Welcome to Novaland: A Proof-of-Concept Study to Analyse Individual Behaviour in a Virtual State on a Text-Based Platform

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Abstract: What if researchers could experimentally manipulate all characteristics of states, economies and public policies and estimate their effects on citizens? This paper summarises evidence from a study allowing such manipulation in a virtual online state. Novaland is a fictitious liberal democracy and welfare state with realistic characteristics. For our novel text- and image-based online platform, we recruited 346 German residents via social media. These participants concurrently participated in an online study of the virtual state and were surveyed before and after. Within Novaland, they were randomly assigned to different experiences, defined by income, corruption, unemployment and a natural disaster. They interacted in sequential phases to co-create collective decisions, including elections and donation pools, which affected the course of the virtual state. We find: (1) the Novaland platform worked technically well, enabling simultaneous online interactions among over 300 participants. (2) Participants behaved in an internally and externally valid manner. (3) The real-world political orientation of participants influenced how they behaved in Novaland, whereas

other sociodemographic characteristics showed little influence. (4) The assigned treatments causally affected political and social behaviour in Novaland. Overall, this data collection is encouraging as it demonstrates the potential of political science research in virtual worlds.

Word count: 6,238 words including table entries and excluding references.

1. Introduction

What can we learn about political behaviour from an experimental virtual-state approach? We present evidence from a study design allowing to manipulate economies, institutions, politics and public policies in a virtual online state called "Novaland." Novaland does not exist. We described it as a liberal democracy and welfare state in which instances of bad governance and corruption as well as individual bad luck could materialise. Participants experienced different versions of Novaland depending on their assigned treatment groups. They had to assess given situations, express opinions and make decisions on multiple occasions. By voting in an election and donating to a disaster relief fund, participants interactively co-created collective outcomes.

Experimentally manipulating state features allows us to vary experiences that we normally cannot vary. We assess the internal and external validity of measurements in this artificial world. As an example, we focus on political solidarities, individuals' willingness to shoulder costs of public redistribution (Goerres 2021; Goerres and Höhne 2023). We test whether this willingness changes by assigned income, corruption experience, unemployment and loss of assets in a natural disaster - factors typically beyond experimental control. In Novaland, we can vary them and explore whether participants' behaviour has meaningful implications for the real world.

Methodologically, we also investigate whether our virtual-world approach can reduce survey fatigue and respondent inattentiveness, issues that become ever more serious in online survey research (Koning et al. 2021; Höhne et al. 2020). Technically, we tested whether the simultaneous interaction of several hundred people in an online environment programmed in the Python-based oTree platform worked. This is not

trivial because interactions mean that information between participants and the server had to be quickly transmitted, stored and retrieved without significant delays.

First, we give an overview of what Novaland looks like. Second, we embed the study in the scarce literature on virtual world studies. Third, we present an assessment framework for this new virtual state study to gauge its added value to political methodology. Fourth, we present the details of our specific data collection before we, fifth, check the anticipated expectations with our empirical evidence. Sixth, we conclude the paper and provide avenues for future research.

2. The Novaland Experience: An Overview

We created a fully online environment in which participants interacted anonymously for about one hour. In this virtual world, participants became citizens of Novaland, a fictitious state with features drawn from existing liberal democracies and welfare states. In Novaland, participants earned different personal incomes, possibly encountered bribing opportunities in an interaction with the welfare state, could face unemployment with partial income loss and could endure a natural disaster with major asset loss.

As a repeated measure, participants were regularly surveyed about their perceived tax burden in Novaland. In addition, participants interacted to co-produce collective outcomes, including a parliamentary election in a four-party system (see Figure 1 for an illustration) and donating to a disaster relief fund that would then be redistributed.

Novaland is a low-immersive virtual study that provides participants with a general overview of life in a virtual state and simulates five months in Novaland. Participants only get text and some images, so that they are at no point under the visual illusion to

be somewhere else. Participating in Novaland only requires internet access and is independent of the browser and device type. Participants were enumerated with an incentive of 12 € (~ 13 US$) for full completion. The look of Novaland was professionally designed and includes easily accessible colour and font schemes.[1]

