# An Exploration of how Trust Online Relates to Psychological and Subjective Wellbeing

Trust and Wellbeing Online

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Internet users often report feelings of stress, anxiety, and a lack of control, often related to uncertainty about the use of algorithms and autonomous systems (AS) behind what they encounter. This may lead to a loss of trust in the services, content, and websites people encounter online. In order to ensure that the online world contributes to human flourishing, it is important to understand how both trust and wellbeing manifest online. This paper describes an online questionnaire exploring the relationships between factors related to trust and psychological and subjective wellbeing, as well as online activity and digital confidence. Results suggest that trust is important to people online but in practice is quite low, and that positive measures of wellbeing outweigh the negative, but more could be done to design AS in a responsible, trustworthy, and wellbeing-affirming manner, particularly considering ways to enhance human autonomy and competence. Suggestions are made for how designers might consider trust and wellbeing when approaching the creation and presentation of online AS.

## CCS CONCEPTS

Human-centered computing • Information systems ~ World Wide Web

## Additional Keywords and Phrases:

Trust, psychological wellbeing, subjective wellbeing, self-determination theory, digital confidence, online activity

# 1 Introduction

Much of the internet as we know it is controlled by, or functions as, a series of AS, which users access to find information, carry out financial transactions and banking, consume entertainment, and access a variety of services. Social media is overrun with algorithms deciding who people can interact with and which content they will be shown. The internet is a necessary staple of everyday life, and as such questions are quite rightly being asked about how this might affect user wellbeing [35,59] and how to leverage digital technology to improve wellbeing [7]. Benefits of being online include increased connectivity with friends and families and access to services, experiences, and information that might be difficult or impossible to access offline. However, there are also areas of real concern about physical and mental harms from online media including bullying, addiction and excessive screen time, scams, coercion, and the spread of disinformation [13,42,70]. Many of these issues relate to how AS are deployed behind the scenes of websites used every day. Users often report uncertainty about whether they can trust the platforms they use [8,12,44] and given that trust and wellbeing are frequently linked [33] it is important to examine both to ensure that the online world contributes to human flourishing. Current measures of wellbeing and trust may not be relevant to the online experience, so research into the online context is vital [5,19,41,56,71].

This paper reports an online questionnaire examining online trust and wellbeing. Wellbeing is discussed in terms of both subjective wellbeing and psychological wellbeing, through the lens of self-determination theory (SDT), a widely used theory of motivation and personality concerned with how agency, wellbeing, and performance are affected by social and cultural factors [65]. The SDT sub-theory of Basic Psychological Needs Theory is used to examine how online experiences relate to satisfaction or undermining of three universal human needs: autonomy, competence, and relatedness [64]. Its main contributions are extending our understanding of basic psychological needs within the online context and examining how trust may relate to wellbeing in online spaces. The research questions are:

1. How do users experience trust online?
2. How are the basic psychological needs and subjective wellbeing related to being online?
3. How are trust and wellbeing related online?

# 2 Background

Trust is highly context specific and multidimensional [47], including trust in AS [6], so studying the particular online context important; online users often report being unsure whether they can trust what they see or experience online [12], but many activities carried out online are presumed to be built on a foundation of trust, for example social network use [40], and the use of financial and health services. Online shopping has received particular attention: high levels of digital trust promote online shopping [37], but in general research on factors related to trust online generates similar findings: familiarity, reputation, and word-of-mouth [4,28,29,37,43]; privacy, security, policies, and regulations [29,74]; perceived benefits from the interaction [37]; perceived quality of information [43]; and website design [37,43], which includes both ease-of-use [4] and things acting as expected and not appearing suspicious or fake [3,29].

Trust online may also be related to understanding, experience of, and attitudes towards the algorithms and other AS that control what users see. Trust is seen as a critical factor in interactions with conversational agents [21], and higher trust in content moderation AS has been related to lower trust in humans [55]; users often encounter both online. Adoption of systems using algorithms is increased by sharing information about use and performance [1], and expert trust in using automated machine learning (ML) was also increased by transparency features [20], and so such transparency may increase trust in AS. It is also suggested that public distrust in AS may be due to a lack of regulation that could guarantee trustworthiness [45]. However, the main issue may actually be over-trust rather than a lack of trust: incorrect (but reasonable) recommendations from ML algorithms were trusted even by experts and this was not improved by providing more information about the system [67]; participants asked to make ethical decisions with the help of AS trusted it even without knowing about training

data or when told negative information about the model [48]. In the latter case the authors suggest increased digital literacy may be a solution. Similarly, it has been suggested that distrust may be due to misunderstanding what AS actually does [45]; the authors also suggest that end-users should not have to decide whether an AS is trustworthy as that should be ensured by experts, regulation, and auditing.

Trust is often related to wellbeing [33]; understanding how trust and wellbeing might be related online can help to ensure that the internet contributes to rather than undermines human flourishing. Definitions of wellbeing often focus on different dimensions of wellbeing within two main psychological traditions: eudaimonic and hedonistic [15]. The first refers to living well and is often referred to as psychological wellbeing (PWB) whilst the latter refers to the balance of positive and negative emotions experienced by an individual and is often conceptualized as subjective wellbeing (SWB). They are separate but related constructs that are experienced together, such that people with high levels of both may be said to be 'flourishing' or having a 'full life' [32,54].

The attainment of PWB is an essential part of SDT [65], a collection of six sub-theories forming a framework of motivation and personality focusing on how an individual's agency, wellbeing, and performance is affected by social and cultural factors. According to the Basic Psychological Needs Theory sub-theory, psychological health and wellbeing are achieved by satisfying the basic psychological needs (BPN) for autonomy (freedom and independence to act as desired), competence (ability to carry out an action effectively and the experience of self-efficacy), and relatedness (meaningful and fulfilling social connections with others) [14,63,64]. BPN are found across cultures [10] and domains (e.g. relationships, school, work, hobbies) [53]. Satisfaction of BPN has been repeatedly found to be positively associated with positive indicators of wellbeing including vitality, positive affect (PA), and overall life satisfaction [16,69]. PA and life satisfaction are two of the three essential components of SWB, the third being negative affect (NA). Activities beneficial to PWB are often also beneficial to SWB but not necessarily vice versa; additionally, immediately after a positive experience SWB tends to be higher but long term increases in PWB are higher [32]. Measuring need satisfaction alongside SWB can provide more well-rounded examinations of wellbeing, combined into a Eudaimonic Activity Model (EAM) which also includes eudaimonic motives and activities [50] to form an overarching model of wellbeing.

