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Prosociality and endorsement of liberty: Communal and individual predictors of attitudes towards surveillance technologies

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ABSTRACT

Background: During the coronavirus disease 2019 (COVID-19) pandemic, digital tracking technologies were recognised as one of the key tools in preventing the spread of the virus and maintaining health security. However, they also raised numerous controversies because of their potential to endanger civil rights and privacy. Most studies on the acceptance of anti-COVID-19 tracking technologies did not include important social factors and did not examine the directionality between variables. We aimed to fill this gap in the present study.
Methods: We conducted a four-wave, representative longitudinal panel survey among Polish citizens on the relationship between acceptance of anti-COVID-19 tracking technologies and prosociality, national identification, and endorsement of individual liberty. Analyses were performed using random-intercept cross-lagged panel models.
Results: We observed bidirectional cross-lagged relationships between prosociality and acceptance of anti-COVID 19 tracking technologies, with a stronger path from prosociality to acceptance than the other way around. Endorsement of individual liberty predicted negative attitudes towards technologies and this relation was strengthened by perceived threat of future technological surveillance. We did not find a significant relationship between acceptance of technologies and national identification at the within-subject level.
Conclusions: This is the first study to analyse dynamic within-person relationships between communal and individual aspects and acceptance of anti-COVID-19 surveillance technologies. We conclude that prosocial attitude may lead to social acceptance of technology that, while helpful to fight with a pandemic, might also infringe on personal rights.

1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic has brought about a breakthrough in the development and use of digital health-related technologies on a large scale. Numerous governments have recognised them as key in preventing the spread of the virus and maintaining health security when exiting national lockdowns (Lucivero et al., 2020). Traditional methods used in public health, such as contact tracing or quarantine, have been enriched with new possibilities of monitoring and data collection provided by smartphones, big data analysis, sensors and drones (Couch, Robinson, & Komesaroff, 2020). Critical to the effectiveness of these technologies is acquisition (and integration) of data from numerous sources: smartphone apps, social media, surveillance cameras, and thermal cameras (Budd et al., 2020). However, such a comprehensive collection of data on the behaviour of citizens has raised numerous controversies. Civil rights organisations and freedom advocates have voiced their criticism as to whether the use of these technologies to fight the pandemic meets the principles of lawfulness, necessity, and proportionality (Gasser, Ienca, Scheibner, Sleigh, & Vayena, 2020). One of the concerns was repurposing, which involves the use of extensive surveillance technologies for purposes other than countering the pandemic, leading a more permanent restriction of civil rights even after the pandemic (Nay, 2020).

Most studies on the acceptance of potentially intrusive anti-COVID-19 technologies have examined attitudes towards privacy (Garret et al., 2021; Gerke, Shachar, Chai, & Cohen, 2020), feelings of threat of the infection (Jansen-Kosterink, Hurmuz, den Ouden, & van Velsen, 2020), or individual differences in authoritarianism and the lack of personal control (Wnuk, Oleksy, & Maison, 2020). Recently, however, research linking the acceptance of surveillance technology to more

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social characteristics has begun to emerge, for example, prosociality (e.g. Kokkoris & Kamleitner, 2020; Williams, Armitage, Tampe, & Dienes, 2020). We aimed to extend the existing research to social aspects related to prosociality and national identification together with the individual endorsement of liberty. Additionally, most studies have been correlational, precluding the determination of the causal relationship between the examined variables or changes in the social acceptance of tracking technologies.

To determine whether the acceptance of tracking technologies is shaped by communal attitudes among people or the importance given to individual freedom over security, we conducted a four-wave representative panel study and examined attitudes towards anti-COVID-19 tracking technologies as well as their predictors. To establish a causal relationship between the used variables, we employed an advanced statistical technique: random-intercept cross-lagged panel model.

1.1. Technological surveillance during the COVID-19 pandemic

The pandemic outbreak resulted in the development and implementation of new technologies focused on mitigating the spread of COVID-19. New digital health technologies were developed that used machine learning and automated decision-making based on people's digital footprints to identify those who are potentially infected, trace their contacts, and enforce social distancing (Calvo, Deterding, & Ryan., 2020). Examples of such techniques include analysing location data stored on or generated by smartphones, scanning public spaces with fever detecting infrared cameras, facial recognition, and other computer vision surveillance technologies (Sookman, 2020). Digital contact tracing has been claimed to be more effective in controlling the spread of the virus than mass quarantine and lockdowns (Ferreti et al., 2020).

Gasser et al. (2020) presented four main categories of digital public health technologies developed for pandemic management: proximity and contact tracing, symptom monitoring, quarantine control, and flow modelling. Proximity tracing, often combined with contact-tracing features, measures the spatial proximity between users to identify when users are exposed to a COVID-19-positive individual (e.g. the Singaporean TraceTogether, Polish StopCOVID, Austrian Stopp Corona, and Australian COVIDSafe (see also Garrett et al., 2021; Lewandowsky et al., 2021). Symptom checkers (such as Spain's CoronaMadrid app) are cost-effective tools allowing users to self-report data on their health and symptoms as well as obtain diagnosis and advice on the next steps (Berry, 2018). Quarantine compliance tools allow real-time monitoring of isolated individuals to determine whether they follow quarantine restrictions; for example, Taiwan's Electronic Fence tracks quarantined overseas arrivals using mobile phone data while ankle bracelets are used in the United States (Couch et al., 2020; Kallingal, 2020). Finally, flow modelling tools or mobility reports quantify and track people's movements in specified geographic regions and rely on aggregated and anonymised datasets collected from a specific geographic region.

Although all these types of technologies are regarded as useful in countering the pandemic, some of them raise privacy compliance issues as they involve, among other things, the collection, use, aggregation, analysis, and disclosure to third parties of datasets that may or may not include re-identifiable data (Gasser et al., 2020). Reuters, for example, reported that users in Israel have started to avoid contact tracing by using prepaid SIM cards or switching to airplane mode to prevent the negative economic impacts of being quarantined (Williams, 2020).

Importantly, however, the concerns around COVID-19-related technologies relate not only to privacy but also to credibility. Heilweil (2020) cautions about over-hyped claims concerning what AI can achieve and whether AI companies have the data and expertise to deliver their promises. Contact tracing in Singapore (Ng, 2020) has already shown its shortcomings, including producing false positives and not flagging cases where the virus has spread. One important concern is the risk of false-positive results generated by unreliable, biased, and non-transparent algorithms. Another is a "surveillance creep," when invigilation methods developed for a limited purpose are used permanently (French & Monahan, 2020). Beyond potential threats to civil rights, surveillance also has psychological consequences. Decades of research have shown that autonomy, a sense of having volition and choice, is crucial for individuals and societies to thrive (Ryan & Deci, 2020). Therefore, surveillance can have negative effects on motivation and well-being as it creates a sense of being permanently controlled (Jensen & Raver, 2012; Lepper & Greene, 1975).

Age, attitude towards technology, and fear of COVID-19 are important predictors of the acceptance of symptom recognition and contact-tracing apps (Jansen-Kosterink et al., 2020). Wnuk et al. (2020) showed that risk of being infected, sense of individual control, right-wing authoritarianism, and endorsement of liberty were significant predictors of anti-COVID-19 tracking technologies' acceptance. On the other hand, studies from Jordan (Abuhammad, Khabour, & Alzoubi, 2020) and Australia (Garret et al., 2021) have revealed that while the acceptability of contact-tracing technology was high, the actual use of the technology was comparably less. The only study examining the relationship between prosocial attitudes and acceptance of surveillance technology was a correlational study by Kokokoris and Kampleitner (2020).