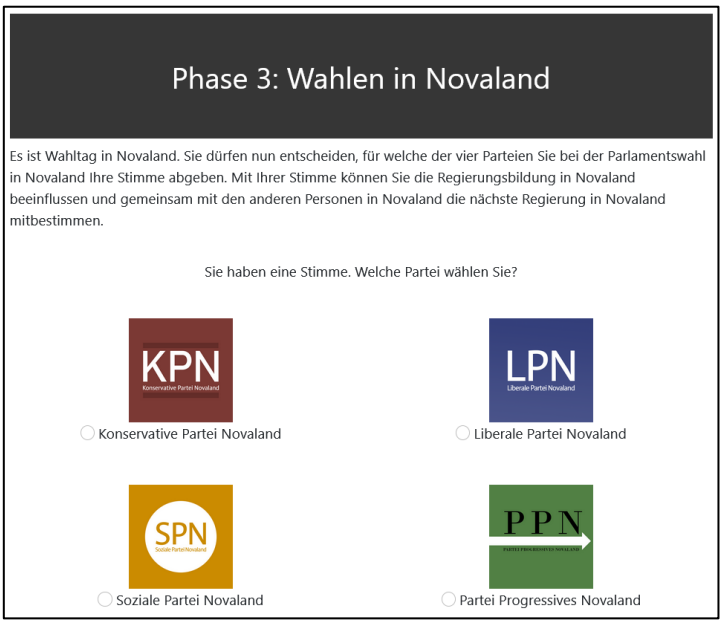

Figure 1. Screenshot of the Novaland election page including four political parties.
Note. Party orientations are as follow: "Konservative Partei Novaland" stands for lower taxes and welfare, but stricter immigration law. "Liberale Partei Novaland" stands for lower taxes and welfare, but looser immigration law. "Soziale Partei Novaland" stands for higher taxes and welfare, but stricter immigration law. "Partei Progressives Novaland" stands for higher taxes and welfare, but looser immigration law.

3. Literature Review: Increasing Levels of Immersion

Recall that Novaland is a primarily set in a text-based environment. It is thus methodologically situated between surveys and more immersive types of virtual environments. We compare our platform to existing approaches by increasing levels of immersion.

Text-Only

The simplest form of immersion presents participants with a short textual scenario and asks them to make a decision or judgement, an approach common in vignette studies.

[1] To experience Novaland you can watch this anonymised screencast: https://osf.io/4c5re?view_only=69a57e8c1a6241e692e2ab1c61f72ba8

These confront respondents with hypothetical but systematically varied situations. While vignette studies offer control and comparability, they are artificial: respondents are implicitly asked to imagine themselves in often unfamiliar situations without a change in context. Their external validity therefore remains debated (Eifler and Petzold 2019; but compare Hainmueller, Hangartner, and Yamamoto 2015).

Another text-based approach is the Dynamic Process Tracing Environment (Andersen, Redlawsk, and Lau 2019). For example, participants follow a self-scrolling stream of information to discover relevant information in an artificial political campaign. Participants immerse themselves in such a situation and take an interest in the outcome of the campaign, even long after their participation has ended (Lau & Redlawsk, 2006). This approach has also been used in other areas, such as for studying consumer behaviour in complex information environments (Groenland, Kuylen, and Bloem 1996).

In Novaland, each page resembles a regular online survey by being mostly text-based. But each page is embedded in a narrative, affected by each participants' decisions.

Text with Narrative

A higher level of immersion involves placing participants in virtual world through a narrative. Jetten et al. (2017), introduced MTurk workers to *Mambiza,* a socially stratified virtual state. Participants were randomly assigned to income groups and read newspaper clippings about different levels of economic insecurity in Mambiza. These treatments affected collective angst, self-definitions as competent and warm, and opposition to immigration (also see Tanjitpiyanond, Jetten, and Peters 2022).

Novaland builds on this level of immersion, but we tell a more complex and interactive narrative compared to Jetten et al. (2017).

Adding Images and Virtual Reality

The next level of immersion is to add images and virtual reality to the study. *Moral machin*e asked millions of volunteers to make moral decision based on text and two-dimensional pictures on moral questions that arise around autonomous driving (Awad et al. 2018), similar to conjoint experiments. Behavioural economists have explored virtual environments as experimental settings, attracted by the combination of lab-like control with more diverse subject pools (Atlas 2008). Virtual reality could also enable "framed field experiments" in which context is manipulated while maintaining control (Innocenti 2017). Virtual reality has been, for instance, used to manipulate time perception and study future discounting (Faralla et al. 2021).

Three-dimensional virtual world studies are practically unknown in political science. However, psychologists demonstrated that even complex social behaviours, like helping and the bystander-effect, can be emulated in virtual environments (Kozlov and Johansen 2010). Another application is the moral trolley problem where participants have to decide to push a trolley and kill one person to save many people (Navarrete et al. 2012).

Second Life, a commercial 3D-virtual reality platform, once held promise for social science research. It seemed to make it easier to create environments that imitate real environments in which individuals need to act by adapting rationally to the environment (Innocenti 2017). An overview of five standard instruments from behavioural economics yielded similar results in Second Life to those in the lab (Chesney, Chuah, and Hoffmann 2009; Duffy 2011). Outside behavioural economics, there are no applications in the social sciences to be found on Web of Science (search "Second Life" in relevant research areas, 07 March 2025).

