Human Digital Index

Tomislav Krištof

Algebra University
Zagreb, Croatia

tomislav.kristof@algebra.hr

Zlatan Morić

Algebra University
Zagreb, Croatia

zlatan.moric@algebra.hr

Luka Maras

Algebra University
Zagreb, Croatia

luka.maras@racunarstvo.hr

Abstract: The purpose of this paper is to examine the proposed five modules of the proposed model of Human Digital Intelligence (HDI) measured by Human Digital Index (HDI), later in text HDI stands for Human Digital Index. HDI is a quotient which shows one's ability to cope with today's digital world (digitality) with efficiency without endangering one's health. Further in this paper we will address this general approach to Human Digital Intelligence as measurable quotient of Human Digital Index and we will sustain ourselves from calling it intelligence since this is more applicable as a marketing term and not the term that has firm scientific foundations.

The proposed five modules are: Digital Integration, Digital Health, Digital Resilience, Digital Influence and Digital Dexterity. Each module will be described based on the research and interpretation of the current situation in the digital world through scientific papers, researches, publications and other sources of information.

Furthermore, the goal is to develop a metric system which will provide a thorough insight into an individual's HDI quotient that is comparable to all examinees of the proposed test. Each module is covered in detail, including the proposed components of each module. The work presented through this paper is a foundation for developing further research and building a comprehensive test for Human Digital Index.

INTRODUCTION

The concept of intelligence [1] or IQ deals with intellectual prowess of humans, which is marked by complex cognitive feats and high levels of motivation and self-awareness [2]. It measures the capacity of a human to deal with the outside world. However, IQ is not the best predictor of one's walk of life in terms of what is considered a success or unsuccess [3]. There are other factors within humans that better determine and predict one's potential to succeed: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism ("The big five personality traits")[5]. When properly measured, these traits provide a better insight of a person. We would like to emphasize grit as a derivative of emotional stability [4], described within the trait of neuroticism, because it has been shown that it is a better success predictor than IQ.

The space left in predictive models that escapes mentioned measuring is education. It includes knowledge and skills developed through formal and non-formal education entities such as universities or official online courses. There is still some space left through informal education processes such as: peer to peer education, "googling", watching YouTube videos. That last one (informal) happens to be one of the strongest channels of our everyday lives and communication because in great measure [6] it deals with the digital realm that is not thoroughly taught in schools. So if we focus on the behavioral level of human functioning, it turns out that a great deal of our available time is spent online either in some sort of interaction, communication or content consumption.

The premise is that the efficiency and consequently success strongly depends on our abilities to deal with all sorts of online challenges. And certainly, to some extent, our efficiency online depends on our IQ, grit, emotional stability and other traits but they don't reach the full potential of describing today's digital human.

In this paper, we will explain and present a five-module measuring system we call HDI that will add quality to existing human measuring systems like IQ and Big five personality traits that are acknowledged by the contemporary mainstream psychology. Our preliminary report is based on professional digital experience and online research by the authors, as well as on a focus group research and one quality research.

EXISTING MODEL - DQ BY DQ INSTITUTE

There is an existing model that is called DQ (Digital Intelligence) [7], which deals with competencies placed within the indicator conveniently called DQ. As stated on the web page. dqinstitute.com, *Digital Intelligence (DQ) is a comprehensive set of technical, cognitive, meta-cognitive, and socio-emotional competencies that are grounded in universal moral values and that enable individuals to face the challenges and harness the opportunities of digital life. DQ has three levels, eight areas, and 24 competencies composed of knowledge, skills, attitudes, and values.*

Table 1. DQ Competencies, source: https://www.dqinstitute.org/dq-framework/

1 Digital Citizen Identity	2 Balanced Use of Technology	3 Behavioral Cyber-Risk Management
4 Personal Cyber Security Management	5 Digital Empathy	6 Digital Footprint Management
7 Media and Information Literacy	8 Privacy Management	9 Digital Co-Creator Identity
10 Healthy Use of Technology	11 Content Cyber-Risk Management	12 Network Security Management
13 Self-Awareness and Management	14 Online Communication and Collaboration	15 Content Creation and Computational Literacy
16 Intellectual Property Rights Management	17 Digital Changemaker Identity	18 Civic Use of Technology
19 Commercial and Community Cyber-Risk Management	20 Organizational Cyber Security Management	21 Relationship Management
22 Public and Mass Communication	23 Data and AI Literacy	24 Participatory Rights Management

It is a comprehensive model of 24 dimensions placed in 8 competencies, through 3 areas., the dimensions are:

1. Digital Identity
2. Digital Use
3. Digital Safety
4. Digital Security
5. Digital Emotional Intelligence
6. Digital Communication
7. Digital Literacy
8. Digital Rights

The areas are:

1. Digital Citizenship
2. Digital Creativity
3. Digital Competitiveness

It also includes three human dimensions through each competences and areas that are:

1. Knowledge
2. Skills
3. Attitudes/Values

This model deals well with mentioned dimensions that thoroughly cover many aspects of digital behavior. It serves as a framework that should standardize competences needed for better digital behavior, content consumption, digital literacy, communication and safety. As stated on the model web page, *The ultimate goal of the DQ Framework is to guide digital practices towards achieving individual and societal well-being across all aspects of one's life.*

The goal of this model, however, is to describe and define competencies as an educational framework. Not to test those competencies. It also deals with education of children and not necessarily all internet users. Furthermore, it lacks some dimension that will be later covered within HDI model.

