeed is habit forming it has the potential to arrest the continuing decline in voter turnout once a critical share of voters have gotten the experience of voting online.

This paper examined the potential of e-voting to be habit forming using cross-sectional data on five elections and recall questions on prior voting behavior.

The data shows e-voting to be very persistent with clearly large shares of e-voters keeping to this mode of participating in comparison to paper ballot or non-voters. E-voting once makes one very likely to vote this way also in subsequent elections. The crucial element of any habit, namely repetitive behavior, is clearly evident for e-voting.

We also examined if the socio-demographic resources usually associated with e-voting, such as age, education, wealth and PC literacy lose their effects at the expense of simply prior e-voting over the years. We did so by employing a path model allowing for previous and second to previous modes of behavior to have their effects. The results do not show that resources lose their explanatory power while prior behavior gains it over time. We do see, however, a consistent and strong effect of prior e-voting, which is also moderated through previous experiences.

Lastly, for a habit in a strict sense to exist the behavior needs not only to be repet-

itive, but also to be separated from the initial supporting attitudes of it. Only automated, not strictly reasoned repetitive behavior is a habit. The evidence shows that consecutive e-voters do stand out as trusting the system more than non-consecutive e-voters, but they do not harbor stronger attitudes in general supportive of e-voting such as trusting internet transactions or being more comfortable that theirs and others' e-votes were counted as cast. This is clear evidence in support for e-voting as habit forming.

In sum, keeping in mind the limitations of cross-sectional data in untangling habit formation we believe there is clear evidence for the very least strong persistence of e-voting. Also, the fact that attitudes strongly supportive of e-voting being not significant in distinguishing "repeat offenders" suggests a certain automaticity which is characteristic for a habit. This mode of voting seems to be self-reinforcing at a quite high level. We believe the findings give support for the potential of remote internet voting to be easily embraced by the wider voter segment given a chance to cast their vote in such manner. Skepticism on the positive potential of electronic voting in enhancing representation is not borne out; on the contrary, if the participation mode is habit forming, then meaningful participation should receive if not a boost then at least be stabilized at its current levels.

References

- Aldrich, J. H., Montgomery, J. M., and Wood, W. (2011). Turnout as a habit. *Political Behavior*, 33:535–563.
- Alvarez, R. and Nagler, J. (2000). Likely consequences of internet voting for political representation. *The Loyola Los Angeles Law Review*, 34:1115–1153.
- Buis, M. (2010). Direct and indirect effects in a logit model. *Stata Journal*, 10(1):11–29.
- Cutts, D., Fieldhouse, E., and John, P. (2009). Is voting habit forming? the longitudinal impact of a gotv campaign in the uk. *Journal of Elections, Public Opinion and Parties*, 19:251–263.
- Denny, K. and Doyle, O. (2009). Does voting history matter? analysing persistence in turnout. *American Journal of Political Science*, 53(1):17–35.
- Dinas, E. (2012). The formation of voting habits. *Journal of Elections, Public Opinion and Parties*, 22(4):431–456.
- Gerber, A., Green, D., and Shachar, R. (2003). Voting may be habit-forming: Evidence from a randomized field experiment. *American Journal of Political Science*, 47(3):540–550.
- Geys, B. (2006). Explaining voter turnout: A review of aggregate-level research. *Electoral Studies*, 25(4):637–663.
- Green, D. and Shachar, R. (2000). Habit formation and political behaviour: Evidence of consuetude in voter turnout. *British Journal of Political Science*, 30(4):561–573.