Here is where we depart with Novaland. There is no two- or three-dimensionality in Novaland apart from some AI-generated pictures that show the result of in-experience choices. This is a conscious decision, balancing participants' immersion with the cost to develop and maintain such a platform.

Role-Playing

The highest level of immersion involves participants to take on the role of somebody else rather than to act as their virtual twin. Most studies discussed so far did not ask this from participants. Novaland therefore draws on commercial government simulation games (e.g., The Political Machine 2016 or Democracy 3), offline role-play teaching in which participants act as citizens (Shellman 2001), and online simulations in international relations teaching in which participants act as policy-makers (Stover 2005) or post-hoc political scientific assessment of online role playing behaviour (Bramson et al. 2022) We also apply principles of early text adventure computer games of the 1980s and 1990s, and online political science experiments (Del Ponte and DeScioli 2019) are applied. To our knowledge, only one similar text-based online role-playing study exists: Simonovits, Kézdi, and Kardos (2018) asked participants to role-play as a minority group member, and then measured their attitudes towards that group.

In the presented version of Novaland, all participants assume the role of a 51-year-old individual of their chosen gender to maintain consistency. In other versions not discussed here, participants were instructed to act as themselves.

Beyond Immersion: Reducing Survey Fatigue and Inattentiveness

Virtual world studies may not only increase immersion, but also help reduce survey fatigues, improve attentiveness and boost completion rates. Standardised survey, especially random-sample population studies, face declining response rates for

decades (Pforr et al. 2015). Participation is increasingly skewed: For example, politically interested individuals are more likely to respond to political science surveys, biasing results through self-selection.

Worsening response rates in population studies are related to the advent of online surveys (Daikeler, Bošnjak, and Lozar Manfreda 2020; Lozar Manfreda et al. 2008), increasing the frequency of survey invitations and creating survey fatigue (Koning et al. 2021). With surveys cheap and easy to program, the challenge has shifted from implementing the study to ensuring participants complete it attentively. Researchers conducting an online survey usually lack control over who participates (Höhne et al. 2025, 9) and how attentive they are (Höhne et al. 2020). In response, methodologists have developed attention checks (Shamon and Berning 2020) and introduced elements of gamification in surveys (Keusch and Zhang 2015).

Online surveys carry low social value—anyone can create one on a free platform. In contrast, virtual-world studies send a stronger signal of effort and uniqueness. This increases their perceived value and entertainment appeal. Participants may join not for the topic, but for the novelty of the experience—potentially broadening the sample and reducing self-selection.

4. An Assessment Framework for Novaland

We are interested in explaining why some people are willing to shoulder costs for other groups by public redistribution, and others are (Goerres 2021; Goerres and Höhne 2023; Rothstein 2021). There is plethora of factors that determine this willingness, including the four determinants we consider: income (Doherty, Gerber, and Green 2006), the experience of corruption (Rothstein and Eek 2009), the experience of unemployment (Naumann, Buss, and Bähr 2016) and being affected by external

shocks, such as natural disasters (Pañeda-Fernández 2022). All factors have already been studied extensively, and now we import them into the virtual state of Novaland.

To estimate the impact of these independent variables, we use one central dependent variable: participants' rating of their individual tax burden in Novaland. All participants pay the same 30% flat income tax regardless of their income, and regularly evaluate their overall tax burden in Novaland. We expect the perceived tax burden to be higher for (1) participants with lower Novaland income, (2) participants who experience unemployment in Novaland, (3) participants who experience on-the-spot corruption at the interface with an agent of the state in Novaland and (4) participants who fall victim to a natural disaster in Novaland.

To evaluate our virtual-state approach, we propose a validity-driven assessment framework. Specifically, we examine two aspects of internal and one aspect of external validity. Other criteria, such as replicability, are not considered here to maintain the paper's focus.

The Perception of Novaland

Optimally, all participants interpret the Novaland stimuli in a similar way. The information, layout and other design aspects should be comprehended similarly across participants. For instance, they must correctly understand their role as citizens of Novaland, and their ability to influence its politics through voting. There should be no systematic variation in this understanding. This first internal validity test is conducted through five comprehension checks. In addition, we test the previously mentioned associations between the tax burden rating and income, unemployment, corruption and becoming a victim of a natural disaster in Novaland. These two empirical tests serve as proxies for determining internal validity.

Sincere Behaviour in Novaland

Participants are informed that they interact anonymously with real people in a fully virtual setting. Novaland takes place in a self-administered online mode, in which participants cannot be monitored by experimenters, different from an in-person lab setting. In addition, there is no such thing as punishment for insincere behaviour, such as satisficing response behaviour (Krosnick 1991). Participants do not face negative consequences as long as they continue until the end. More specifically, they have to participate for the entire hour to receive the incentive. The motivation for this approach was to ensure that participants immerse themselves and to prevent undesirable behaviour, such as breaking-off, severely compromising the success and quality of Novaland. This second internal validity test is conducted through an analysis of break-off (i.e., not finishing the entire study) and speeding (i.e., extremely fast reading and responding without the possibility to thoroughly participate). In addition, we look at the association between speeding and comprehension check success.