Literature about online experiences often focuses on negative experiences such as cyberbullying or negative social comparison; problematic internet and social media use has been linked to personality and psychological needs [46]. Increased social media use has been associated with decreased life satisfaction and quality of life in children [52], and may be damaging to mental health [61], increase negative affect and reduce self-esteem [26], or cause social overload [9] undermining relatedness and autonomy; increased reliance on the online world may decrease face-to-face contact and socialization, also undermining relatedness. However, internet connectivity and the use of the internet have also been positively related to life satisfaction [24]. During the pandemic, positive online social comparison predicted improvements in anxiety, stress, loneliness, and life satisfaction [62]. Being exposed to online positivity in social networks may have benefits over and above offline social support for some [41], and non-users of the internet may have lower life satisfaction [58]. Both online gaming and social media may improve emotional wellbeing through self-expression, as well as satisfying self-determination and relatedness [7], or providing an outlet for attaining BPN [51]. Social media and other communication technologies can facilitate a sense of togetherness that many people highly value, allowing communities of support to emerge and niche groups to form. Increased choice in terms of access to vast amounts of information and content may promote autonomy; conversely too much choice may be overwhelming. Successfully carrying out activities or finding information and navigating the online world as desired may improve self-efficacy and a sense of competence. User understanding and digital literacy have been found to positively affect levels of online wellbeing [30], but digital skills do not necessarily increase satisfaction [24]. Perceived competence may also influence how users deal with negative experiences [36].

Whilst the use of personalisation and automated decision-making algorithms to organise and recommend content to the user helps to cut through the vast amounts of information available, these algorithms rely on huge quantities of personal data and users are often given practically no (usable) information about how that data is used. The fairness, accuracy, and reliability of such systems might affect the wellbeing of the user and society as a

whole, as highlighted by IEEE Standards Association standard on assessing the impact of autonomous and intelligent systems on wellbeing [35]. Users often report feelings of disempowerment, anxiety, stress, and defeatism surrounding their use of the internet [12], and increased use of automated decision-making algorithms online may lead to feeling a lack of agency, choice, or control [22,70], both of which suggest a reduction in autonomy. Users also commonly feel that they do not understand what is happening to them or their data when online [25] and may therefore find that their competence is undermined. A users' relationship with technology has also been shown to relate to wellbeing when interacting with social media [57]. It has also been suggested that the design of user experiences can be improved through consideration of BPN [60,71]. Understanding how to design with responsibility, trust(worthiness), and wellbeing in mind is vital, as many designers agree that they and the tech companies they work for are responsible for digital wellbeing, due to their power over design and its implications [2].

Satisfying BPN may lead to motivations to trust, in turn affecting willingness to continue to trust or to restore trust [73]. Trust in technologies including AS often depends on the behaviours of those involved in their development and release [11,49,68] Additionally, people are often unaware they are encountering an AS online and therefore cannot assess trustworthiness [45]; their only trust experience would be towards other people, which is a consistent predictor of SWB [33], and institutions, both of which are positively associated with life satisfaction [23,39], and suggest an association with relatedness. Trust in AS in different contexts was related to technical affinity [6] and trust in technology may relate to public understanding and acceptance of science [68], so trust and competence are likely related. Older adults often report feeling they have no choice but to use online services that they do not understand or trust [8], increasing NA and undermining autonomy. Trustworthy AI, according to the European Commission, should demonstrate respect for human autonomy, prevention of harm, fairness, and explicability [34]; this first principal speaks directly to the BPN for autonomy. Measures of trust have also included competence (along with benevolence and reciprocity which are associated with relatedness) as important factors in trust [31].

The remainder of the paper describes an online questionnaire which aimed to examine these issues of PWB, SWB, and trust online.

# 3 Method

## 3.1 Development of the study

Principals of responsible research and innovation (RRI) were embedded in this study from the start [38]. The context of the study has its roots in two multi-year EPSRC-funded projects which had specific RRI workpackages and aims. Throughout the projects, the research team engaged with an advisory group made up of potential users of the systems under study, and of the specific demographics being studied (children and young people, young adults and older adults). This group helped to form the research questions, context of studies, and methods used, including co-creating materials for parts of the projects. This study takes the results of these research and advisory activities and broadens out the demographics to the general internet population. In particular, the 'Trust' section of the questionnaire (section 3.3.4) was developed using an iterative and user-driven design process. It was designed during 6 advisory group meetings and a series of workshops looking at broader issues of online trust [19], resulting in a prototype which ensured that the language was understandable and relevant, and that the items showed good internal reliability.

## 3.2 Participants

A total of 301 participants began the study, with 260 completing at least the wellbeing questions and therefore being included in analysis. Table 1 summarises participant demographics. Half were female (51.2%), a quarter were aged 26-35 years old (26.5%), and most resided in the UK (76.9%). Nearly two thirds are employed (63.1%), and the majority had at least an undergraduate qualification (79.6%). Participants were recruited via email and

social media and had to confirm they were over 16 years old to take part. Participants gave anonymous consent but were given the option to provide contact details to be entered into a prize draw after taking part.

**Table 1: Demographics of survey participants**

| | Answer categories | Percent respondents | Number of respondents |
|---|---|---|---|
| Gender | Male | 44.6 | 116 |
| | Female | 51.2 | 133 |
| | Non-binary | 2.3 | 6 |
| | Other/prefer not to say | 1.5 | 4 |
| Age | 16-25 | 15.4 | 40 |
| | 26-35 | 26.5 | 69 |
| | 36-45 | 20.4 | 53 |
| | 46-55 | 14.2 | 37 |
| | 56-65 | 8.1 | 21 |
| | 66-75 | 11.5 | 31 |
| | 76+ | 3.5 | 9 |
| Country of Residence | United Kingdom | 76.9 | 200 |
| | Outside of UK (21 countries) | 19.2 | 50 |
| Employment | Employed | 63.1 | 164 |
| | Unemployed, including homemaker | 5.4 | 14 |
| | Retired | 14.2 | 37 |
| | Student | 16.2 | 42 |
| Education | Less than University | 17.7 | 46 |
| | Undergraduate | 20.4 | 53 |
| | Postgraduate | 51.2 | 133 |
| | Professional Qualification | 8.1 | 21 |

## 3.3 Materials and Procedure

The study was approved by [removed for review]. It was carried out online using Qualtrics survey software. First, participants were presented with a description of the study and its aims, a full privacy notice, and consent form. In the first section, participants were asked (but not required) to supply basic demographic details (Table 1). They were then asked a series of multiple-choice questions related to four areas: online activity, BPN, SWB, and trust.