However, no study has assessed the changes in attitudes towards tracking technologies over the course of the pandemic. For example, people may perceive that the risk of being infected is lower than they thought and therefore they do not feel the need for additional prevention measures. They may also feel increasingly tired of existing limitations and become convinced that they are not necessary. Conversely, when they think that prosocial behaviour aimed at protecting themselves and others from the coronavirus is their responsibility, they can also express greater acceptance for controversial but helpful technologies.

Thus, to address those questions, in a four-wave panel study, we examined communal and individualistic factors that may predict changes in attitude towards the acceptance of tracking technologies. Among communal factors, we distinguished the local level (prosocial behaviour towards friends and acquaintances) and the broader community level (identification with the national group). Regarding individualistic aspects, we focused on the endorsement of individual liberty in the context of COVID-19. We also tested the moderating role of perceived efficacy of tracking technologies and threat of future technological surveillance.

1.2. Communal attitudes and acceptance of anti-COVID 19 tracking technologies: the role of prosociality and national identification

As the perception of risk associated with personal consequences of the COVID-19 infection may be perceived as relatively low, many people may conclude that the situation does not require such radical measures' lockdown and actively choose not to adhere to "unnecessary" restrictions (Jetten, Reicher, Haslam, & Cruwys, 2020). The crucial task for the authorities was to convince people that complying with the burdensome restrictions is effective in countering COVID-19, and failure to do so may undermine the efforts of many (Gallotti, Valle, Castaldo, Sacco, & De Domenico, 2020; Johnson, 2020). A common method used by authorities to promote responsible behaviours in times of the pandemic was to appeal to citizens' prosociality (e.g. Jordan, Yoeli, & Rand, 2020).

Prosocial behaviour may be defined as any action intended to benefit another person or society, including actions from small everyday efforts to large-scale initiatives aimed at making the world a better place (Nelson, Layous, Cole, & Lyuobomirsky, 2016; Penner, Dovidio, Piliavin, & Schroeder, 2005). A prevalent opinion is that during societal crises, people tend to act selfishly and ignore social order (e.g. Zaki, 2020); however, research also shows that such exceptional situations may lead to an increase in prosocial attitudes. For example, survivors of catastrophes behave more altruistically and exhibit enhanced solidarity towards each other (Zaki, 2020; Bauer et al., 2016; Páez, Basabe, Ubillos, & González-Castro, 2007). During the pandemic, millions of people have been exhibiting prosocial attitudes, such as developing community self-help initiatives and adhering to authorities' recommendations, not only to protect themselves but also to care for the more vulnerable others and avoid overburdening the public health system (e.g. Morgan, 2020).

Such positive reactions to crises are in line with numerous studies in psychology and behavioural economics concluding that people are indeed concerned about the well-being of others (Batson, O'Quin, Fultz, Vanderplas, & Isen, 1983; DeSteno, 2018; Fehr & Fischbacher, 2003; Hofmann, Luhmann, Fisher, Vohs, & Baumeister, 2014; Jordan et al., 2020) and consider the social consequences of their behaviour (Bartling, Weber, & Yao, 2015; Fehr & Schmidt, 1999; Tricomi, Rangel, Camerer, & O'Doherty, 2010). Complying with health recommendations can be increased by demonstrating the outcomes of proper and improper behaviours (Campos-Mercade, Meier, Schneider, & Wengström, 2021; Brewer, Chapman, Rothman, Leask, & Kempe, 2017; Jordan et al., 2020; Everett, Colombatto, Chituc, Brady, & Crockett, 2020). In the context of epidemics, promoting prosocial motivation may influence vaccination decisions, reducing the costs and mortality of the community (Shim, Chapman, Townsend, & Galvani, 2012). Campos-Mercede et al. (2021) found that prosocially oriented individuals are more likely to adhere to guidelines such as social distancing and use of face masks. Moreover, they gather information on how they can protect others and donate to the COVID-19 funds more often. Similarly, intention to social distancing increased when it was framed as a remedy for public threat rather than a personal threat (Jordan et al., 2020).

Other research on the role of prosociality during the pandemic has shown that this characteristic may be associated with a less obvious way of caring for others, i.e. a greater willingness to use controversial surveillance technologies in order to fight COVID-19. For example, Kokkoris and Kamleitner (2020) demonstrated that perceived prosocial responsibility correlated with the willingness to accept surveillance in order to fight against the current pandemic. Additionally, a qualitative study by Williams, Armitage, Tampe, and Dienes (2020) showed that a factor distinguishing people who want to use tracking apps from those who are reluctant to do so is the belief that using these apps is morally right, as it would be beneficial for the whole society. Importantly, participants who were willing to use such technologies were aware of the associated threat to the civil rights, but they perceived the potential benefits for the greater good as outweighing their concerns. They shared many doubts with people who were against surveillance technologies, but they decided that public health is more important than, e.g. privacy infringement. These insights were additionally supported by O'Callaghan et al. (2020), who found that one of the most common reasons given for downloading tracking apps was a sense of community responsibility.

The above studies show that prosocial attitudes may be associated with a greater tendency to accept useful but potentially dangerous anti-COVID-19 technologies. However, their primary limitation is a correlational design, which does not allow inference of causal relationships between variables. To address this weakness, we used a longitudinal design to test the hypothesis that people who are more concerned about the well-being of others during pandemics (e.g. declare more frequent prosocial behaviours) may also be more likely to accept COVID-19 surveillance technologies. As the threat of coronavirus is more tangible and immediate than the potential side-effects of surveillance technologies, prosocially oriented people may perceive such solutions as benefiting the society and therefore worthy of implementation.

Prosociality is not the only example of possible bonds with other people and predictors of putting the well-being of others over an individual's self-interest. Another way to reduce the negative impact of selfish motivations on the acceptance of harsh countermeasures is to see oneself as a part of a broader category, 'we' instead of 'I', i.e. activating a broader social identity (Haslam & Reicher, 2006). According to social identity theory, individuals possess a personal identity—which includes beliefs about one's skills, abilities, or attributes—and also social identities that define the self in terms of membership in various social groups (e.g., Tajfel, 1982; Turner, 1982). Numerous studies have shown a relationship between shared social identity and solidarity with other ingroups in the context of disasters (Drury, 2018). A strong sense of identification with one's group is related to an increased motivation to help other members of the group (Ellemers, Spears, & Doosje, 1999; Levine, Prosser, Evans, & Reicher, 2005), increased cooperation (Buchan et al., 2011; De Cremer & Van Vugt, 1999), or even costly behaviour for the benefit of the ingroup members (Kalin & Sambanis, 2018) and greater collective efforts aimed at preventing the pandemic within one's country (e.g. Dovidio, Ikizler, Kunst, & Levy, 2020). Additionally, enhanced group identification is related to a greater adherence to group norms (e.g. Neighbors et al., 2010; Stevens, Rees, & Polman, 2019), prompting pro-health behaviours such as getting vaccinated (Falomir-Pichastor, Toscani, & Despointes, 2009); this suggests that the stronger the sense of social identity in oneself, the more motivated the person will be to behave according to group rules (see also Reese et al., 2020). A recent study across several countries demonstrated that national identification predicted preventive behaviour in the time of the COVID-19 pandemic (Van Bavel et al., 2020).