INCOMPLETENESS OF THE DQ MODEL

1. It does not cover any kind of verifying the competences at the time of writing

2. It is oriented only towards children through their education modules, kind of educational platform available on dqworld.net

3. It has a broad definition of competencies, for example, *Public and mass communication*. (How do we measure it?)

4. The modules aren't refined as precisely as in the HDI proposed model

5. There is no or little measurement of (some random examples)

    a. Digital influence

    b. Digital networking

    c. Digital addiction

    d. Screen time quality

    e. Digital value transfer

    f. Etc.

7. And ultimately it is not a test of any kind

The answer to the comprehensive DQ model is to make additional efforts to further refine modules and facets of those modules and to modify and adjust them to make them testable, verifiable, measurable, comparable and thus more relevant. And the final goal is to provide a verifiable universal standard of human digital "intelligence" that can benefit the bearer of the index value(HDI) and the perceiver of the value. Example may be, a job candidate and an employer representative.

THE FIVE MODULES OF HUMAN DIGITAL INDEX - RESEARCH

THE FOCUS GROUP

The focus group took place on 20th June 2018. It was organized by the research company Prizma CPI, Zagreb, Croatia.[8]. We gathered 12 people of different walks of life, young to mid-aged, reasonably computer savvy. With predominantly open questions we tried to see what these people thought about digital in general and upon their responses led the conversation to conclusions. The first question was to establish the accumulated time of of their use of computers (for both private and business purposes), as well as their habits. Each contributor responded differently but the common variable is that all of them started using computers at an early age. Some of them use computers for gaming, many as means of earning a living, but all of them as a primary way of communicating and getting the news. As a huge milestone in the development of the human civilization, the digitalization is a positive thing. Some answers were as follows:

"I like Pinterest, apps, fitness apps, something that makes me feel good about myself, not to show myself to people. So, digital is integrated into your life, and I can't imagine going back to previous life."

"When I decided to come here, I asked for you to send me the location, because of the digital age, I trust my phone and I wouldn't be able to do that without a navigation system."

Some answers opened questions that reveal a negative side to digitalization.

"What they get from parents and school system, a true religion about what is right or wrong, and everything that is available is not necessary right, for example, dark web, If children are not educated and didn't get appropriate filter, they could be damaged, we have screen time, and they prove that mental and physical well-being is influenced and correlates with screen time, regardless of screen time quality and if screen time daily is too long it is bad for us, both for children and adult. "

Further on the negative.

"In my opinion, negative sight reflects on social component, especially in the young generation, teenagers, because they don't usually talk face to face, they use mobile, they don't sit on a coffee and talk for a couple of hours, now they are losing social component in case of digital age."

When asked about digital intelligence as a concept, they described it in a different but converging way.

Question: "In the digital world, what kind of skills you need to be skillful as a digital person?"

Answers: *"Awareness of consequences", "Confident", "Learn the digital language that communicates through forms, pictures, icons", "Self-confident", "Social skills"*

When confronted with the five modules of digital intelligence they had to decide which is the most important.

Question: "What is the most important module to be better in the future as a digital person?"

Answers were predominantly digital health, then digital dexterity, then digital influence.

In general, the results of the focus group were that the five modules cover in great deal the concept of digital intelligence. It was also concluded that the measuring of digital intelligence may help an individual to better perceive her/himself in a digital environment compared to the rest of the population and most importantly to seek solutions of self-improvement.

Further online research was done to help construct a five-module system of variables that build the aggregate of HDI as presented further in the paper.

THE ONLINE QUALITY RESEARCH

The online survey was available from 17.12.2018 to 18.1.2019, approximately a month, the number of people who successfully completed the survey was 61. The first part of the survey was quantitative and demographic in character.
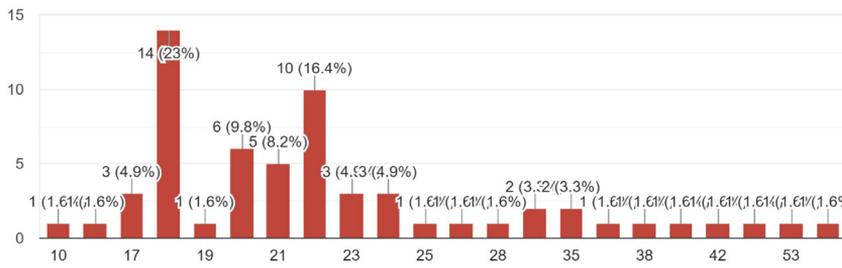

Figure 1. Age of examinees.