### 3.3.1 Online Activity

Participants were asked to indicate on a 5-point scale from 'very rarely or never' to 'very often or always' the frequency with which they took part in 6 online activities in the previous four weeks: socialising, making purchases, finding information, watching videos or playing games, sharing or creating content, and finance or organisation. Items on this scale can be taken separately or totaled to give an overall indication of activity levels from 6 to 30. Participants were also asked to rate, on a 5-point scale of 'very low' to 'very high', 6 statements related to their digital literacy, to understand how much confidence they had in their ability online: "Your overall digital literacy"; "Your knowledge of how to keep safe online"; "Your ability to tell whether or not a website is trustworthy"; "Your knowledge of how to control your personal data online"; "Your ability to control what happens to you online"; "Your ability to find reliable information online". This scale shows good Cronbach's alpha reliability ($\alpha = 0.88$).

### 3.3.2 Basic Psychological Needs

There are several scales to measure satisfaction of BPN, with perhaps the most widely used and extensively validated being the Basic Psychological Need Satisfaction scale [27,63,65]. The Balanced Measure of Psychological Needs (BMPN) is a modified version of this which considers satisfaction and dissatisfaction of needs separately rather than on a continuum [66]. This section used a slightly modified version of the BMPN to try and better capture the online context which may have specific effects on basic needs [19,71]. Participants were asked to think about their online experiences in the past four weeks and indicate on a 5-point Likert scale their agreement or disagreement with 18 statements, 3 each measuring satisfaction of autonomy, competence, and relatedness, and 3 each measuring dissatisfaction of autonomy, competence, and relatedness. Scales showed good reliability (competence satisfaction $\alpha$=0.74; relatedness satisfaction $\alpha$=0.77; autonomy dissatisfaction $\alpha$=0.73; competence dissatisfaction $\alpha$=0.79), except for autonomy satisfaction ($\alpha$=0.50) and relatedness dissatisfaction ($\alpha$=0.56) which are taken as single item scales for inferential analysis (Table 2). Scores for each subscale are taken as the average of all items between 1 and 5. Overall satisfaction and overall dissatisfaction are also calculated as an average of all relevant items between 1 and 5, also showing good reliability (satisfaction $\alpha$=0.76, dissatisfaction $\alpha$=0.81).

**Table 2: Cronbach's alpha reliability for BMPN subscales[a]**

| Subscale | alpha | Items |
|---|---|---|
| Autonomy satisfaction | 0.50 | *My choices represented my thoughts, feelings, and ideas* |
| | | I was free to do things my own way |
| | | I was doing what really interests me |
| Autonomy dissatisfaction | 0.73 | I felt a lot of pressure I could do without |
| | | I was being told what I had to do |
| | | I had to do things I did not want to |
| Competence satisfaction | 0.74 | I was successfully completing difficult tasks |
| | | I took on and mastered hard tasks |
| | | I did well even at the hard things |
| Competence dissatisfaction | 0.79 | I struggled doing something I should be good at |
| | | I did something stupid, that made me feel incompetent |
| | | I experienced some kind of failure or was unable to do well at something |
| Relatedness satisfaction | 0.77 | I felt a sense of closeness to the people I interacted with |
| | | I felt a sense of contact with people I like |
| | | I felt connected with others |
| Relatedness dissatisfaction | 0.56 | *I had disagreements or conflicts with people* |
| | | I felt unappreciated |
| | | I did not interact with people as much as I would have liked |
| Overall satisfaction | 0.73 | All satisfaction items |
| Overall dissatisfaction | 0.81 | All dissatisfaction items |

[a] Statements in italics were used as single item constructs.

### 3.3.3 Subjective Wellbeing

Commonly used scales to measure SWB include the Positive and Negative Affect Schedule (PANAS) [72] and the Scale of Positive and Negative Experience (SPANE) [17], both of which ask users to rate how much they have recently experienced a list of equivalent positive and negative emotions. However, there are currently no measures specifically looking at the online context, which may produce different feelings and experiences that relate to wellbeing [56]. In this section participants completed a modified SPANE [17] developed based on

previous research [12,18] as well as initial checks for reliability and context [19]. Participants were asked to think about their online experiences in the past four weeks and report how much they experienced each of 12 emotions, six positive and six negative, on a 5-point scale from 'very rarely or never' to 'very often or always'. Scales for both PA and NA show good reliability (PA α=0.78, NA α=0.80, Table 3). Scores for each subscale are the average of all items from 1 to 5; the balance of affect was also calculated by subtracting the NA score from the PA score for a range of -4 (extremely negative experiences) to +4 (extremely positive experiences).

**Table 3: Cronbach's alpha reliability for SWB subscales**

| Subscale | alpha | Items |
|---|---|---|
| Positive affect | 0.78 | Empowered |
| | | Pleased |
| | | Creative |
| | | In control |
| | | Calm |
| | | Safe |
| Negative affect | 0.80 | Annoyed |
| | | Anxious |
| | | Apathetic |
| | | Powerless |
| | | Paranoid |
| | | Disempowered |

### 3.3.4 Trust

Measuring trust is a complex matter, and existing scales to measure trust may not be appropriate for online settings [5]. The effect of automated decision-making algorithms adds a complexity to understandings of online trust, and so this section identified specific features of platforms and services that might relate to trust online, co-created during previous research (see section 3.1). Participants were asked to think about their online life in general and indicate how much they agreed or disagreed with statements related to trust, on a 5-point Likert scale. This included 5 statements related to the importance of trust to them when they are online, 6 statements related to how trusting they are online, and 16 contextual statements related to different online experiences. The "importance of trust" and "trusting beliefs" subscales achieved acceptable reliability (importance α=0.67, beliefs α=0.87). Scores for each subscale are the average of all items from 1 to 5. The remaining 16 trust items were examined separately for contextual information.