Associations Between Novaland and the Real World

We finally examine one aspect of external validity. To draw conclusions about political and societal behaviour from Novaland (in-experience variables) we investigate their associations with participant characteristics and behaviours in the real world (out-of-experience variables). To this end, we attempt to predict perceived tax burden in Novaland with participants' real income, left-right orientation, and preferences on taxes and welfare (all three are self-reported measures). We expect a higher perceived tax burden in Novaland among those with higher income, those on the right, and those who want lower taxes and reduced welfare services in the real world. This would mirror previous research on the associations of tax preferences and tax burden perceptions with income (Gideon 2017; Yamamura 2025; Fernández-Albertos and Kuo 2018), left-right orientation, and welfare state support (Bremer and Bürgisser 2024; Jacques

2023; Roosma, van Oorschot, and Gelissen 2016). Moreover, research has shown that women, the highly educated, and those on the political left tend to donate more (Rajan, Pink, and Dow 2009). We therefore investigate the effects of gender, education, and left-right orientation on donations in Novaland. In addition, we investigate the association between donating in Novaland and donating the incentive (in the amount of 12€) paid out for completing in the study, assuming a positive association between in-experience and out-of-experience donations.

5. Details on the Data Collection

Collecting Data Through a Social Media Recruitment Strategy

Novaland is programmed on the Python-based oTree platform (Chen, Schonger, and Wickens 2016) and its code will be publicly available on Github. We started by developing storyboards for the development of the Novaland experience and then commissioned its programming to a professional programmer. Data was collected on May 3, 2023, from a convenience sample recruited via social media advertisements on Instagram and Facebook with no info advertised as to the study content. Participant recruitment started on April 28, 2023. Participants were required to register for the study until 6 pm on May 2, 2023. The day before the data collection, an email with individualised access links was sent out to all registered participants. The registration process involved a short survey on sociodemographic characteristics and some political attitudes. These pieces of information were both unlikely to prime respondents and impossible to be affected by treatment effects (see Blackwell et al. 2025). In total, 609 individuals registered to participate, of which 431 participants (71%) started, of which 346 participants (80%) completed the entire Novaland study. If not reported otherwise, only statistics on those who finished participation are reported. For some

variables, such as sociodemographic data and comprehension checks, there is some item non-response, which never accounts for more than 5 % of participants. In all descriptive statistics, missing percentages to 100% are therefore due to item nonresponse.

Participation took about one hour (from 7 to 8 PM) and participants received an incentive of 12€ that was paid out via the online money transfer system PayPal. Instead of a pay-out, 20 participants (6 %) donated their incentive to "Tafel Deutschland," the German association of local food banks. The data collection is based on a data management plan agreed upon with the university's data protection officer. Ethics approval was granted by an ethics review board at the University of Duisburg-Essen.

We had conducted no power analysis as we our primary interest was not the estimation of causal effects of theoretical interest, but to maximise the number of participants who would engage with our server.

The Temporal Structure of Novaland

Participants experienced their own version of Novaland as its citizens. While we defined the five phases of the virtual state representing a time-span of five months, the course Novaland took depended on participants' collective decisions. Participants earned a monthly income in Novas (explained to be about at parity with the Euro), had living expenses (e.g., housing and food), participated in an election, experienced a natural disaster in the form of a wildfire, and could donate from their savings in Novaland. Table 1 presents the five Novaland phases and their content.

Table 1. Phases of Novaland

Phase	Time period	Scope
1	7.00	Introduction and story telling
2		Income, corruption, unemployment treatment, spending decisions
3	7.29 pm	Party platforms and election

4	7.30 to 7.39 pm	Election outcome and natural disaster
5	7.40 to 8.00 pm	Disaster treatment

After general information on Novaland in phase 1, participants were informed about their income, and the taxes they have to pay in phase 2. They then made spending decisions regarding housing, food and leisure costs. These obliged expenses served three purposes: (1) to support immersion in Novaland, (2) to validate the manipulation of income and (3) to mitigate experimental demand effects. Afterwards, they could face the corruption and unemployment treatment. In total, four sequential random assignments were implemented in the data collection, all with equal group sizes and orthogonal to one another in a 3-2-2-2 design. Table 2 illustrates the treatments.

