

Enhancing Users' Attitudes towards WebIDs: Exploring the Effects of Persuasive Messaging on User Adoption.

The adoption of WebIDs

An experiment exploring the effects of persuasive messaging on the user adoption of WebIDs.

Tim, Theys

Research group for Media, Innovation and Communication Technologies, Ghent University, Tim.Theys@UGent.be

Tom, Haegemans

Research Center for Management Informatics, Catholic University of Leuven, tom.haegemans@kuleuven.be

Jelle, Saldien

Research group for Media, Innovation and Communication Technologies, Ghent University, jelle.saldien@ugent.be

Lieven, De Marez

Research group for Media, Innovation and Communication Technologies, Ghent University, Lieven.DeMarez@UGent.be

Javad, Kashefi

Research group for Media, Innovation and Communication Technologies, Ghent University, javad.kashefi@ugent.be

As society and businesses increasingly rely on data, individuals are growing more uneasy about the protection and management of their personal information. Solid, a decentralized web standard, offers a promising solution by providing individuals with a personal online data store and a corresponding WebID for identification. However, the adoption of WebIDs is still in its early stages and many companies remain uncertain about how to position WebIDs in a way that ensures user acceptance. This study leverages the theory of planned behaviour to explore the effects of different types of persuasive reasoning, aimed at strengthening individuals' attitudes, on their intention to create a WebID. The study identified three persuasive messaging strategies from practice favouring the choice for WebIDs: enhanced control, enhanced personalization, and Single Sign-On (SSO). An online experiment presented participants with one of the persuasive messages and the choice of creating a WebID or using existing accounts (Google, Apple, Facebook) to register on a news website. The results indicate that highlighting enhanced personalization or positioning WebIDs as a Single Sign-On (SSO) solution significantly increased the adoption rate of WebIDs, in contrast to emphasizing enhanced control. This study lays the groundwork for future comprehensive research aimed at exploring the underlying reasons behind the positive influence of certain factors on the adoption of WebIDs.

CCS CONCEPTS • Human-centered computing • Interaction design • Empirical studies in interaction design

Additional Keywords and Phrases: personal data stores, technology acceptance, user adoption, Theory of Planned Behaviour, persuasive messaging

1 Introduction

In today's data-driven society, individuals are increasingly concerned about their privacy and the control they have over their personal information [1]. In response to this growing demand for transparency and control, a web

standard called Solid (Social LInked Data) has emerged as a promising solution. Solid aims to realize the web 'as originally envisioned' by Tim Berners-Lee [2] when he introduced it to the world in 1989. Solid introduces a decentralized approach to web architecture [3], challenging the prevailing centralized data model dominating the internet, where data is concentrated and controlled by a few entities (e.g. Google, Apple and Facebook). By providing individuals with personal online data stores (often referred to as data vaults), Solid empowers them to store and manage their personal data independently of the application they are using [4]. By utilizing personal online data stores, individuals can attain greater control over their personal data, as they can securely store and manage their information within a decentralized repository. This empowers individuals to effectively utilize their data across various applications while maintaining control over its access and usage [5].

However, to establish their personal data store within the Solid ecosystem, individuals are required to create a WebID. A WebID is a unique identifier, represented by a Uniform Resource Identifier (URI) in the form of a web address (e.g. use.id/username), that enables individuals to securely access and manage their data within the decentralized Solid ecosystem. Through this web address, users can access their public profile and seamlessly log on to any personal online data store. This eliminates the requirement to create new login credentials for each website and reduces reliance on a centralized identity provider. It thus serves as a digital identity for users, providing them with a means to authenticate themselves and assert control over their personal information stored in their personal online data stores [6].

Despite the potential advantages of Solid and WebIDs, the adoption of this technology is still in its infancy. Various companies, including prominent organizations like the BBC [7] and the Flemish government [8] are recognizing the potential of Solid and exploring first applications. However, many companies remain uncertain about how to position WebIDs to ensure user acceptance. It is thus essential to understand the factors that influence the adoption of WebIDs to facilitate their successful implementation and uptake.