**Table 3: Cronbach's alpha reliability for trust subscales**

| Subscale | alpha | Items |
|---|---|---|
| Importance of trust | 0.67 | I would stop using a website if I didn't trust it |
| | | I use websites that give me what I want even if I don't trust them (reversed item) |
| | | I think about trust when I am online |
| | | Users should be able to trust the websites they use |
| | | My choice to use a website is related to my personal values |
| | | I often use websites that I don't trust (reversed item) |
| Trusting beliefs | 0.87 | I feel a sense of trust in most of the websites I use |
| | | Most of the websites I use act in people's best interests |

| Subscale | alpha | Items |
|---|---|---|
| | | I have confidence in most of the websites I use to do what they say they will |
| | | Most of the websites I use treat their users fairly |
| | | Most of the websites I use are basically honest |
| | | Most of the websites I use are trustworthy |

## 3.4 Analysis

Analysis was carried out in IBM SPSS Statistics 26. Summary statistics were calculated for all subscales and other variables. Many variables showed significant negative skew (e.g. towards 'strongly agree'), with some also showing significant kurtosis. As such non-parametric tests are used. Related-Samples Friedman's Two-Way Analysis of Variance by Ranks with post hoc pairwise comparisons with Bonferroni correction for multiple tests is used to examine the differences between satisfaction and dissatisfaction of needs. Related-Samples Wilcoxon Signed Rank Tests are used to examine overall satisfaction vs dissatisfaction, PA vs NA, and "importance of trust" vs "trusting beliefs". Spearman's rho correlations were carried out to investigate relationships between variables. All inferential statistical analysis used a statistical significance threshold of $p<0.05$. For correlations, values above 0.40 are considered moderate, and above 0.70 are strong; below 0.20 correlations indicate an extremely weak or non-existent relationship even if significant.

# 4 Results

Participants indicated that they went online frequently for a variety of reasons (Figure 1). Digital confidence was high (median=3.8, IQR=0.8) as were overall activity levels (median=23.0, IQR=5.0). The most common activities (Table 4) were finding information and socialising (both median=5.0, Very often or always, IQR=1.0); watching videos and financial activities were often carried out (both median=4.0, Often, IQR=1.0); the least common were sharing or creating content and making purchases (both median=3.00, Sometimes, IQR=2.0). Increased activity levels are significantly positively related to increased digital confidence, $r_s=0.23$, $p<0.001$, as is the specific activity of finding information ($r_s=0.25$, $p<0.001$). Sharing content has no relationship to digital content and the rest are extremely weak.

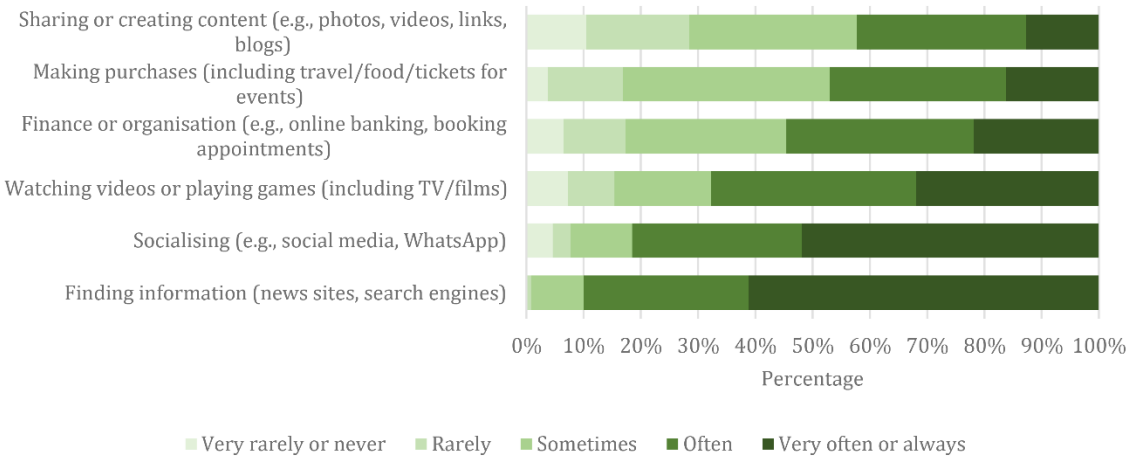


**Figure 1. Frequency of online activities in the previous four weeks.**

## 4.1 Trust

Scores for "importance of trust" (median=4.2, IQR=0.8) are significantly higher than "trusting beliefs" (median=3.5, IQR=1.0), z=2271.0, p<0.001. "Importance of trust" is also significantly positively correlated with "trusting beliefs" ($r_s$=0.41, p<0.001). There are no relationships between online activity and these aspects of trust (Table 4). Only the negative relationship between "importance of trust" and time spent watching videos or playing games is significant and it is extremely weak. Similarly, digital confidence does not relate to either aspect of trust.

**Table 4: Median responses for online activities and contextual trust items, and Spearman's rho correlations with trust subscales[a]**