The value of supporting and implementing actions aimed at an effective fight against the coronavirus was particularly emphasised by medical authorities and governments and fighting with pandemics was often described as "national efforts" (e.g. Vallance, 2020). Therefore, we expect that higher ingroup identification predicts higher acceptance of anti-COVID-19 tracking technologies.

1.3. Endorsement of individual liberty as a potential hindrance to acceptance of anti-COVID-19 tracking technologies

Prosociality and social identity, as manifestations of the communal aspects of human nature, can be associated with greater acceptance of controversial but useful tracking technologies. We assumed that the opposite is applicable for the endorsement of liberty. Many experts have emphasised that one of the negative consequences of the coronavirus pandemic may be a change in the value that citizens attribute to freedom (Gasser et al., 2020; Gulati, Dunne, & Kelly, 2020; Nay, 2020). In a situation of global threat, the endorsement of civil rights can be quickly replaced by the need to ensure the greatest possible security for oneself and one's family (Nay, 2020). People are more likely to accept undemocratic solutions if their society is facing danger (Kossowska et al., 2011), including enhanced surveillance (Cohrs, Kielmann, Maes, & Moschner, 2005; Huddy, Feldman, & Weber, 2007), restriction of free speech (Dietrich & Crabtree, 2019), and limitations of privacy (Norris, 2017).

The case of the COVID-19 pandemic, however, cannot be compared to previous research on civil rights in times of threat. The introduction of restrictions on individual freedom is unprecedented and global (Zhang, Wang, Rauch, & Wei, 2020). Public health measures such as stay-at-home orders, closing businesses, and banning of mass gatherings caused a bulk of protests in most countries where such restrictions were introduced. Protests against governmental public health measures were taking place in countries with different governance systems, from liberal democracies to autocracies, including various groups of inhabitants, from representatives of rich elites to the poorest citizens (Carothers, 2020; Reicher & Stott, 2020), and encompassed the variety of motivations, depending on the local context. In Western countries, protests are often driven by society's tiredness with ubiquitous restrictions and are directed against 'anti-citizen' regulations that place security and public health before individual freedom (Kowalewski, 2020; Pleyers, 2020). Protesters often highlight concerns about using the pandemic situation to introduce undemocratic methods of governance, and these worries are reinforced by various conspiracy theories about elites using the pandemic against ordinary people (Oleksy, Wnuk, Maison, & Łyś, 2021; Imhoff & Lamberty, 2020). Such demonstrations have intensified especially in the later phases of the pandemic, often gathering thousands of participants who are convinced that government restrictions are not proportional to the threat (such as the protests in Berlin or Warsaw, see Vieten, 2020).

What attitudes towards tracking technologies will be displayed by people worried about being stripped of their freedom in the name of fighting the pandemic? On the one hand, the use of such technologies could effectively counteract the need for introducing the harshest restrictions, such as full lockdowns. On the other hand, one of the most common motifs that are present during protests is citizens' opposition to governmental control and scepticism towards authorities' good intentions. Therefore, it is likely that these citizens would not want to equip the government with tools as efficient as tracking technologies. We hypothesise that endorsement of individual liberty will be a negative predictor of acceptance of surveillance technologies.

In addition to the main predictions, we intended to test whether the perceived efficacy of surveillance technologies and the threat of future technological surveillance would change the relationship between the above-mentioned independent variables and the dependent variable. Previous studies based on the Technology Acceptance Model indicated that the perceived usefulness of technology is a significant predictor of its use (e.g. Dillon, 2001; Holden & Rada, 2011), so we expected that when these technologies were not regarded as effective, the relationship between social and individual motives and acceptance should diminish. Furthermore, perceiving surveillance technologies as a threat to society could reduce the impact of prosociality and national identification and strengthen the effect of individual liberty. We thus tested the moderating role of the threat of future technological surveillance.

We also controlled whether the effects of our main independent variables would still hold, whilst the general tendency to follow rules and regulations was included in the model. Previous research showed that authoritarian people were more inclined to support surveillance technologies because they are usually introduced as government-led solutions and, as such, promote compliance with norms and obedience to authority (see e.g. Wnuk et al., 2020).

2. Research hypotheses

Hypothesis 1. We expect that people who are concerned about the well-being of others during the pandemic (e.g. declare more frequent prosocial behaviours) will be more likely to accept COVID-19 surveillance technologies.

Hypothesis 2. We hypothesise that higher ingroup identification predicts higher acceptance of anti-COVID-19 tracking technologies.

Hypothesis 3. We hypothesise that endorsement of individual liberty will be a negative predictor of acceptance of surveillance technologies.

Additionally we will test whether these relationships will be moderated by the level of perceived efficacy of surveillance technologies and perceived threat of future technological surveillance.

3. Overview of four waves of the study

A four-wave panel study was conducted between May 4th and December 22nd, 2020. The first wave took place between the 4th and the 7th of May, which was 6 weeks after the beginning of the lockdown caused by the COVID-19 pandemic. Although the media were stressing that the number of tests to detect the coronavirus was insufficient, many restrictions began to be loosened—for instance, recreation in forests and parks was allowed and the number of people in shops increased (wearing a mask was still an obligation).

The second wave took place between the 4th and the 17th of June. Almost all restrictions introduced to counteract the pandemic were lifted, with only wearing masks in closed spaces being obligatory. Many people also paid less attention to social distancing and felt that the first wave of the pandemic was beginning to end.

The third wave of the study was conducted between the 7th and the 17th of July, 4 months after the first case of coronavirus infection was detected in Poland. The daily number of detected cases did not lower; however, the number of deaths decreased, and the number of convalescents increased. Fewer and fewer people adhered to preventive measures, and the desire for normalisation was strong. The Prime Minister declared that the situation was stable, and Poland was going to fully contain the pandemic.

The fourth wave took place between the 3rd and the 22nd December. For almost 4 weeks, the new restrictions (remote learning in schools, closure of cultural and sports facilities and restaurants, and ban on mass events) were implemented due to high increases in the number of COVID-19 cases at the end of October and the beginning of November.

4. Method

4.1. Participants and procedure

A total of 1179 adults took part in the first wave of an online study, conducted using the Internet research panel (sampled from a poll of 150,000 verified panelists using the computer-assisted web interviewing method).[1] The random-quota sample was representative of the Polish adult population in terms of sex, age, and a place of residence. In order to ensure the quality of the data, 49 outliers were removed: 24 participants using only the highest or the lowest scale levels in the whole survey, 25 participants using only the midpoint of the scale. Finally, data from 1130 participants were analysed. Vast majority (99%, $n = 1123$) of participants declared that Poland was their country of origin. The sample included 569 females (50.4%) and 561 males (49.6%), age range from 18 to 85 ($M = 44.53$, $SD = 15.83$). The second data collection was done among 971 participants from the previous wave (473 women, 498 men; age ranged from 18 to 85 years, $M = 45.35$, $SD = 15.42$). Third wave of the study was conducted among 818 participants of the previous wave (387 women, 431 men; age ranged from 18 to 85 years, $M = 46.27$, $SD = 15.07$). Fourth data collection included 688 participants of the previous wave (315 women and 373 men, aged ranges from 18 to 85 years, $M = 47.30$, $SD = 14.88$). The studies were approved by the Scientific Research Ethics Committee of the Faculty of Psychology at the University of Warsaw.