Theoretically, the adoption of a technology by humans can be explained by frameworks such as the Theory of Planned Behaviour [9], the Technology Acceptance Model [10] and the Unified Theory of Technology Acceptance [11]. Of these frameworks, the Theory of Planned Behaviour generally provides more insights than the other frameworks that were mentioned [12].

The Theory of Planned Behaviour, as shown in Figure 1, aims to explain why an individual performs a certain kind of behaviour (i.e. in this case: creating a WebID or not). According to the theory, an individual will perform a certain kind of behaviour when they have a high intention to do so. The theory also states that the intention to perform a behaviour is based on the individual's attitude towards the behaviour (i.e. does the individual find it important or useful to create a WebID), the subjective norm (i.e. does the individual think others are also creating a WebID), and perceived behavioural control (i.e. is it easy to create a WebID).

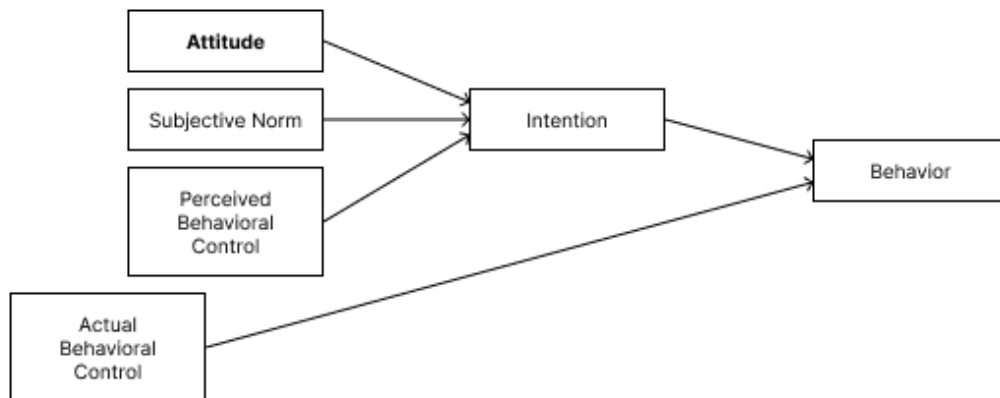


Figure 1: The Theory of Planned Behaviour [9]

Studies that apply the theory of planned behaviour to explain technology acceptance, generally find that improving an individual's attitude is the easiest way to strengthen the intention to adopt a certain type of technology [13]. Therefore, we initiated a first exploratory study grounded in current practices, aiming to investigate the impact of persuasive messaging to strengthen an individual's attitude towards creating a WebID.

RQ: Which type of persuasive reasoning, aimed at strengthening individuals' attitudes, exerts the greatest influence on their intention to create a WebID?

In order to address this research question, an initial review was conducted on the current practices employed by companies utilizing WebIDs to identify which messages related to an individual's attitude would be most impactful. Next, we conducted an experiment in which we tested which one of these messages had the largest effect on users' adoption of WebIDs.

2 Methodology

To examine the influence of various persuasive reasoning approaches aimed at enhancing individuals' attitudes, an online experiment was conducted. The primary focus of this experiment was to investigate the impact of these approaches on individuals' intention to create a WebID. Participants were therefore instructed to locate and click on a specific article within a novel news website, necessitating the creation of an account on the site. Upon account creation, participants were presented with a choice between two options: creating a WebID along with a corresponding personal online data store or opting to log in using their Google, Apple, or Facebook accounts. The website, called 'VRT Kort,' was introduced as a novel platform for delivering personalized news updates by the public broadcaster. Upon successfully accessing the designated article, participants received a reward facilitated by our panel manager. While our main focus regarded the choices made by participants during the account creation phase, we deliberately designed the task to prioritize article retrieval rather than registration. This approach aimed to prevent participants from solely focusing their attention on the registration process. By minimizing the priming effect associated with the registration procedure, we aimed to maintain the external validity of the registration process.