- Margolis, M. and Resnick, D. (2000). *Politics as usual: the cyberspace" revolution"*. Sage Publications, Inc.
- Mossberger, K., Tolbert, C., and Stansbury, M. (2003). *Virtual inequality: Beyond the digital divide*. Georgetown University Press.
- Nickerson, D. (2008). Is voting contagious? evidence from two field experiments. *American Political Science Review*, 102(1):49–57.
- Norris, P. (2001). *Digital Divide: Civic Engagement, Information Poverty, and the Internet Worldwide*. Cambridge University Press.
- Plutzer, E. (2002). Becoming a habitual voter: Inertia, resources, and growth in young adulthood. *American Political Science Review*, 96(1):41–56.
- Putnam, R. (2001). *Bowling alone: The collapse and revival of American community*. Simon and Schuster.
- Smets, K. and van Ham, C. (2013). The embarrassment of riches? a meta-analysis of individual-level research on voter turnout. *Electoral Studies*, 32(2):344–359.
- Solop, F. (2002). Digital democracy comes of age: Internet voting and the 2000 arizona democratic primary election. *PS: Political Science and Politics*, 34(2):289–293.
- van Dijk, J. (2000). *Digital democracy: Issues of theory and practice*, chapter Widening information gaps and policies of prevention., pages 166–183. Sage.
- van Dijk, J. (2005). *The deepening divide: Inequality in the information society*. Sage.

Vassil, K., Solvak, M., Vinkel, P., Trechsel, A., Alvarez, R., and Hall, T. (2014). Diffusion of internet voting: Usage patterns of internet voting in estonia between 2005-2013. *Paper presented at the 72nd MPSA Annual Conference, 3-6 April, 2014, Chicago.*

Wilhelm, A. (2000). *Democracy in the digital age: Challenges to political life in cyberspace.* Routledge.

A Appendix: summary statistics

Table A1: Means and standard deviations (in parentheses) of the variables used

	2009	2011	2013	2014	Total
$E - vote_t$	0.49 (0.50)	0.50 (0.50)	0.21 (0.41)	0.23 (0.42)	0.36 (0.48)
$E - vote_{t-1}$	0.35 (0.48)	0.26 (0.44)	0.21 (0.40)	0.18 (0.38)	0.24 (0.43)
$Mode_{t-2}$: e-vote	0.08 (-)	0.18 (-)	0.07 (-)	0.11 (-)	0.11 (-)
$Mode_{t-2}$: paper vote	0.55 (-)	0.47 (-)	0.65 (-)	0.60 (-)	0.57 (-)
$Mode_{t-2}$: non-vote	0.37 (-)	0.35 (-)	0.28 (-)	0.29 (-)	0.32 (-)
PC lit. good	0.39 (0.49)	0.36 (0.48)	0.32 (0.47)	0.44 (0.49)	0.38 (0.48)
PC lit. average	0.31 (0.46)	0.31 (0.46)	0.30 (0.46)	0.25 (0.44)	0.29 (0.46)
PC lit. basic	0.13 (0.33)	0.13 (0.34)	0.16 (0.36)	0.13 (0.33)	0.14 (0.34)
PC lit. poor	0.17 (0.37)	0.19 (0.39)	0.21 (0.41)	0.17 (0.37)	0.18 (0.39)
Age	47.67 (17.37)	50.37 (18.10)	51.12 (17.61)	49.31 (18.14)	49.63 (17.85)
Educ. higher	0.36 (0.48)	0.34 (0.47)	0.27 (0.44)	0.28 (0.45)	0.31 (0.46)
Educ. secondary	0.55 (0.50)	0.55 (0.50)	0.54 (0.50)	0.53 (0.50)	0.54 (0.50)
Educ. basic	0.10 (0.29)	0.11 (0.31)	0.19 (0.39)	0.19 (0.39)	0.14 (0.35)
Income decile	4.44 (2.95)	3.85 (3.38)	4.85 (3.04)	4.95 (3.12)	4.50 (3.16)
Trust e-vote	0.87 (0.33)	0.74 (0.44)	0.70 (0.46)	0.78 (0.42)	0.78 (0.42)
Trust internet transactions	0.88 (0.33)	0.56 (0.50)	0.78 (0.42)	0.81 (0.39)	0.76 (0.43)
Confident own e-vote count as cast	0.95	0.93	0.92	0.90	0.93

Continued on next page

Table A1 continued from previous page

	2009	2011	2013	2014	Total
	(0.22)	(0.25)	(0.28)	(0.29)	(0.26)
Confident other e-votes count as cast	0.91	0.88	0.85	0.83	0.87
	(0.28)	(0.32)	(0.35)	(0.38)	(0.34)
N	1000	1007	1042	1002	4051