| | Median (IQR) | Correlation with 'Importance of trust' | Correlation with 'Trusting beliefs' |
|---|---|---|---|
| Online activity (previous 4 weeks): | | | |
| Total online activity | 23.0 (5.0) | 0.02 | 0.05 |
| Finding information (news sites, search engines) | 5.0 (1.0) | 0.03 | 0.08 |
| Socialising (e.g., social media, WhatsApp) | 5.0 (1.0) | -0.00 | -0.01 |
| Watching videos or playing games (including TV/films) | 4.0 (1.0) | -0.16* | -0.04 |
| Finance or organisation (e.g., online banking, booking appointments) | 4.0 (1.0) | 0.15 | 0.09 |
| Making purchases (including travel/food/tickets for events) | 3.0 (2.0) | -0.02 | 0.12 |
| Sharing or creating content (e.g., photos, videos, links, blogs) | 3.0 (2.0) | 0.10 | 0.04 |
| Contextual Trust statements: | | | |
| I consider whether I trust the website when using a site that requires my financial details | 5.0 (1.0) | 0.21** | 0.27*** |
| I don't trust sites that ask for personal data without explanation | 5.0 (1.0) | 0.22*** | 0.04 |
| It is important that I trust the social media platforms that I use | 4.0 (2.0) | 0.34*** | 0.25*** |
| A good brand reputation increases my trust in a website | 4.0 (1.0) | 0.20** | 0.28*** |
| I am more likely to trust websites that I have used before | 4.0 (1.0) | 0.18** | 0.20** |
| I trust websites more if my friends and family use them | 4.0 (1.0) | 0.04 | 0.25*** |
| In general, websites that clearly display their security measures are more trustworthy | 4.0 (1.0) | 0.22*** | 0.21** |
| Websites that give me control over my data are more trustworthy | 4.0 (1.0) | 0.12 | 0.10 |
| Negative feedback in the press or on social media reduces my trust in a website | 4.0 (0.0) | 0.00 | 0.10 |
| I look at the relevant website policies before I can trust the site | 3.0 (2.0) | 0.13* | -0.06 |
| In general, when online I trust that I will get the best recommendations for me | 3.0 (2.0) | 0.08 | 0.32*** |
| In general, when online I trust that search results will be reliable | 3.0 (2.0) | 0.01 | 0.26*** |
| Overall, online reviews are usually trustworthy | 3.0 (2.0) | -0.04 | 0.18 |
| I am more likely to trust websites that are easy to use | 3.0 (1.0) | -0.13* | 0.15* |
| My trust in a site is affected by the algorithms that it uses | 3.0 (1.0) | 0.14* | -0.02 |
| I don't need to trust sites that I go to for purely entertainment purposes | 2.0 (2.0) | -0.41*** | -0.12 |

[a]Significant correlations are indicated by *p<0.05 **p<0.01 ***p<0.001.

In terms of the remaining (contextual) trust items (Table 4), participants strongly agreed that they didn't trust websites that ask for personal data without explanation, and that they consider trust when conducting financial transactions online (all median=5.0, IQR=1.0). They agreed that it was important to trust social media platforms (median=4.0, IQR=2.0), that reputation, having used a site, friends and family that use a site, having control over data, and clear security measures all increase trust (all median=4.0, IQR=1.0). They also agreed that negative

feedback in the press or on social media reduced trust (median=4, IQR=0.0). They neither agreed nor disagreed that they trusted they would get the best recommendations or reliable search results, that reviews are trustworthy, or that they sought out relevant policies before trusting a site (all median=3.0, IQR=2.0). They were also ambivalent that their trust was affected by the sites' algorithms or ease of use (all median=3.0, IQR=1.0). Finally, they disagreed that it was not necessary to trust websites that were purely for entertainment (median=2.0, IQR=2.0).

Most relationships between contextual trust items and "Importance of trust" or "Trusting beliefs" are extremely weak or non-significant (Table 4). Agreement with the statement "I don't need to trust sites that I go to for purely entertainment purposes" shows a moderate negative association with "importance of trust", $r_s$=-0.41, p<0.001. There are weak associations between "importance of trust" and "I don't trust sites that ask for personal data without explanation", "In general, websites that clearly display their security measures are more trustworthy", "A good brand reputation increases my trust in a website", and the importance of trust in using social media and financial transactions. There are also weak associations between "trusting beliefs" and stronger trust in websites with clear security measures and good reputations, stronger trust in recommendations and search results, "I trust websites more if my friends and family use them", "I am more likely to trust websites that I have used before", and the need to trust financial and social media sites.

## 4.2 Wellbeing

Over half of the participants (59.6%) somewhat or strongly agreed that their online activities influenced their sense of wellbeing (median=4.0, IQR=1.0). Satisfaction of needs is high for all three needs (Figure 2, autonomy median=4.0, IQR=1.0; competence median=3.7, IQR=1.0; relatedness median=4, IQR=0.7) and dissatisfaction of needs is low (autonomy median=2.7, IQR=1.7; competence median=2.3, IQR=1.3; relatedness median=2.0, IQR=2.0). A Related-Samples Friedman's Two-Way ANOVA by ranks showed a significant effect, $X^2(5)$=466.4, p<0.001 between satisfaction and dissatisfaction of needs. Pairwise comparisons for multiple tests show that satisfaction is significantly higher than dissatisfaction for each need (p<0.001); for satisfaction, relatedness is significantly higher than competence (p=0.003); there are no significant differences for dissatisfaction. Related-Samples Wilcoxon Signed Rank Test shows that overall satisfaction (median=3.8, IQR=0.7) is significantly higher than overall dissatisfaction (median=2.4, IQR=1.0), z=1445.0, p<0.001. Participants showed relatively high PA (median=3.5, IQR=0.8) and low NA (median=2.5, IQR=1.2), with significantly higher levels of PA (z=3511.0, p<0.001) and an overall positive balance (median=1.0, IQR=1.7).

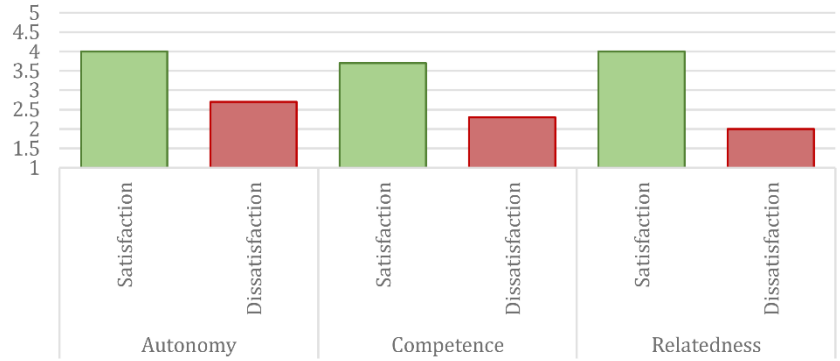


**Figure 2. Median scores for BPN satisfaction and dissatisfaction, 1=strongly disagree, 2=disagree, 3=neither agree nor disagree, 4=disagree, 5=strongly agree**

Table 5 shows relationships between the satisfaction and dissatisfaction of needs. Increases in autonomy dissatisfaction are moderately associated with increases in competence dissatisfaction ($r_s$=0.50, p<0.001). Increases in autonomy satisfaction are weakly related to decreases in autonomy dissatisfaction and increased relatedness satisfaction; increased autonomy dissatisfaction is weakly related to increased relatedness dissatisfaction; higher competence dis/satisfaction is weakly related to higher relatedness dis/satisfaction. Finally overall need satisfaction is weakly related to lower autonomy and competence dissatisfaction and overall dissatisfaction, and overall need dissatisfaction is weakly related to lower autonomy and relatedness satisfaction. The remaining significant correlations are extremely weak.