4.2. Measures

Unless otherwise noted, participants responded on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*).

Attitudes towards surveillance technologies to counteract the pandemic (AST) were measured with five items previously used by Wnuk et al. (2020), related to surveillance technologies, e.g., "Surveillance cameras with an automatic facial recognition system to quickly identify persons who do not comply with the authorities' recommendations". The participants were asked to indicate their attitude towards these technological solutions on a scale from 1 (*It should not be introduced in Poland*) to 7 (*It should be introduced in Poland*). We used the mean value of all items in the analyses. The scale had good reliability in all four waves: T1: $\alpha = 0.85$; T2: $\alpha = 0.87$; T3: $\alpha = 0.90$; and T4: $\alpha = 0.93$.

Prosociality was measured with seven items, based on House (1981) and Tardy (1985): Examples of items include the following: (during the last week) "I encourage my family and friends to take actions that may slow down the spread of the pandemic", "I help people around me to deal with the difficulties and obstacles associated with the epidemic", T1: $\alpha = 0.86$; T2: $\alpha = 0.90$; T3: $\alpha = 0.90$, and T4: $\alpha = 0.89$.

National identification was measured with three items adapted from

[1] The study was a part of a larger survey conducted in Poland during the COVID-19 pandemic.

Cameron's (2004) scale where Poles were the reference group (i.e., "I have a lot in common with other Poles", "In general, being a Pole is an important part of my self-image", and "Generally, I feel good when I think about myself as a Pole"); T1: α = 0.87; T2: α = 0.86; T3: α = 0.88, and T4: α = 0.90.

Endorsement of liberty in the context of the COVID-19 pandemic was measured only in three waves[2] with three items: "I believe that the coronavirus threat does not justify limiting people's ability to live their lives in their own way", "I would agree to any restrictions of my freedom, if they can help in the fight against the coronavirus" (reverse coded), and "The freedom to do what is important to me is more important than safety"; T1: α = 0.64; T2: α = 0.71; and T3: α = 0.71.

Perceived efficacy of surveillance technologies was measured with one item: "I think that applications analysing personal data (current health information, travel and contact history) are effective in fighting the coronavirus".

Submission to authority was measured with one item "Obedience and respect for authority are the most important values children should learn" (from the Right-wing Authoritarianism Scale, see Funke, 2005)

Threat of future technological surveillance was measured with one item "I am afraid that the new technologies used to fight the coronavirus pandemic can be used for surveilling citizens even after the pandemic is over".

4.3. Analytical strategy

First, we used latent growth curve modelling (LGCM; Bollen & Curran, 2006) to examine changes of acceptance of surveillance technologies (AST) over the course of the pandemic. The univariate LGCMS enables examination of (1) the initial level of given variable (i.e. intercept); (2) its rate of change (i.e. slope); (3) the relationship between the initial level and its rate of change (Brailean et al., 2017; Ni et al., 2020).

Since our main aim was to obtain detailed insights into the causal relationship between our variables, we applied the random intercept cross-lagged panel model (RI-CLPM; Hamaker, Kuiper, & Grasman, 2015). RI-CLPM allowed for less biased estimations of causality than standard cross-lagged panel models (CLPM) (Hamaker et al., 2015). The CLPM method is less effective in disentangling between-person stability of variables and within-person change (Mund & Nestler, 2019), which may lead to biased interpretation of estimates (Berry & Willoughby, 2017; Hamaker et al., 2015; Osborne & Sibley, 2020). The RI-CLPM models enable the decomposition of observed variables into two parts: 1) time-invariant, trait-like, "between-person" factors and 2) more state-like, time-varying, or "within-person" factors (Hamaker et al., 2015). In such models, the random intercept for each variable is used to extract its time-invariant characteristics; therefore, the remaining cross-lagged paths can be interpreted as reflecting within-person changes over time. In other words, RI-CLMP enabled us to investigate whether an individual's deviation from their expected score of one variable (e.g. independent variable) in T1 predicts their deviations in the other variable (e.g. dependent variable) in T2. See Fig. 1 for a sample RICLPM model.

In the present study, we modelled three separate RI-CLPMs for our three predictors of AST: prosociality, national identification, and endorsement of liberty (see an example in Fig. 1). This approach can be justified by the high complexity of RI-CLPM models and potential convergence issues when more than two constructs are examined simultaneously (Golec de Zavala, Bierwiaczonek, Baran, Keenan, & Hase, 2020; Schwaba & Bleidorn, 2021; Meagher & Cheadle, 2020). To increase model parsimony, we constrained autoregressive and cross-lagged paths to be equal over time of three first waves, however, following the recommendation from the authors of RI-CLPM models (Hamaker et al., 2015), we finally analysed a model in which the final lag differed from the others in its path weight, because the lag for the fourth wave was much longer than between the first three waves of our study.

In the final step, we reanalysed the three models with covariates, i.e. submission to authority and demographic variables (gender and age) and tested moderation effects by perceived efficacy of tracking technologies and perceived threat of future surveillance.

[2] This is due to our mistake.

5. Results

5.1. Attrition analysis

We examined systematic patterns of attrition by comparing incomplete responders (n = 1130) with complete responders (n = 688) on key demographic variables and main variables used in the models. Complete responders were more likely to be men than women, $\chi^2(1) = 10.98$, p = .001, and were older than incomplete responders, t(1128) = - 6.06, p < .001. We did not observe any significant differences according to the rest of variables used (AST: t(1128) = - 0.09, p = .92, prosociality: t(1128) = 1.31, p = .19, national identification: t(1128) = 0.05, p = .96, perceived efficacy of technology: t(1128) = −1.69, p = .09; submission to authority: t(1128) = -0.556, p = .58; threat of future technological surveillance: t(1128) = 0.014, p = .99). Therefore, we assumed missing data in our variables can be treated as missing at random when demographic variables are included in the model (MAR; see Young & Johnson, 2015). Accordingly, for handling missing data, we used full information maximum likelihood method that provides unbiased parameter estimates when data were MAR (Enders & Bandalos, 2001).

5.2. Confirmatory factor analyses and measurement invariance

We conducted confirmatory factor analysis (CFA) based on the results obtained in the first wave. The analysis confirmed the assumed structure of measures, the model fit was acceptable χ^2 (125) = 693.179, RMSEA = 0.06, CFI = 0.91, SRMR = 0.05. Based on the modification indices we added correlations between two error terms in three scales (endorsement of liberty, prosociality and acceptance of surveillance technologies). We also conducted invariance tests to confirm the structure of measures in all waves. Following the advice of Vandenberg and Lance (2000) a series of increasingly stringent restrictions on model parameters were imposed. For evaluating model-fit across models, we used the following criteria (Kline, 2016): CFI, TLI, RMSEA and SRMR. All models met the required criteria. In support of measurement invariance, ΔCFI, ΔRMSEA, ΔSRMR, observed across all models, were no greater than 0.015 (Chen, 2007; Cheung & Rensvold, 2002; Zacher & Rudolph, 2020).