Participants interacted sequentially at two points in Novaland: In phase 3, they voted in parliamentary elections, choosing among four parties. In phase 4, they learned about the election results: Depending on vote shares, a new government was formed that changed income tax progressivity, directly affecting participants' Novaland income. In the same phase, participants were informed about a wildfire affecting Novaland and could donate to a disaster relief fund. In phase 5, half of participants were randomised to be directly affected by the wildfire. Donations from phase 4 were then distributed to them, creating a second sequential interaction. The platform allows expansion to real-time interactions such as group chats or behavioural games. Participants concluded the study by completing a post-experimental survey.

Table 2. Overview of treatments in Novaland

Phase	Order	Manipulation	Content	Treatment Groups
2	1st	Income	Net monthly income	0) 1400 Novas (low), 1) 2000 Novas (middle), 2) 3500 Novas (high)
2	2nd	Corruption	Opportunity to bribe to jump the queue for COVID-19 vaccination	0) No corruption 1) Corruption

2	3rd	Unemployment	Unemployment due to insolvency of the employer	0) No unemployment 1) Unemployment
5	4th	Disaster	Losing most assets due to a wildfire	0) Not affected 1) Affected

Note. In independent tests for the effectiveness of random assignment for each treatment, we found no significant differences regarding age, gender, education, income, immigrant status and recruitment platform.

Variable Description

During the registration process, we measured most of participant's sociodemographic characteristics and attitudes, which are thus measured pre-treatment. This involved information on the social media platform (Facebook and Instagram) from which participants were recruited: recruitment platform (0=Facebook, 1=Instagram). We also measured the following sociodemographic characteristics: age (in years), gender (0=male and diverse, 1=female), education (0=no school certificate giving access to higher education, 1=school certificate giving access to higher education), personal net income (in Euros), immigrant status (0=not first-generation immigrant, 1=first-generation immigrant), and political orientation (0=left to 1=right).

Within Novaland, we included five comprehension checks. In phase 1, the comprehension checks asked participants about the following aspects: (1) citizenship in Novaland, (2) right to vote, and (3) governmental financing. In phase 2, they asked about (4) participants' personal income in Novaland, and (5) personal income in relation to others. Participants' answers were dummy-coded: correct (1=yes). We also measured participants' tax burden rating in phases 2 (twice), 3, 4, and 5 (twice) (0=too low to 1=too high). In response to the wildfires, participants could donate to the victims: Donated in Novaland (1=yes).

In the post-experimental survey following immediately after Novaland, we asked for real-world attitudes, donating the incentive, and evaluations of study participation. We measured participants' preferences weighting taxes against welfare services: taxes vs

welfare (0=lower taxes and welfare services to 1=more taxes and welfare services). We also measured participants' real-life donation behaviour by asking them whether they would like to donate their incentive to the association of German food banks: incentive donation (1=yes). We measured participants' location during the study: at home (1=yes). Finally, we measured the participation device: mobile device (1=yes).

We standardized all variables so that they run from 0 to 1 to facilitate statistical comparisons and results interpretation. Online appendix A1 includes English translations of all questions used in this study including answer formats (e.g., rating scales).

Sample Description

Participants had a mean age of about 42 years. About 57% of them identified as female, 40% as male, and about 1 % as diverse. In terms of education, about 27% of participants did not have a school certificate allowing them access to higher education (low to medium education level), whereas 71 % of participants had "Abitur", the highest school-leaving certificate (high education level). Participants' median net personal income was 1750€, and about 8% were first generation immigrants. About 51% were recruited from Facebook, and 48% from Instagram. Most participants completed the survey from home (89%), and about 51% used a mobile device (i.e., smartphone or tablet) to participate.

6. Empirical Results

We will follow our validity-driven assessment framework and first report our results with respect to internal validity. We then will turn to the results on external validity.

Internal Validity: The Perception of Novaland

To infer participants' commitment and attention during their time in Novaland, we investigate participants' answers to five comprehension checks. As shown in Table 3, the majority of participants successfully passed the comprehension checks, indicating that they paid close attention to the information provided in Novaland. However, a substantially higher number of participants passed the checks in the first phase (>90%) than the checks in the second phase (>73%). This suggests that participants either got inattentive over time (a sign of fatigue) or that the comprehension checks in the second phase were more challenging. Item nonresponse to the comprehension checks varies between about 2% and 5%.

Table 3. Outcome of the comprehension checks

Phase	No	Comprehension check	Correct (%)	Incorrect (%)	Item nonresponse (%)
1	1	Citizenship	90.5	6.4	3.2
	2	Right to vote	93.4	2.0	4.6
	3	Governmental financing	95.1	2.0	2.9
2	4	Personal income	86.4	11.0	2.6
	5	Income compared to others	73.7	24.6	1.7

Note. Due to rounding, the percentages may not add up 100%. Number of observations: 346.