**Table 5: Spearman's rho correlations between BPN satisfaction and dissatisfaction[a]**

| | Autonomy | | Competence | | Relatedness | | Overall | |
|---|---|---|---|---|---|---|---|---|
| | Sat | Dis | Sat | Dis | Sat | Dis | Sat | Dis |
| Autonomy satisfaction | - | -0.27*** | 0.17** | -0.20** | 0.23*** | -0.13* | - | -0.28*** |
| Autonomy dissatisfaction | -0.27*** | - | 0.02 | 0.50*** | -0.14* | 0.30*** | -0.25*** | - |
| Competence satisfaction | 0.17** | 0.02 | - | -0.18** | 0.23*** | 0.09 | - | -0.08 |
| Competence dissatisfaction | 0.20** | 0.50*** | -0.18** | - | -0.16** | 0.26*** | -0.25*** | - |
| Relatedness satisfaction | 0.23*** | -0.14* | 0.23*** | -0.16** | - | -0.10 | - | -0.23*** |
| Relatedness dissatisfaction | -0.13* | 0.30*** | 0.09 | 0.26*** | -0.10 | - | -0.07 | - |
| Overall satisfaction | - | -0.25*** | - | -0.10 | - | -0.07 | - | -0.31*** |
| Overall dissatisfaction | -0.28*** | - | -0.08 | - | -0.23*** | - | -0.31*** | - |

[a]Significant correlations are indicated by *p<0.05 **p<0.01 ***p<0.001. Subscales which contain the same items are not correlated (-).

Table 6 shows relationships between affect and BPN. Higher PA is moderately related to lower NA ($r_s$=-0.59, p<0.001). Higher PA is weakly related to higher satisfaction of all needs and to lower dissatisfaction of autonomy and competence; there is a moderate positive relationship between PA and overall need satisfaction ($r_s$=0.56, p<0.001) and a weak negative relationship with overall need dissatisfaction. Higher NA is weakly related to lower need satisfaction across the board, and moderately to higher overall need dissatisfaction ($r_s$=0.60, p<0.001) and dissatisfaction of autonomy ($r_s$=0.52, p<0.001) and competence ($r_s$=0.52, p<0.001); the relationship to relatedness dissatisfaction is weak. Higher affect balance moderately relates to higher overall need satisfaction ($r_s$=0.49, p<0.001), and to lower overall need dissatisfaction ($r_s$=-0.56, p<0.001 and dissatisfaction of autonomy ($r_s$=-0.49, p<0.001) and competence ($r_s$=-0.48, p<0.001); there is a weak positive relationship with satisfaction of all three needs.

**Table 6: Spearman's rho correlations between BPN and affect[a]**

| | Positive affect | Negative affect | Affect balance |
|---|---|---|---|
| Autonomy satisfaction | 0.25*** | -0.23*** | 0.27*** |
| Autonomy dissatisfaction | -0.31*** | 0.52*** | -0.49*** |
| Competence satisfaction | 0.38*** | -0.23*** | 0.31*** |
| Competence dissatisfaction | -0.31*** | 0.52*** | -0.48*** |
| Relatedness satisfaction | 0.30*** | -0.23*** | 0.27*** |
| Relatedness dissatisfaction | -0.09 | 0.24*** | -0.20** |
| Overall satisfaction | 0.56*** | -0.39*** | 0.49*** |
| Overall dissatisfaction | -0.36*** | 0.60*** | -0.56*** |

[a]Significant correlations are indicated by *p<0.05 **p<0.01 ***p<0.001.

Table 7 shows relationships between online activity and wellbeing. Increases in overall activity relate weakly to increased relatedness satisfaction and overall satisfaction. Individually, socializing relates weakly to relatedness satisfaction, and sharing or creating content shows weak positive relationships to relatedness

satisfaction, overall need satisfaction, and PA. No other activities appear to relate to wellbeing. Increases in digital confidence relate weakly to increases in competence and relatedness satisfaction, overall need satisfaction, PA, and affect balance; increases in digital confidence also relate weakly to decreases in competence dissatisfaction and overall dissatisfaction.

**Table 7: Spearman's rho correlations between wellbeing and online activity[a]**

| | Socialising | Purchases | Information | Games / videos | Content creation / sharing | Finance / organisation | Overall online activity | Digital confidence |
|---|---|---|---|---|---|---|---|---|
| Aut. sat. | 0.02 | -0.07 | -0.01 | 0.05 | 0.07 | 0.00 | 0.01 | 0.13* |
| Aut. dis. | 0.08 | 0.04 | 0.11 | 0.05 | 0.2 | 0.01 | 0.08 | -0.10 |
| Com. sat. | -0.01 | 0.05 | 0.15* | 0.10 | 0.10 | 0.07 | 0.13* | 0.28*** |
| Com. dis. | 0.03 | -0.04 | -0.02 | 0.06 | -0.01 | -0.09 | 0.00 | -0.23*** |
| Rel. sat. | 0.29*** | 0.10 | 0.11 | 0.04 | 0.31*** | 0.13* | 0.26*** | 0.09 |
| Rel. dis. | 0.14* | 0.04 | 0.02 | 0.15* | 0.07 | 0.06 | 0.15* | 0.01 |
| Overall sat. | 0.14* | 0.06 | 0.15* | 0.11 | 0.24*** | 0.09 | 0.20*** | 0.27*** |
| Overall dis. | 0.05 | 0.04 | 0.05 | 0.10 | 0.01 | 0.01 | 0.08 | -0.16** |
| Pos. affect | 0.08 | 0.02 | 0.06 | 0.03 | 0.21*** | 0.00 | 0.09 | 0.30*** |
| Neg. affect | 0.09 | 0.08 | 0.05 | 0.16* | -0.02 | 0.09 | 0.14* | -0.18** |
| Affect balance | -0.01 | -0.05 | 0.00 | -0.10 | 0.11 | -0.07 | -0.06 | 0.26*** |

[a]Significant correlations are indicated by *p<0.05 **p<0.01 ***p<0.001.