5.3. Descriptive statistics and zero-order correlations

Table 1 provides descriptive statistics and intercorrelations among study variables. Both prosociality and national identification were positively associated with acceptance of surveillance technology in each wave of measurement while endorsement of liberty was negatively correlated with it. The initial level of acceptance of surveillance technology was around the midpoint and gradually decreased (see Table 1). In order to test whether AST changed significantly over time we conducted the latent growth curve analysis.

5.4. Latent growth curve analysis

We compared univariate latent growth curve models including latent intercept factor only (no-growth models) with models involving linear change slope factor (growth models). We used the robust maximum likelihood estimation (MLR) to account for non-normally distributed data. Model fit improved significantly when the slope factors were added ($\chi^2(8) = 10.32$, p = .24, CFI = 1.00, RMSEA = 0.02) vs. no-growth

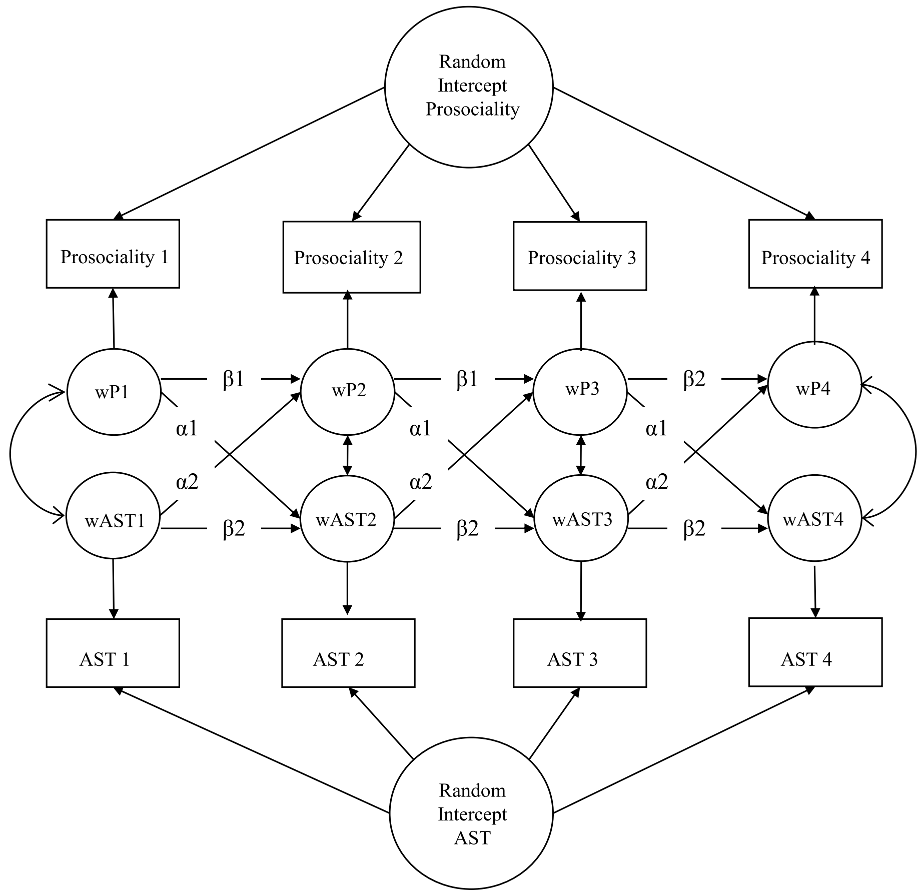

Fig. 1. Random intercept cross-lagged panel model (RI-CLPM) for the estimation of the reciprocal relationship between prosociality and acceptance of surveillance technologies (AST) for the four-wave panel data. Each observed score is divided into two parts: a within-person part and a between-person part. The wAST and wP factors represent the within-person part. The two random intercepts capture the between-person part.

model ($\chi^2(11) = 90.72$, $p < .01$, CFI = 0.93, RMSEA = 0.09), confirming linear decrease of AST over time. Intercept and linear slope were significantly and negatively interrelated ($B = -0.15$, $SE = 0.04$) which means that the lower the AST level in the first wave, the greater the drop in subsequent waves.

5.5. Random-intercept cross-lagged panel models

To examine the mutual relationship and causality between used variables, we modelled three RI-CLPMs for examined predictors of AST: prosociality, national identification, and endorsement of liberty separately. Models with prosociality and national identification were analysed in four waves, and endorsement of liberty was analysed in three waves. Robust maximum likelihood estimation (MLR) was used to account for non-normally distributed data. We used the maximum likelihood procedure (FIML) to deal with missing values. All models indicated good fit to the data (see Table 2), adding covariates did not change models' parameters (see Table 3).

At the between-person level, we found a significant correlation between the random intercept factors of prosociality and AST, which mean that persons who reported higher levels of prosociality also accepted surveillance technologies to a greater extent across four waves of measurement. Regarding the within-person level, the results revealed a reciprocal, bidirectional relationship between prosociality and AST in both time frames, from T1 - T3 and T3 - T4. To establish in which direction the effect was stronger, we compared unconstrained model fit with the model constrained on the directional cross-lagged parameters. Constrained model had reduced model fit, $\Delta\chi^2(1) = 8.91$, $p < .001$, suggesting no equality between the two paths. Therefore, prosociality had a larger effect on AST than the other way around (see Table 4).

In case of the relationship between national identification and AST, we did not observe any significant cross-lagged effects, neither from national identification to AST, nor from AST to national identification. However, at the between-subject level the correlation between those two variables was significant and positive, showing that participants with higher national identification were more willing to accept surveillance technologies than low identifiers (Table 4).

The relationship between endorsement of liberty and AST was significant and negative both at the between- and within-subject levels. In other words, persons who endorse individual liberty more strongly were less willing to accept surveillance technologies across all three waves, and an individual change in endorsement in liberty caused a change in acceptance of surveillance technologies (see Table 4).

In all three models the main results did not change significantly when covariates were added (see Table 5).[3]

Additionally, we conducted moderating analyses including two moderators, perceived efficacy of tracking technologies and perceived threat of future technological surveillance. The RI-CLPM analyses allow for multigroup comparisons therefore we divided subjects into two groups based on a mean value of each moderator. Following Mulder and Hammaker (2020) we investigated whether a multiple group model in which there are no constraints across the groups would have better fit than a model in which the lagged regression coefficients are constrained to be identical across the groups. It was demonstrated that in case of

[3] We also conducted analyses with unconstrained paths in RICLPM and there were no significant differences in model parameters.

Table 1
Means, standard deviations, and correlations with confidence intervals.