In order to evaluate which type of persuasive reasoning exerts the greatest influence on users' intention to create a WebID, we manipulated the persuasive messaging used to present the argument favouring the selection of a WebID. From practice, three distinct approaches were identified to enhance individuals' attitudes towards creating a WebID. These approaches formed the basis for the three experimental conditions in the study. Each condition employed a different persuasive messaging strategy that emphasized a specific benefit of utilizing WebIDs. These approaches were derived from eight real-world experiences and aimed to capture the diverse ways in which WebIDs can be presented to users. A comprehensive list of the various company websites that were examined to identify different approaches in the positioning of Solid and WebIDs can be found in Appendix A. The three conditions were as follows and are displayed in [Figure 2](#):

Enhanced control

'Manage your data yourself and create a data vault with use.id¹! Create a use.id WebID now so you always retain ownership of your data! After this, you can log in to the platform immediately.'

As Solid offers individuals the ability to have a personal online data store that is connected to their WebID, it empowers users to exercise greater control over their data, allowing them to securely store and manage their information within a decentralized repository. An example of this emphasis on enhanced data control can be observed in the practices adopted by the BBC. Their trial application 'together+ Data Pod'² grants users a dedicated personal online data store to store their streaming history, ensuring that explicit consent from the user is obtained before the BBC can access this data.

1 Use.id is a company that provides Solid pods and corresponding WebIDs to users (<https://get.use.id/>).

2 <https://www.bbc.co.uk/rd/blog/2022-10-social-tv-and-personal-data>

Enhanced personalization

'Enjoy optimal personalization with your use.id account. Connect different services like Spotify and Netflix so we can give you the best recommendations.'

As Solid allows users to store data from multiple applications in their personal online data store, it serves as a catalyst for improved personalization services. Applications can leverage this access to a broader set of data, with the explicit consent of users, to enable enhanced tailored and customized experiences. This means that applications can utilize a wider range of user data to provide more personalized recommendations and deliver customized services that align with individual preferences and needs. A concrete illustration of a company that prioritizes the enhanced personalization capabilities provided by Solid is the start-up Datavillage³. Their Solid based plugin allows users to receive enhanced personalized recommendations on the streaming service of the public broadcaster. These recommendations are based on the users' Spotify listening history, which is stored in their personal online data store.

Single Sign-On (SSO)

'One login for all your Flemish media accounts with use.id!' (Followed by a row of icons of prominent Flemish media platforms.)

The decentralized architecture of Solid provides users with a secure means to access multiple applications using their WebID, which in turn reduces the cognitive burden associated with remembering multiple usernames and passwords. WebIDs can thus serve as an alternative Single Sign-On (SSO) solution. For instance, in the Netherlands, five prominent media players have collaborated in the initiative known as the 'Stichting Nederlandse Datakluis'⁴ (Dutch Data Vault Foundation) to explore this potential.

The websites used in this experiment can be accessed through the provided links in the footnote.⁵

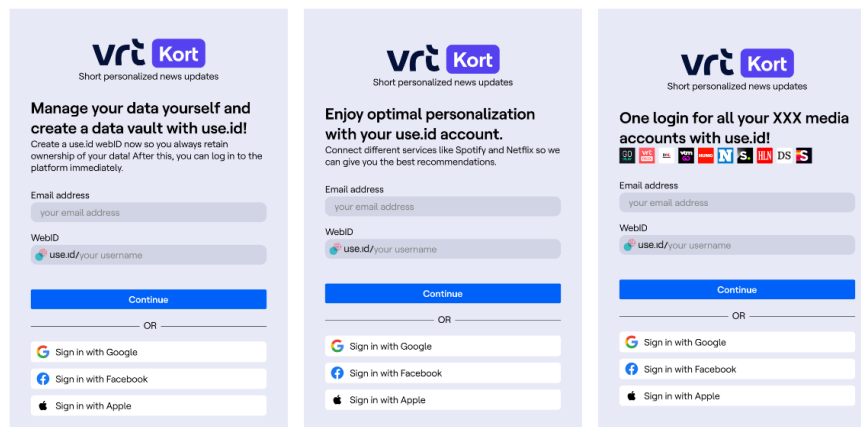


Figure 2: Overview of the three experimental conditions (translated version). From left to right: 1) Enhanced control 2) Enhanced personalization 3) Single Sign-On