## 4.3 The Relationship between Trust and Wellbeing

Table 8 shows the relationships between "importance of trust" and "trusting beliefs" and online wellbeing. Increases in "importance of trust" are weakly associated with higher autonomy and affect balance, and lower autonomy dissatisfaction, overall need dissatisfaction, and NA. Stronger "trusting beliefs" are associated with higher autonomy satisfaction, overall need satisfaction, PA and affect balance, and lower autonomy dissatisfaction, overall need dissatisfaction, and NA.

**Table 8: Spearman's rho correlations between wellbeing and the importance of trust and trusting beliefs[a]**

| | Correlation with 'Importance of trust' | Correlation with 'Trusting beliefs' |
|---|---|---|
| Autonomy satisfaction | 0.07 | 0.20** |
| Autonomy dissatisfaction | -0.20** | -0.22** |
| Competence satisfaction | 0.08 | 0.14* |
| Competence dissatisfaction | -0.16 * | -0.18** |
| Relatedness satisfaction | 0.14* | 0.16* |
| Relatedness dissatisfaction | -0.11 | -0.11 |
| Overall satisfaction | 0.18** | 0.24*** |
| Overall dissatisfaction | -0.22** | -0.20** |
| Positive affect | 0.18** | 0.29*** |
| Negative affect | -0.25*** | -0.31*** |
| Affect balance | 0.24*** | 0.32*** |

[a]Significant correlations are indicated by *p<0.05 **p<0.01 ***p<0.001.

In terms of contextual trust items, any association between psychological needs or affect were extremely weak. Only relatedness satisfaction was weakly related to feeling that it is important to trust social media platforms ($r_s$=0.21, p<0.001).

# 5 Discussion

The aim of this paper was to explore experiences of and attitudes towards trust in the online world and how this relates to wellbeing, in particular looking at the satisfaction and dissatisfaction of BPN and attainment of SWB. Participants indicated that they went online most frequently for finding information or socialising, and most participants felt that their online activities influenced their sense of wellbeing; they also felt that trust was an important factor online and that online activity affected their levels of trust. Digital confidence was also high among participants, with those who did more online feeling higher confidence. This discussion addresses the three main research questions in turn.

## 5.1 Trust online is seen as important, but trust levels are only moderate

The first research question was "how do users experience trust online?" Overall, participants did not feel a great deal of trust towards the internet but considered trust online important. They felt particularly strongly that they considered trust when conducting financial transactions, and slightly less so that it was important to trust social media platforms. Participants who felt that trust was important also felt this more than others across different types of websites (financial, social media, and entertainment), although levels of trust were not related to the actual activities carried out online.

Reputation, familiarity, friends and family using a website all increase trust, as expected [3,4,28,29,37,43], however they were ambivalent about ease-of-use being a factor in trust as previously found [4]. Placing more importance in trust is, perhaps surprisingly, associated with trusting the internet more. This may imply that participants who think more about trust have higher understanding and confidence in being able to trust what they encounter; however, trust does not appear to relate to levels of digital confidence, contra findings that trust increases with digital literacy [6,48,68]. It may be that people who consider trust important tend to over-trust [48,67], or that people who place more importance in trust spend more time seeking information such as privacy policies and security measures in order to trust the sites they use [28,74], or they are more choosy about the sites they use, and therefore are more familiar with them, are used to their design and normal experiences of interacting with them. In fact, the feeling that trust in websites was related to reputation and familiarity was higher in those with higher trust, as were clear security measures; agreement that trust was related to security, data use, and reputation were also higher in those who placed more importance on trust.

Whilst participants did not feel that their trust was affected by the algorithms used by websites, participants strongly agreed that they didn't trust websites that ask for personal data without explanation, and agreed that having control over data, and clear security measures increase trust [29,74]. These are important factors to consider in the design of websites that rely on AS, particularly relating to transparent information on how data is used and kept safe. However the presentation of this information is also important to consider, given that misunderstanding can lead to distrust [45]. Additionally, participants indicated that their trust isn't contingent on reading the website policies, so users are making these trust decisions related to data and security in other ways, most likely related to the overall user experience and design of the website [37,43] and clear information not hidden in terms and conditions.

Participants did not have particularly high trust in the content of what they find online, for example that they got reliable results or recommendations or that they could trust online reviews. Increased trust in content was related to increased trust overall. Given that trust is linked to content appearing as expected, not suspicious, or fake [3,29], and the perceived quality of information [43] this lack of confidence in content may explain some of the low levels of trust.

## 5.2 Satisfaction of basic psychological needs and positive affect outweigh dissatisfaction and negative affect

The second question was "how are the basic psychological needs and SWB related to being online?" All BPN show low levels of dissatisfaction, satisfaction is relatively high and significantly higher than dissatisfaction. Participants also showed relatively high PA, and moderate to low NA, with an overall positive balance. PA is significantly higher than NA, and the more PA a user has, the lower NA they experienced. It is heartening to see this pattern, that overall participants felt their online lives to be more conducive to living well than detrimental. Whilst dissatisfaction of each need is similar, there are differences in need satisfaction. In general, increases in dis/satisfaction of one need is associated with increases in dis/satisfaction of other needs, and experiences of autonomy and competence appear particularly related. This implies that people who feel more confident about being online also feel more freedom of choice and self-efficacy. However, relatedness and autonomy are both higher than competence.

In general, higher PA and affect balance are related to lower dissatisfaction and higher satisfaction of needs. Likewise, higher NA is generally related to lower satisfaction and higher dissatisfaction of needs. This agrees with previous literature, for example that lower autonomy such as decreased agency and choice relates to higher NA such as stress and anxiety [12,22,70] and increased PA relates to lower anxiety, stress, loneliness, and negative life satisfaction [62]. The only need for which this is not true is relatedness dissatisfaction, which is not related to either increases or decreases in PA. As such it is not the case that experiences such as disagreements and conflicts override feelings of happiness. The relatively consistent relationship between PWB and SWB backs up previous research highlighting this relationship [16,32,69] and suggests that measuring them together can provide a broader understanding of wellbeing in general [50] and enhance our understanding of the effects of being online.