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. AST1	3.98	1.43														
2. AST2	3.81	1.42	.63** [.59, .67]													
3. AST3	3.73	1.46	.63** [.59, .67]	.66** [.62, .69]												
4. AST4	3.61	1.53	.54** [.49, .59]	.62** [.57, .66]	.61** [.57, .66]											
5. PS1	3.51	0.79	.27** [.21, .32]	.21** [.15, .27]	.20** [.14, .27]	.16** [.08, .23]										
6. PS2	3.43	0.86	.29** [.23, .34]	.30** [.24, .35]	.29** [.23, .35]	.25** [.18, .32]	.71** [.67, .74]									
7. PS3	3.38	0.86	.33** [.26, .39]	.34** [.28, .40]	.31** [.25, .37]	.32** [.25, .39]	.64** [.60, .68]	.74** [.71, .77]								
8. PS4	3.42	0.84	.22** [.14, .29]	.23** [.15, .30]	.27** [.20, .34]	.30** [.23, .37]	.60** [.55, .65]	.67** [.63, .71]	.69** [.65, .73]							
9. NI1	4.64	1.41	.32** [.27, .37]	.23** [.16, .28]	.25** [.18, .31]	.22** [.15, .29]	.30** [.25, .35]	.35** [.29, .40]	.35** [.29, .41]	.32** [.25, .39]						
10. NI2	4.53	1.40	.27** [.21, .33]	.27** [.21, .33]	.27** [.21, .34]	.25** [.18, .32]	.29** [.23, .35]	.34** [.28, .39]	.36** [.30, .42]	.33** [.27, .40]	.78** [.75, .80]					
11. NI3	4.59	1.41	.27** [.21, .33]	.22** [.15, .28]	.29** [.23, .35]	.24** [.17, .31]	.31** [.24, .37]	.34** [.28, .40]	.37** [.31, .43]	.35** [.28, .41]	.78** [.75, .80]	.81** [.78, .83]				
12. NI4	4.59	1.47	.28** [.21, .35]	.20** [.12, .27]	.23** [.16, .30]	.24** [.17, .31]	.29** [.22, .35]	.33** [.26, .39]	.39** [.32, .45]	.37** [.30, .43]	.77** [.74, .80]	.78** [.75, .81]	.79** [.77, .82]			
13. L1	3.71	1.30	-.39** [-.43, −.34]	-.42** [-.47, −.36]	-.37** [-.43, −.31]	-.32** [-.39, −.25]	-.23** [-.28, −.17]	-.29** [-.35, −.24]	-.27** [-.33, −.20]	-.26** [-.33, −.19]	-.17** [-.22, −.11]	-.18** [-.24, −.12]	-.20** [-.26, −.13]	-.19** [-.26, −.12]		
14. L2	3.68	1.32	-.40** [-.45, −.35]	-.45** [-.50, −.40]	-.42** [-.48, −.37]	-.38** [-.44, −.31]	-.26** [-.32, −.20]	-.32** [-.38, −.26]	-.30** [-.36, −.23]	-.28** [-.35, −.21]	-.26** [-.32, −.20]	-.22** [-.28, −.16]	-.23** [-.29, −.16]	-.22** [-.29, −.14]	.66** [.63, .70]	
15. L3	3.75	1.28	-.39** [-.44, −.33]	-.44** [-.49, −.38]	-.45** [-.50, −.39]	-.38** [-.44, −.31]	-.29** [-.35, −.22]	-.36** [-.42, −.30]	-.30** [-.36, −.24]	-.30** [-.36, −.23]	-.20** [-.26, −.13]	-.21** [-.28, −.14]	-.17** [-.24, −.11]	-.18** [-.25, −.10]	.65** [.61, .69]	.74** [.71, .77]

Note. AST – acceptance of surveillance technologies, PS – prosociality, NI – national identification, L – endorsement of liberty.
M and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. The confidence interval is a plausible range of population correlations that could have caused the sample correlation (Cumming, 2014). $^{*}p < .05$. $^{**}p < .01$.

Table 2
RI-CLPM models parameters.

Model	χ2	*Df*	*P*	CFI	RMSEA	SRMR	AIC
PS↔AST	68.805	19	<.001	.98	.05	.04	18323.142
NI ↔AST	50.743	19	<.001	.99	.03	.03	21322.579
L↔AST	14.179	8	<.001	.99	.03	.02	17503.859

Note: PS – prosociality, NI – national identification, L – endorsement of liberty.

Table 3
RI-CLPM models parameters with covariates (age, sex and submission to authority).

Model	χ2	*Df*	*P*	CFI	RMSEA	SRMR	AIC
PS↔AST	176.608	62	<.001	.97	.04	.05	30249.347
NI↔AST	149.232	62	<.001	.99	.04	.05	33030.077
L↔AST	97.466	32	<.001	.98	.05	.05	27306.166

Note: PS – prosociality, NI – national identification, L – endorsement of liberty.

prosociality and national identification all models with constraints imposed did not differ significantly from models without them (see Table 6 for the exact χ^2 differences) and this implied there were no moderation effects. In case of endorsement of liberty the chi-square difference test of the models with perceived threat was significant (Table 6). Hence, we concluded that the constraints are untenable and that there appeared the lagged effects for individuals with different levels of threat of future surveillance are different, namely only for those high in threat the endorsement of liberty significantly predicted acceptance of tracking technologies.

We also observed significant correlations between moderators and acceptance of tracking technologies, $r = 0.52$, $p < .001$ and $r = -0.31$, $p < .001$ for perceived efficacy and perceived threat of future surveillance, respectively.

6. Discussion

Since the pandemic outbreak, multiple authors have discussed how technology, including digital surveillance, artificial intelligence, machine learning, and data science, has contributed to the fight against COVID-19 (e.g. Kumar, Gupta, & Srivastava, 2020; Gasser et al., 2020; Hussein, 2020; Ruiz Estrada, 2020; Nguyen et al. 2020). The use of tracking technologies was perceived as another challenge faced by governments in balancing civil rights and the necessity to efficiently counteract the pandemic (Flood, MacDonnell, Thomson, & Wilson,

Table 4
Results of random-intercept cross-lagged panel models.

Parameters	B	SE	p
RI-CLPM 1: PS↔AST			
Autoregressive Paths			
PS T1 – T3	0.315	0.070	.000
PS T3 – T4	0.237	0.075	.001
AST T1 – T3	0.121	0.069	.083
AST T3 – T4	0.029	0.096	.763
Cross-Lagged Path			
PS→AST T1 – T3	0.254	0.094	.007
PS→AST T3 – T4	0.397	0.149	.008
AST→PS T1 – T3	0.075	0.029	.001
AST→PS T3 – T4	0.073	0.035	.033
4-waves between subject correlation	.247	0.041	.000
RI-CLPM 2: NI↔AST			
Autoregressive Paths			
NI T1 – T3	0.078	0.048	.102
NI T3 – T4	0.034	0.083	.683
AST T1 – T3	0.097	0.061	.113
AST T3 – T4	0.008	0.097	.933
Cross-Lagged Path			
NI→AST T1 – T3	0.039	0.051	.441
NI→AST T3 – T4	0.054	0.100	.590
AST→NI T1 – T3	−0.034	0.032	.292
AST→NI T3 – T4	−0.015	0.047	.750
4-waves between subject correlation	.517	.063	.000
RI-CLPM 3: L↔AST			
Autoregressive Paths			
L T1 – T3	0.079	0.089	.373
AST T1 – T3	0.014	0.073	.852
Cross-Lagged Path			
L→AST T1 – T3	−0.165	0.065	.011
AST→L T1 – T3	−0.090	0.050	.073
3-waves between subject correlation	−0.646	0.066	.000

Note. PS – prosociality, NI – national identification, L - endorsement of liberty.

Table 5
Results of Random-Intercept Cross-Lagged Panel Models including covariates (age, sex and submission to authority).