In a next step, we evaluate the treatment effects with a question asking participants to rate their personal tax burden in Novaland multiple times across phases. Remember high values indicate participants perceived their tax burden as too high. As shown by the OLS regression results in Table 4, we find significant differences in the tax burden rating for our income treatment, which randomly allocated participants to earn a low, middle or high income in Novaland. Participants in the low-income group rated their

tax burden as significantly higher than those in the middle- and high-income group. However, there is no significant difference in tax burden ratings between those in the middle- and high-income groups (b=-0.040, SE=0.022, p=0.075). In contrast to our expectation, the corruption treatment did not affect participants' tax burden rating at all. Turning to the unemployment treatment, we find that those who experienced unemployment rated their tax burden to be higher than those not affected by unemployment in Novaland. Again, this finding is in line with our expectations. Finally, we find that those directly affected by the disastrous wildfire rate their tax burden significantly higher than those not directly affected by it. In sum, our substantive expectations worked for three out of four treatments.

Table 1. OLS regression models predicting tax burden rating

	Dependent variable: Tax burden rating measured at			
	Phase 2 No 1	Phase 2 No 1	Phase 2 No 2	Phase 5 No 2
Model	(1)	(2)	(3)	(4)
Middle income treatment	-0.104 SE=0.022 p<0.001			
High income treatment	-0.144 SE=0.022 p<0.001			
Corruption treatment		-0.021 SE=0.019 p=0.276		
Unemployment treatment			0.132 SE=0.020 p<0.001	
Disaster treatment				0.053 SE=0.025 p=0.037
Constant	0.724 SE=0.016 p<0.001	0.652 SE=0.013 p<0.001	0.632 SE=0.015 p<0.001	0.610 SE=0.017 p<0.001
R^2	0.114	0.002	0.108	0.019

Note. Each cell shows the estimate, the standard error (SE), and the p-value (p). Tax burden ratings run from 0=too low to 1=too high. Number of observations: 346 to 228.

Internal Validity: Sincere Behaviour in Novaland

As shown in Table 5, only 85 participants out of the 431 participants that started Novaland broke off before its end. This results in an overall break-off rate of about 20%, which aligns with common break-off rates in web surveys (Schlosser and Mays 2018). Most of these break-offs took place in the very first phase (about 10%). The remaining break-offs took place somewhere on participants' way to the fifth phase, with a very low break-off rate in the second phase. Online appendix A2 provides a logistic regression model analysing break-off, indicating that break-off is not related to participants' sociodemographic characteristics, such as age and gender. In total, 346 participants remained for the substantive statistical analysis.

Next, we look at speeding. Participants are defined as speeders if they sped on at least one survey page, i.e. completed a page under a time threshold of 150ms reading time per word (Brysbaert 2019). Response times were measured in seconds on the server-side level, and therefore include page loading times (Heerwegh 2011). The number of speeders increased over the phases, except for phase 5. However, the high prevalence of speeders masks that there was low speeding on the page level. On average, speeding only occurred on about 11% of the pages in Novaland. Online appendix A2 provides a logistic regression model analysing speeding, indicating that it was negatively associated with older age, but not with any other sociodemographic characteristics.

Table 5. Break-off and speeding in Novaland

	Phase					
	1	2	3	4	5	Total
Break-off						
Number of break-offs	43	4	11	17	10	85
% of starting participants	10.0	0.9	2.6	3.9	2.3	19.7
Speeding						
Number of speeders	184	179	241	244	104	302
% of completes	53.2	51.7	69.7	70.5	30.1	87.3
% of pages speeded	13.2	8.3	17.6	14.2	3.3	10.9

Note. Number of observations: 431 for break-off and 346 for speeding.

We additionally analysed whether and to what extent speeding is negatively associated with successfully passing the comprehension checks (in phase 1, phase, 2 and both phases). As shown in Table 6, the results of pairwise correlations (Pearson's Phi) indicate no significant association between speeding and comprehension check passing. This indicates that even speeding participants pay sufficient attention to consume key information in Novaland.

Table 6. Pairwise correlations between speeding and comprehension check success

	(1) Speeder in phase 1	(2) Speeder in phase 2	(3) Speeder in phase 1 or 2
All comprehension checks correct	-0.069 p=0.197	-0.015 p=0.786	-0.076 p=0.157

Note. Phi coefficient between a binary variable indicating whether a participant answered all comprehension checks correctly (1=Yes) and whether a respondent showed speeding behaviour on at least one page in phase 1, in phase 2, or in phases 1 or 2 (1=Yes). Number of observations: 346.