A between-subject design was used as participants were randomly assigned to one of the three conditions. Participants were not made aware of this assignment. A total of 169 users engaged with one of three designated websites. Of this group, 82 participants successfully fulfilled the prescribed task, encompassing the creation of a WebID or authentication via prominent platforms such as Google, Apple, or Facebook. The distribution of these accomplished users occurred across distinct experimental conditions, as detailed in [Table 1](#).

3 <https://www.datavillage.me/media>

4 <https://www.datakluis.nl/>

5 <https://solidlab.webflow.io/login6>, <https://solidlab.webflow.io/login7>, <https://solidlab.webflow.io/login8>

Table 1: Demographic distribution of participants among the conditions

	Enhanced control	Enhanced personalization	SSO
Number of participants (n)	29	26	27
Average age (years)	44	50	54
% female	43%	23%	41%
% higher educated	54%	42%	44%

3 Experimental results

To examine the impact of the various persuasive messaging strategies on the adoption of WebIDs, we measured the proportion of users who successfully registered on the website and opted to create a WebID, as opposed to utilizing Google, Apple, or Facebook login options. The outcomes are presented in [Figure 3](#).

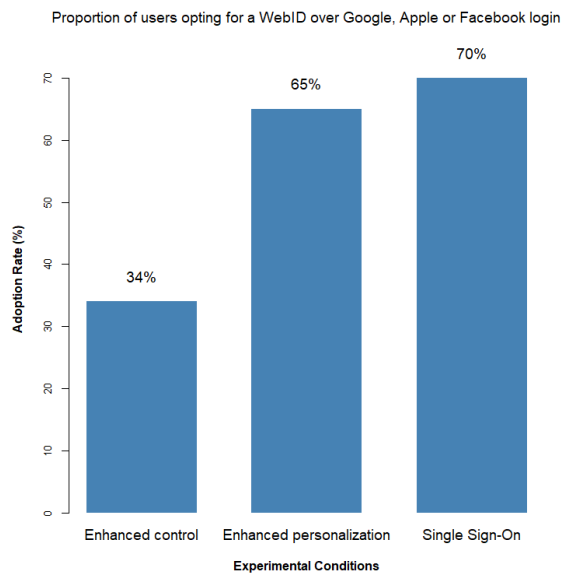


Figure 3: Experimental results indicating the proportion of users opting for WebID over Google, Apple or Facebook login

A one-way analysis of variance (ANOVA) was performed to examine the effects of the different persuasive messaging techniques. The results revealed a statistically significant difference in the adoption rate of WebIDs among the three groups ($F(2,79) = 4.655, p = .0123$), as presented in [Table 2](#).

Table 2: One-way ANOVA analysis outcomes

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Condition	2	2.129	1.0646	4.655	0.0123*
Residuals	79	18.066	0.2287		

* $p < 0.05$

To further examine the results, a Tukey post-hoc test was performed. The results revealed that when the persuasive messaging emphasized enhanced control over personal data, the proportion of users choosing to create a WebID was significantly lower compared to when the emphasis was on enhanced personalization ($p = 0.050$; 95% CI = [0.001, 0.618]; [Table 3](#)) or when WebIDs were positioned as an alternative Single Sign-On (SSO) solution ($p = 0.017$; 95% CI = [0.053, 0.664]; [Table 3](#)). The study did not find a significant difference in adoption rates between emphasizing enhanced personalization or positioning WebIDs as a Single Sign-On (SSO) solution.