Parameters	B	SE	p
RI-CLPM 1: PS↔AST			
Autoregressive Paths			
PS T1 – T3	0.314	0.070	.000
PS T3 – T4	0.229	0.073	.002
AST T1 – T3	0.114	0.067	.090
AST T3 – T4	0.041	0.097	.668
Cross-Lagged Path			
PS→AST T1 – T3	0.250	0.092	.006
PS→AST T3 – T4	0.380	0.149	.011
AST→PS T1 – T3	0.066	0.029	.022
AST→PS T3 – T4	0.070	0.035	.043
4-waves between subject correlation	0.252	0.041	.000
RI-CLPM 2: NI↔AST			
Autoregressive Paths			
NI T1 – T3	0.087	0.047	.067
NI T3 – T4	0.042	0.083	.609
AST T1 – T3	0.095	0.061	.121
AST T3 – T4	0.019	0.098	.845
Cross-Lagged Path			
NI→AST T1 – T3	0.037	0.051	.467
NI→AST T3 – T4	0.076	0.101	.452
AST→NI T1 – T3	−0.024	0.032	.458
AST→NI T3 – T4	−0.002	0.047	.960
4-waves between subject correlation	.523	.063	.000
RI-CLPM 3: L↔AST			
Autoregressive Paths			
L T1 – T3	0.084	0.090	.352
AST T1 – T3	0.033	0.073	.644
Cross-Lagged Path			
L→AST T1 – T3	−0.176	−0.176	.009
AST→L T1 – T3	−0.089	0.051	.084
3-waves between subject correlation	−0.634	0.066	.000

Note. PS – prosociality, NI – national identification, L - endorsement of liberty.

Table 6
Comparison of RI-CLPMs with and without moderation effects.

Model	χ2	Df	Δχ2 p
PS↔AST			
1. Perceived efficacy – no mod.	84.279	38	
2. Perceived efficacy – mod.	77.155	34	.440
1. Threat – no mod.	74.282	38	
2. Threat – mod.	70.569	34	.860
NI↔AST			
1. Perceived efficacy – no mod.	61.673	38	
2. Perceived efficacy – mod.	55.076	34	.396
1. Threat – no mod.	60.969	38	
2. Threat – mod.	57.151	34	.664
L↔AST			
1. Perceived efficacy – no mod.	13.085	14	
2. Perceived efficacy – mod.	14.917	10	.902
1. Threat – no mod.	38.741	14	
2. Threat – mod.	21.936	10	.015

Note: PS – prosociality, NI – national identification, L – endorsement of liberty; no mod. – no moderation effects, i.e. cross-lagged effects constrained across groups, mod. - moderation effects.

2020; Nay, 2020) and has triggered numerous discussions on the benefits and risks associated with the implementation of these solutions (e.g. Giglio, 2020; Wong, 2020; Singer & Sang-Hun, 2020). Here, we examined the social predictors of attitudes towards anti-COVID-19 surveillance technologies during the pandemic. We employed advanced longitudinal analysis to examine causality between communal and individual aspects and attitudes towards technologies, as we were especially interested in within-person processes over time.

First, we examined whether acceptance of tracking technologies have changed over the course of the pandemic in Poland. The results revealed that acceptance of surveillance technologies significantly decreased within the 8 months of study, although was still around the midpoint of the scale. Even, when situation changed in the second wave of the pandemic, and the number of infections and fatalities increased, followed by the re-implemented restrictions (ban on mass events, remote learning in schools, closure of shops, cultural and sports facilities, and restaurants), people were still less willing to accept surveillance technologies than at the beginning of the pandemic. These results indicated that the acceptance of controversial tracking technologies did not follow the changing pandemic context.

Consistently with previous correlational studies, we observed a significant correlation between prosocial behaviour and acceptance of tracking technologies at the between-person level across three waves of measurement. In accordance with our predictions, within-person changes in prosociality temporally preceded within-person changes in acceptance of tracking technology over time. Importantly, this effect was stronger than the reciprocal effect from acceptance of tracking technology to prosociality, perceived efficacy of the technology, and demographic variables. These findings contribute to the area of developing research on the relationship between prosocial attitudes and the acceptance of technological measures that may have serious but delayed negative consequences (Kokkoris & Kamleitner, 2020). By using RI-CLPM, our research has extended previous correlational findings by showing that the relation between prosociality and acceptance of tracking technologies is not only present at the between-subject level, but also at the within-subject level, thus providing preliminary evidence for the causality of this relationship.

Many studies on prosociality show that people are able to act against their own interests for the benefit of others (e.g. Penner et al., 2005). One of the reasons for such prosocial behaviour mentioned in the literature is that the feeling of close relationships with others may lead individuals to sacrifice their own interest because they feel dependent and committed to those relationships (e.g. Van Lange et al., 1997). This may explain the effect of this study (e.g. the lack of moderating effect of perceived threat of future technological surveillance), in which the declaration of prosociality concerned relatives and friends. Those who are driven by a desire to help others may then be less sensitive to potential threats of implemented technological solutions. This outcome is also in line with that of Williams (2020), who found that participants who were willing to use tracking technologies were at the same time aware of the associated risk for civil rights. However, from their view, the overall societal benefits outweighed their objections.

In our research, prosociality measured the extent to which one is taking care of others in his or her close vicinity. However, we were also interested in how identification with a much broader group—one's own nation—can translate into acceptance of tracking technologies. On the between-person level, acceptance of anti-COVID-19 tracking technologies and national identification were strongly correlated across four waves of measurement. This agrees with studies showing that identification with one's own nation can encourage people to take part in costly efforts for the sake of the other members of the national community (Dovidio, Ikizer, Kunst, & Levy, 2020; Kalin & Sambanis, 2018). Also, in the context of COVID-19, Van Bavel et al. (2020) stated that national identification was positively related to support of public health and pro-health behaviour in numerous countries. Our results extend these findings, demonstrating that stronger identification may be related not only to protective behaviour and adherence to medical authorities, but also to an endorsement of controversial technological solutions. It is worth reflecting on how specific these results are to the context of a pandemic when political leaders very often referred to national identity to effectively mobilise society to fight with COVID-19 (Van Bavel, 2020; Haslam, 2020; Haslam & Reicher, 2006). Among higher identifiers, presenting the struggle against COVID-19 as a joint goal of the whole nation could have resulted in a greater focus on the advantages of tracking technologies ("they are helpful in the fight against the disease") and reduced concerns about temporally less salient issues such as civil rights or privacy.

However, contrary to our hypothesis, we did not observe a significant cross-lagged effect of identification with national ingroup on acceptance of tracking technologies at the within-subject level. It means that changes in national identification in e.g. Time 1 was not related to an increase in acceptance of technologies in subsequent time of measurement, implying lack of causal relationship between these two variables. It seems that in shaping attitudes towards tracking technologies, prosociality, defined as a concern about one's relatives and friends, is important rather than national identity, which is an identification with the much broader—and potentially more abstract—group of unknown others (see e.g. Anderson, 1983). As studies have shown, people tend to prioritise local over global interest because of the perceived reciprocity. In reciprocal exchange, actors give to others as others give to them, and choose steady commitments, as well as short-term costs to maximise long-term gain. The global nature of the COVID-19 pandemic may make people more prone to focus on smaller family and friends groups, seeking security in embedded relationships (Levine & Baker, 2008) as their sense of personal efficacy during the pandemic may be extremely low (Kerr & Kaufman-Gilliland, 1997). Previous studies also showed that, for example, voters trust local news outlets more than national ones (Graham, 2017) and believe government at the local level more than that at the state level (McCarthy, 2018). Therefore, changes in prosociality aimed at one's close surroundings may be more important for the acceptance of controversial technologies than a sense of national community.