In terms of online activity, only socializing and sharing or creating content are associated with wellbeing in this study. The former is positively associated with relatedness satisfaction and the latter with both relatedness satisfaction and PA as well as digital confidence. Increases in online activity in sum are also related to higher digital confidence and relatedness satisfaction. Increased information seeking also relates to higher confidence. No other needs, or levels of SWB are related to increases or decreases in online activity. This does not support literature which shows that increased or 'problematic' internet use may lower BPN [46] and increase NA [9]; it does support findings that social media use is associated with increased relatedness [7] but not BPN in general [51].

Digital confidence appears to have the most relationships with wellbeing online. Higher digital confidence is associated with overall need satisfaction and lower digital confidence is associated with lower overall satisfaction. Users with higher digital confidence also appear to experience greater PA and a higher overall affect balance. This agrees with suggestions that digital literacy and positive relationships with technology relate to increased wellbeing [30,57]. Increases in digital confidence are related to increased competence satisfaction and decreased competence dissatisfaction. It is perhaps not surprising that a user who feels that they have good digital literacy and can carry out the tasks they need to online experience better competence than those who perceive their abilities to be lower [25]. It does however suggest that designers should consider how to increase the confidence of their users through the use of their online systems and incorporate AS in a way that is both autonomy and competence affirming [60,71] rather than automating everything and hiding processes and choices behind fancy UX.

## 5.3 Trust is only weakly related to wellbeing online

Whilst trust and wellbeing have been related in other literature [33], in this study relationships were weak. Placing greater importance on trust online appears related to improved autonomy, and decrease overall dissatisfaction as well as improved PA and lower NA. Increased trust online also related to improved autonomy and overall satisfaction (and decreased dissatisfaction) as well as higher PA and lower NA. Although weak, this does agree with findings that higher trust is related to greater life satisfaction [23,39] and SWB [33] and that

satisfaction of BPN can increase trust [73]; the latter appears especially true for autonomy, suggesting this BPN is most important for trust (and trustworthiness [34]) rather than competence and relatedness [31]. It also agrees with findings that low trust relates to low affect [8]. Overall, results suggest that feeling trust in the websites and platforms that they use makes users happier and more satisfied online, improving wellbeing overall.

## 5.4 Limitations and future work

It is vital to be able to reliably measure the online experience as people spend much of their lives on the internet, especially since the pandemic, and this could have potentially significant consequences both online and off. The scales used to measure trust and wellbeing experiences in this study worked quite well, but both autonomy satisfaction and relatedness dissatisfaction had reliability issues. Given the prevalence of literature on both factors, for example the importance of control over ones' online life, and the effects of social comparison and social overload, it is important that these needs are accurately measured. Further work on BPN online is therefore needed.

This paper reported simple relationships to the variables studied as a first exploration of the context and the appropriateness of the theories and measures used; subgroup analysis and further examination of the data may prove fruitful. Finally, there are always limitations surrounding the use of online surveys as a method: measure of online activity relied on self-report rather than measuring actual behaviour so future work may consider looking at tracking online activity and relating that to trust and wellbeing measures. Additionally, as this was an online survey about being online, the survey will have missed those who do not use the internet for whatever reason, including lack of understanding or feeling that it is detrimental to their wellbeing, and respondents may have been skewed towards those who use the internet frequently and feel that it is beneficial to them. It is always a challenge to study non-use and barriers to use, but these are worthy goals for future work.

# 6 Conclusions: Towards a more responsible, trustworthy, and wellbeing affirming internet

This paper examined how being online related to users' experiences of trust and wellbeing, with the view to understanding how the AS that run the internet may be created and presented in a more responsible, trustworthy, and wellbeing affirming way. Concepts of BPN and SWB were related to user trust, the importance they place on trust, and opinions on what contributes to trust. In addition, users' digital confidence and self-reported online activity was examined. Findings indicate that the needs for autonomy, competence, and relatedness are satisfied more than dissatisfied online, and that satisfaction and dissatisfaction of needs were related respectively to experiences of positive and negative affect. The relationship is a fruitful one to explore and designers should consider how their systems can help satisfy BPN and in that way increase both PWB and SWB. Examining both together can also enhance our understanding of the effects of being online.

Trust is felt by users to be important but actual trust in the internet is only moderate; measures of wellbeing did not relate strongly to trust, but results suggest that feeling trust in the websites and platforms that they use makes users happier and more satisfied online, highlighting the importance of designing systems for trust. However, it is vital that these systems are not only trusted, but trustworthy. Participants did not base their evaluations of trust and trustworthiness on the algorithms/AS in use by platforms, nor do they read privacy policies to make such judgments. They do however consider what is being done with their data and what the outcomes of this is. Designers looking to create trustworthy AS for online experiences should consider this. Presentation of information surrounding the use of AS is important to avoid misunderstanding, aid in clarity, and to support the autonomy and competence of the user. This last is especially important given the relationship between autonomy, trust considerations, and evaluations of trustworthiness. Information should be presented as part of the user experience, rather than hidden in terms and conditions or obfuscated by the design of the page, and be conducive to human autonomy rather than automating every decision; equally one should be aware of information overload and providing unnecessary or potentially misleading information (e.g. overstating the

accuracy of a decision-making algorithm). Another important consideration for designing for trust and trustworthiness relates to the content of websites: participants did not feel that content such as reviews, search results, and recommendations were trustworthy in general. Given that content of all kinds online is increasingly governed by algorithms and ML, from the order of presentation, which content is prioritized, to actual generation of content, this lack of trust in content needs to be addressed by designers of AS. Finally, in addition to avoiding over-automation to affirm autonomy, designers should consider how their AS might increase the confidence of users and be competence affirming.

## ACKNOWLEDGMENTS

This work was supported by the Engineering and Physical Sciences Research Council [grant numbers EP/T022493/1, EP/V00784X/1, EP/R033633/1]. Elvira Perez Vallejos also acknowledges the financial support of the Medical Research Council [grant number MR/T046864/1] and the NIHR Nottingham Biomedical Research Centre.

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