Table 3: Post-hoc Tukey-HSD comparison analysis results

		diff	lwr	upr	p adj
Enhanced control	Enhanced personalization	0,309	0,001	0,618	0,050*
	SSO	0,359	0,053	0,664	0,017*
Enhanced personalization	SSO	0,050	-0,264	0,364	0,924

* $p < 0.05$

4 Conclusion

Our results show that emphasizing enhanced personalization or positioning WebIDs as a Single Sign-On (SSO) solution led to significantly higher adoption rates compared to emphasizing enhanced personal data control. These findings underscore the impact of persuasive reasoning strategies in shaping users' decisions regarding WebID adoption.

Practically, our study suggests that companies should carefully consider their messaging strategies when promoting the adoption of WebIDs. The lower adoption of WebIDs when enhanced personal data control is emphasized may be attributed to privacy and consent fatigue, as individuals become wary of managing their data across multiple platforms [14], [15]. The cognitive burden and concerns related to data privacy and security may lead users to hesitate in adopting WebIDs. However, framing WebIDs as a convenient Single Sign-On (SSO) solution or a means to enable personalized experiences can foster higher adoption rates by reducing perceived complexity and appealing to users' desire for convenience and tailored content. Striking a balance between addressing privacy concerns and highlighting the benefits of WebIDs is crucial for encouraging adoption and building trust in the digital landscape. Furthermore, the question arises whether individuals genuinely anticipate additional data control functionalities in this context. Further exploration of this aspect could provide valuable insights into users' preferences and inform the development of more effective strategies for privacy management and promoting WebID adoption.

While our study successfully identified differences in the adoption rates based on various persuasive messaging strategies, it is important to acknowledge its limitations in providing a comprehensive explanation for these differences. As a result, our study serves as a foundation for future research endeavours that can delve deeper into the underlying reasons behind the positive influence of specific factors on WebID adoption. By conducting more extensive qualitative investigations, future studies can provide a more comprehensive understanding of the mechanisms at play in WebID adoption, thereby contributing valuable insights and advancements to the field.

ACKNOWLEDGMENTS

Supported by SolidLab Vlaanderen (Flemish Government, EWI and RRF project V023/10)

A Appendix A

Table 4: List of the various websites that served as valuable inspiration in the formation of the experimental conditions

Website	Description
https://get.use.id/	Use.id provides SaaS components so companies can get started easily with Solid technology.
https://www.inrupt.com/	Inrupt provides enterprise-grade Solid software and services.
https://my.karamel.career/login	Karamel is a career platform that uses WebIDs as login method.
https://www.bbc.co.uk/rd/blog/2022-10-social-tv-and-personal-data	The BBC launched a first Solid demo in which users streaming data is stored in a Solid pod.
https://www.datavillage.me/technology	Datavillage provides a personal AI platform that enables organizations to use and combine the personal data of their consumers through the use of Solid pods.
https://www.vlaanderen.be/digitaal-vlaanderen/athumi-het-vlaams-datanutsbedrijf	Athumi is a neutral public company that facilitates secure data exchange and data collaboration between consumers, businesses, agencies and governments through Solid.
https://www.konsolidate.eu/	Konsolidate guides businesses through the decentralized web revolution, powered by personal data vaults, linked open data and the semantic web.
https://www.datakluis.nl/	An initiative of five mayor Dutch media companies exploring the possibilities of a Dutch data vault.