We also tested whether the perceived efficacy of tracking technologies and the threat of surveillance would moderate the relations between the main predictors and acceptance of tracking technologies; however, we did not find support for their moderating role in case of prosociality and national identification. It thus seems that our results hold true regardless of whether the participants believe that surveillance applications are effective in counteracting COVID-19 and irrespective of the perceived threat of their surveillance capacity.

In addition to community-related predictors, we examined the role of endorsement of individual liberty as a factor that may reduce acceptance of tracking technologies. In line with previous studies (Wnuk et al., 2020), we demonstrated that at the between-person level, endorsement of liberty and acceptance of tracking technologies were negatively correlated across three waves of measurement. Notably, we also found temporal within-person dynamics between liberty and attitudes towards these technologies. The more a person, in a given measurement, agrees that counteracting COVID-19 is not an excuse to restrict individual freedom, the less he or she considers tracking technologies worth implementing in the next time of measurement. Moreover, we demonstrated that especially people who were both high in perceived threat of future surveillance and high in endorsement of liberty were against introducing the anti-COVID tracking technologies. Thus, we demonstrated that tracking technologies are indeed perceived as posing a potential threat to liberty and that valuing liberty over anti-COVID-19 measures can also translate into a critical attitude towards new technological solutions. These results are crucial at a time when societal fatigue of ubiquitous restrictions is growing in many countries and, with it, the distrust towards the intentions of the governments (Kowalewski, 2020; Pleyers, 2020; Vieten, 2020). People who particularly value freedom may not view tracking technologies as a mean to free themselves from the burden of existing limitations, but as another threat.

6.1. Implications of the study

We argue that appealing to prosocial motives (e.g. by governments and other authorities) can be a viable strategy to convince the public of the value of using anti-COVID-19 tracking technologies. Our research suggests that an increased willingness to engage in prosocial behaviour may translate into more positive attitudes towards other potentially helpful ways of taking care of public health. Moreover, social campaigns aimed at encouraging the public to use tracking technologies may be particularly persuasive for people already characterised by greater prosociality—such individuals may become local opinion leaders and convince others of the potential usefulness of health tracking technologies. However, when such campaigns are designed, it is important to remember that people are generally aware of the risks associated with tracking technologies, such as potential violations of privacy and other civil rights. In our study, the majority of the participants were concerned about the threat of these technologies' future surveillance capacity. Therefore, even if increased prosociality may result in more positive attitudes towards anti-COVID-19 tracking technologies, in many cases, this may not mean anxiety-free approval but rather a choice of the *lesser of two evils*. For this reason, a balance between user privacy and health benefits should be a primary concern for both the designers of tracking technologies and the authorities responsible for their implementation. Authorities should ensure that these technologies are used only for their stated purpose (i.e. supporting public health) and that they respect citizens' privacy. The public should be given real and transparent information about the scope of data collection and its use. Other potential solutions to increase transparency and reduce public concern would be, for example, making the source code of the tracking applications publicly available or establishing independent committees consisting of impartial experts to monitor the tracking technologies' design and data governance (see also Akinbi, Forshaw, & Blinkhorn, 2020). The above recommendations may be particularly useful for reducing concerns about anti-COVID-19 technologies among people for whom individual freedom is of value.

6.2. Limitations and future directions

Our research is not free from limitations. First, our research was limited to one country only. However, we argue that the conclusions drawn from Polish experience are largely generalisable for many other European countries with comparable stages of pandemic development—from sudden restriction combined with a high level of uncertainty at the beginning to the slow establishment of "new normal" and gradual lifting of restrictions to the second wave of the pandemic. All these factors could influence people's perception of the COVID-19 threat and be associated with a different social response, such as a greater or lesser tendency to engage in prosocial behaviour or identification with the nation.

Second, our results may be more representative of countries that have not introduced tracking technologies on a larger scale. It would be important to examine relationships between social aspects and acceptance of these technologies in countries where anti-COVID-19 surveillance systems have been extensively implemented (e.g. China and Israel). Also, future studies should consider an even broader range of anti-COVID-19 tracking technologies, given the continuing technological advances in this area.

Cultural differences can also be an important factor in explaining people's general tendency to accept new technologies. For example, in countries such as Singapore or Japan, where technological solutions are implemented on a daily basis, the general level of acceptance may be higher than in countries where such measures are not so common, including Poland. Cultural differences may also influence other variables used. For example, Poland has a relatively low level of social capital measured as a general trust (Eurobarometer, 2019), and generally people are more willing to make financial donations for charity than actually invest their time and work (CBOS, 2016). It would be interesting to compare our results with similar research from more collectivistic (or individualistic) countries.

Third, while our results demonstrated temporal within-person dynamics between prosociality, endorsement of liberty, and AST, future studies should use experimental designs to confirm the causal effects between these variables. Moreover, they should employ manipulations of empathy (Pfattheicher, Nockur, Böhm, Sassenrath, & Petersen, 2020) to evaluate whether it would be related not only to increased tendency to behave in prosocial way but also to accept helpful but potentially dangerous technological solutions.

Fourth, variables used as moderators and covariates were measured with only one item and the reliability of these measures cannot be established. In future studies more precise scales should be used.

Finally, we did not measure endorsement of liberty in the fourth wave. Cross-lagged analysis has shown stability of the relationship between endorsement of liberty and acceptance of anti-COVID-19 tracking technologies; nevertheless, our results would be stronger if we could have shown that this relationship still holds in the context of the second wave of the pandemic.

Additionally, future studies could focus on implementing the Technology Acceptance Model (see e.g. Davis, 1986; Marangunić & Granić, 2015) in the context of the COVID-19 pandemic and testing the extent to which the actual use of anti-COVID-19 tracking technologies and their perceived ease of use and usefulness predict the acceptance of this tool to counteract the pandemic. Our study demonstrates that societal dimensions as predictors of attitudes towards using technology may be worth including in the model, and this may be a possible direction of the development of the Technology Acceptance Model.

7. Conclusion

The question of where the line is drawn between effective action against the threat to people's health and potential hazard to civil liberties is particularly relevant during the COVID-19 pandemic. Although helpful, anti-COVID-19 surveillance technologies have aroused a lot of controversy regarding their potential to be dangerous for civil rights. This is the first study to analyse dynamic, within-person relationships between communal and individual factors and acceptance of anti-COVID-19 tracking technologies. Our results suggest that appealing to prosocial motives (e.g. by governments and other authorities) may be effective in convincing the public of the value of implementing such technologies. However, authorities should ensure that these technologies are used only for their stated purpose and respect privacy; otherwise, they may be resisted by those for whom individual freedom is of value.

Author credit statement

Anna Wnuk: Conceptualization, Methodology, Formal analysis, Funding acquisition, Writing – original draft, Writing – review & editing. Tomasz Oleksy: Conceptualization, Methodology, Funding acquisition, Formal analysis, Writing – original draft, Writing – review & editing. Anna Domaradzka: Funding acquisition, Writing – original draft, Writing – review & editing.

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