External Validity: Association Between Novaland and the Real World

To assess the external validity of measurements in Novaland, we examine whether participants' behaviour in Novaland aligns with their real-world characteristics, attitudes and donation behaviour. For this purpose, we investigate the association between participants' real-world income, left-right orientation, and preferences on taxes and welfare with the tax burden ratings in Novaland. Specifically, we expect participants to rate their tax burden as higher if they have higher real-life income, a more right-wing political orientation, and favour lowering taxes and reducing welfare services. Table 7 shows results from OLS regression models with the perceived tax burden averaged over its six measurements in Novaland as dependent variable.

Overall, our findings align with our expectations. Those with higher income perceive their tax burden in Novaland as significantly higher. This also applies when including control variables, such as age and gender. Similarly, participants with a more right-wing political orientation perceive their tax burden in Novaland to be significantly higher than those with a more left-wing political orientation. This finding still remains the same after the inclusion of control variables. Finally, we find that participants who favour lower taxes and reduced welfare services in the real world perceive their tax burden in Novaland as significantly higher. Again, this finding holds both when including the controls, indicating the robustness of our results.

Table 7. OLS regression models predicting tax burden rating with real-life characteristics

	Dependent variable: Average tax burden rating					
Model	(1)	(2)	(3)	(4)	(5)	(6)
Personal income	0.173 SE=0.060 p=0.004	0.240 SE=0.069 p=0.001		0.202 SE=0.070 p=0.004		0.153 SE=0.070 p=0.029
Left-Right orientation			0.134 SE=0.047 p=0.004	0.113 SE=0.047 p=0.017		
Taxes vs welfare					-0.165 SE=0.031 p<0.001	-0.141 SE=0.032 p<0.001
Age		-0.004 SE=0.048 p=0.937		0.001 SE=0.048 p=0.977		0.012 SE=0.047 p=0.791
Gender		0.036 SE=0.020 p=0.069		0.039 SE=0.020 p=0.051		0.029 SE=0.019 p=0.136
Education		-0.024 SE=0.023 p=0.298		-0.020 SE=0.023 p=0.398		-0.019 SE=0.023 p=0.407
Immigrant status		0.106 SE=0.034 p=0.002		0.106 SE=0.033 p=0.002		0.099 SE=0.033 p=0.003
Recruitment platform		0.027 SE=0.021 p=0.199		0.024 SE=0.021 p=0.254		0.025 SE=0.020 p=0.207
Constant	0.619 SE=0.018 p<0.001	0.578 SE=0.036 p<0.001	0.610 SE=0.021 p<0.001	0.537 SE=0.040 p<0.001	0.746 SE=0.018 p<0.001	0.666 SE=0.041 p<0.001
R^2	0.025	0.076	0.024	0.092	0.080	0.130

Note. Each cell shows the estimate, the standard error (SE), and the p-value (p). Average tax burden ratings run from 0=too low to 1=too high. Number of observations: 330.

Second, we analyse whether gender, education, and political orientation are associated with donations in Novaland. We expect women, the highly educated and those on the political left to be more likely to donate in Novaland. Table 8 reports logistic regression results with a dichotomous dependent variable indicating whether participants donated in Novaland (1=yes). Importantly, we exclude participants unable to donate in Novaland due to a negative or zero account balance.

Contrary to our expectations, female and higher-educated participants are not significantly more likely to donate in Novaland. The coefficient for gender is positive but not statistically significant (in both models). Likewise, having obtained a school-leaving certificate granting access to higher education is not significantly associated with a donation in Novaland. However, we find support for our expectation on the effect of left-right orientation. Participants on the right are significantly less likely to donate in Novaland. This also applies when including control variables, such as gender and education, indicating the robustness of this result.

Table 8. Logistic regression models predicting whether participant donated in Novaland with real-life characteristics

	Dependent variable: Donated in Novaland				
Model	(1)	(2)	(3)	(4)	(5)
Gender	0.663		0.266		0.146
	SE=0.384		SE=0.423		SE=0.446
	p=0.084		p=0.529		p=0.743
Education		-0.710	-0.086		-0.220
		SE=0.506	SE=0.558		SE=0.570
		p=0.161	p=0.878		p=0.700
Left-Right orientation				-3.598	-3.204
				SE=0.987	SE=1.059
				p<0.001	p=0.002
Age			2.458		2.337
			SE=1.174		SE=1.195
			p=0.036		p=0.050
Personal income			-3.646		-2.689
			SE=1.350		SE=1.415
			p=0.007		p=0.057
Immigrant status			0.057		0.050
			SE=0.789		SE=0.802
			p=0.942		p=0.951
Recruitment platform			0.128		0.098
			SE=0.442		SE=0.452
			p=0.773		p=0.828
Constant	1.872	2.760	2.223	3.825	3.617
	SE=0.253	SE=0.461	SE=0.809	SE=0.532	SE=0.982
	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001
Pseudo R^2	0.015	0.011	0.071	0.070	0.118

Note. Each cell shows the estimate, the standard error (SE), and the p-value (p). Donated in Novaland (1=yes).