REFERENCES

- C. Wang, N. Zhang, and C. Wang, "Managing privacy in the digital economy," *Fundamental Research*, vol. 1, no. 5, pp. 543–551, 2021, doi: <https://doi.org/10.1016/j.fmre.2021.08.009>.
- T. Berners-Lee, J. Hendler, and O. Lassila, "The semantic web," *Scientific American*, 284(5), 28, vol. 284, no. 5, p. 28, 2001
- E. Mansour et al., "A Demonstration of the Solid Platform for Social Web Applications," in *25th International Conference on World Wide Web*, 2016, pp. 223–226.
- R. Dedecker, W. Slabbinck, J. Wright, P. Hochstenbach, P. Colpaert, and R. Verborgh, "What's in a Pod?~ A knowledge graph interpretation for the Solid ecosystem," in *Proceedings of the 6th Workshop on Storing, Querying and Benchmarking Knowledge Graphs*, M. Saleem and A.-C. Ngonga Ngomo, Eds., in *CEUR Workshop Proceedings*, vol. 3279. Oct. 2022, pp. 81–96. [Online]. Available: <https://solidlabresearch.github.io/WhatsInAPod/>
- P. Mechant, R. De Wolf, M. Van Compernelle, G. Joris, T. Evens, and L. De Marex, "Saving the web by decentralizing data networks? A socio-technical reflection on the promise of decentralization and personal data stores," *2021 14th CMI International Conference - Critical ICT Infrastructures and Platforms (CMI)*, pp. 1–6, Nov. 2021, doi: 10.1109/CMI53512.2021.9663788.
- R. Verborgh, "Re-decentralizing the Web, for good this time," in *Linking the World's Information: A Collection of Essays on the Work of Sir Tim Berners-Lee*, O. Seneviratne and J. Hendler, Eds., ACM, 2022. [Online]. Available: <https://ruben.verborgh.org/articles/redecentralizing-the-web/>
- BBC, "Together+Data Pod," 2022. Accessed: Jun. 02, 2023. [Online]. Available: <https://www.bbc.co.uk/taster/pilots/together-pod>
- C. Michiels, "Vlaanderen lanceert Athumi: bepalen we binnenkort zelf wat er met onze online data gebeurt?," May 04, 2023. Accessed: Jun. 02, 2023. [Online]. Available: <https://www.vrt.be/vrtnws/nl/2023/05/04/vlaanderen-lanceert-athumi-bepalen-we-binnenkort-zelf-wat-er-me/>
- I. Ajzen, "The theory of planned behavior," *Organ Behav Hum Decis Process*, vol. 50, no. 2, pp. 179–211, 1991, doi: [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T).
- F. D. Davis, "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly*, vol. 13, no. 3, pp. 319–340, 1989, doi: 10.2307/249008.
- V. Venkatesh, M. G. Morris, G. B. Davis, and F. D. Davis, "User Acceptance of Information Technology: Toward a Unified View," *MIS Quarterly*, vol. 27, no. 3, pp. 425–478, 2003, doi: 10.2307/30036540.
- K. Mathieson, "Predicting User Intentions: Comparing the Technology Acceptance Model with the Theory of Planned Behavior," *Information Systems Research*, vol. 2, pp. 173–191, Sep. 1991, doi: 10.1287/isre.2.3.173.
- T. Haegemans, M. Snoeck, and W. Lemahieu, "Entering data correctly: An empirical evaluation of the theory of planned behaviour in the context of manual data acquisition," *Reliab Eng Syst Saf*, vol. 178, pp. 12–30, 2018, doi: <https://doi.org/10.1016/j.res.2018.05.009>.
- H. Choi, J. Park, and Y. Jung, "The role of privacy fatigue in online privacy behavior," *Comput Human Behav*, vol. 81, pp. 42–51, 2018, doi: <https://doi.org/10.1016/j.chb.2017.12.001>.

B. W. Schermer, B. Custers, and S. van der Hof, "The crisis of consent: how stronger legal protection may lead to weaker consent in data protection," *Ethics Inf Technol*, vol. 16, no. 2, pp. 171–182, 2014, doi: 10.1007/s10676-014-9343-8.

© Tim Theys 2023. This is the author's version of the work. It is posted here for your personal use. Not for redistribution. The definitive version was published in *Mensch und Computer 2023 (MuC '23)*, September 3--6, 2023, Rapperswil, Switzerland, <https://doi.org/10.1145/3603555.3608559>.