Number of observations: 312.

Finally, we examine whether donation behaviour in Novaland predicts real-world donation choices. Specifically, we expect a positive association between donating in Novaland and donating the study incentive in the amount of 12€. Initially, we intended to estimate logistic regression models with the dependent variable donating the study incentive (1=yes) as dependent variable. However, all participants who refrained from donating in Novaland also chose to keep their study incentive. We are thus unable to estimate these models. Instead, we take a simpler approach and report a cross-

tabulation of donations in Novaland and the study incentive in Table 9. We test for their independence using Fisher's Exact Test. The test's outcome indicates that the donations are not independent from each other. Participants that do not donate in Novaland show a lower prevalence of donating their study incentive, supporting our expectation.

Table 9. Cross-Tabulation of donation in Novaland with donation of the real-world incentive

			Donated in Novaland			
			No	Yes	Unable to donate	Total
Donated Study Incentive	No	N Observed	33	278	15	326
		% Total	9.5	80.4	4.3	94.2
	Yes	N Observed	0	16	4	20
		% Total	0	4.6	1.2	5.8
	Total	N Observed	33	294	19	346
		% Total	9.5	85.0	5.5	100
Fisher's Exact Test: p=0.017						

Note. Number of observations: 346.

7. Conclusions

In this paper, we explored the potential of virtual world studies in political science. Such designs enable manipulation of experiences, such as economic shocks or unemployment, that can normally only be observed. We introduced Novaland, a novel virtual online state that allows researchers to experimentally manipulate normally immutable individual and institutional characteristics, such as income levels and elections. Our main results are: (1) the platform worked technically well, with over 300 participants simultaneously interacting online at the same time. (2) Participants behaved in an internally and externally valid manner. (3) Real-world political

orientations of participants, but not sociodemographic characteristics, influenced behaviour in Novaland. (4) The treatments causally affected the way in which the participants behaved towards others and towards politics and policies in Novaland.

The sequential virtual state approach used in Novaland produces internally valid results. The comprehension checks indicate a high level of attention during participation, with success rates of up to 95%. While success declined from phase 1 to phase 2, this likely reflects higher task difficulty, especially for the income-related check (with only 74% success rate), rather than increasing inattentiveness. Participants' tax burden ratings matched our expectations in three out of four tests, providing further empirical support for the internal validity of Novaland. These findings indicate that political scientists can use Novaland to test theoretically derived hypotheses, before investing in more costly field experiment.

Participants also showed sincere participation behaviour in Novaland. Break-off rates were similar to those observed in other self-administered online survey (Schlosser and Mays 2018). Most importantly, there is no evidence for differential break-off by sociodemographic characteristics (see Online appendix A2). We count this as very good news. While the 12€ incentive was relatively high, compared to, for example, 5€ in the high-quality German FReDA panel on couple experiences (Schneider et al. 2021), it was appropriate given the respondent burden of registering in, scheduling of, and participating in the study for an hour. Another indicator of sincere participation is the low rate of speeders on a page-level. As shown by previous research, speeding is associated with satisficing behaviour, such as primacy effects (Malhotra 2008). Additionally, the non-association between speeding and successful comprehension check answering provides further evidence for Novaland's internal validity.

Novaland offers political scientists a powerful experimental tool for studying individual and institutional factors typically beyond their control. By experimentally isolating the effects of highly correlated individual characteristics, Novaland allows researchers to disentangle their causal effects — something that is difficult in observational studies. Beyond individual-level factors, Novaland also enables experimental variation of institutional designs, which are typically stable and correlated with cultural or historical factors in real-world settings. By modifying key institutional features, such as electoral systems or policy regimes, researchers can identify the causal effects of institutions. Finally, a dynamic approach could also be applied to show, for example, how changes in electoral rules influence voting behaviour. Findings from Novaland can have real-world relevance, as demonstrated by our assessment of external validity. They can therefore inform broader political science debates and complement more traditional field studies.

Novaland has broader applications beyond research. First, it can be used in teaching. Students can be asked to think about institutional design, implement these institutions in Novaland, and test how participants, such as their class peers, react to design features. Second, the platform can serve as a virtual policy lab. Before policy-makers implement a public policy, they could test how citizens react to that policy in the artificial world of Novaland. This is especially useful in a political system like Germany, where strict legal rules prohibiting the unequal treatment of citizens constrain piloting of public policies. Third, empirical democratic theorists can implement utopian or dystopian versions of democratic systems in the Novaland experience. For instance, decision by delegation to mini-publics or other features of modern direct democracy can be simulated. Fourth, researchers can explore whether experiences in Novaland influence real-world behaviour. For instance, does experiencing bad luck in Novaland make people more sensitive towards the unlucky in the real world?

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