The average year of age of the examinees is 23. Most answers we got were given by the examinees of age between 17 and 25 years. (45 answers).
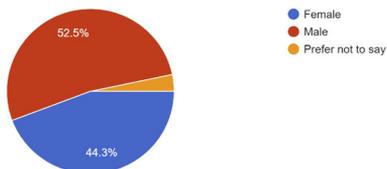

Figure 2. Gender of examinees

When asked about their dream occupation (that may or may not be digital), the most answers were converging into these:

• CEO

• Digital marketing expert

• Medicine

• Photography

• IT (game/web development)

• Designer

We may with significant assurance state that the majority of dream occupations were within digital communications, but in the fields of medicine, art and education.

The intensity of the usage of the following digital activities, services and products in regard to at least one on the each sub-list...(1 - never use it, 3 - occasionally use it, 5 - intensively use it) is:

Table 2. Usage of digital activities, services and products

Purpose	Average consumption (1-5)
Social Networks: Instagram, Facebook, Twitter, LinkedIn…	**3,98**
Communication: WhatsApp, Viber, other similar	**4,40**
Free time: Netflix, TV on demand, Online radio, Deezer, Spotify, other similar	3,08
Buying: Amazon, Wish, Alibaba, eBay, other similar	2,40
Devices: Chromecast, Google home, Amazon Alexa, Apple, other similar	1,88
Services: Google Drive, Google Apps, MS Office 365, Dropbox, iCloud, other similar	3,51
Administration and finance: e-citizen, e-banking, e-government, other similar	3,04
Education: Coursera, Udemy, Lynda, YouTube, other similar	3,73
Informing 1: Mainstream digital news sources	2,7
Informing 2: Alternative digital news sources	2,88
TV	2,47
Radio	2,39
Newspapers and magazines	1,85
Conventional buying	3,42
Classroom education	3,85
Free time out-of-home: bicycle, walking, running, gym, hobby, other sport	**3,73**
Free time in-home: books	2,65
Free time in-home: cooking, working around the house, garage, maintenance, hobby	3,39
In-person socializing: friends, relatives, close people	**4,0**

Our examinees are active users of digital channels. However they still perform outdoor activities in numbers that will benefit their mental and physical wellbeing. This is according to trends. [9]

Here are important questions and consequential answers to them regarding digitality in quality terms. They work as fundaments for building an HDI.

How is digitality good for society in general? (57 answers)

We can summarize the answers as following. Communication is easier, quicker and more interesting. We are worldwide connected and everything is in the palm of our hand. We can build an excellent networking, reach broader audience, build a brand and follow trends in real time. We can learn from other's experiences and errors, everything is faster (online shopping, e-banking, social network, work that is not dependent of location, there are many digital tools that help us be more efficient). No physical borders. Better information of anything around us, like for example price comparison. Digitality gives everyone an equal starting point.

How is digitality bad for society in general? (57 answers)

We can summarize the answers as following. We live in a cold, brutal world, people are prone to negative actions (cyberbullying, cybercrime…), for they can hide behind their keyboard and fake profiles. No touch with the real world, there is a value issue. Our values are distorted. New generations exercise less and don't get outdoor enough. There is a stress as a consequence of missing out, unless one is plugged in constantly. Addiction, loneliness, depression. No privacy, people feel exposed, prone to negative effect produced by the influencers. Digitality is crushing emotional and social intelligence. The consequence is lack of productivity at work and school. Likes and follows mirror self-confidence which leads to loneliness and narcissism. Dark web, distorted perception of reality. People expect everything now. There is no boredom to produce creativity, people are constantly being poked by interactivity. No need for creativity.

In our research we have created two personas, one being Iris who is well connected and digital opposed to Christian who is less connected and not digital at all. The following questions and the answers are summarized to give an outlook at proposed modules.

DIGITAL INTEGRATION

Based on what characteristics, behaviors, habits can we describe Iris as well integrated into the digital world?

Answers shortened to keywords: active, dependent on information, trends, online communication, self-confidence, safety, privately connected to many friends, business wise connected to many partners, advertising is easier, content rich environment, articles, education, YouTube, Google, notification, addiction, anxiety, online personal brand

Based on what characteristics, behaviors, habits can we describe Christian as poorly integrated into the digital world?

Answers shortened to keywords: hates hyper connectivity, not integrated, not publishing, posting, old school media like magazines, personal life not dependent of digital, cannot grasp the purpose of digitality, Not aware of the benefits of digitality. Not playing games. Prefers in person communication.

DIGITAL INFLUENCE

Based on what characteristics, behaviors, habits can we describe Iris as a prominent influencer in the digital world? (50 answers)

Answers shortened to keywords: very active online through various platforms, deeper knowledge of digitality, influencer, personal brand, high engagement (likes, follows, comments, reactions), promote other brands on their request, expert, communicates opinions, stands, values, expands her social network, understands digital culture, shapes other's opinions, expresses herself, posts about sensitive topics, people want to connect to her

Based on what characteristics, behaviors, habits can we describe Christian as poorly influential in the digital world? (47 answers)

Answers shortened to keywords: avoids digital world, not active, not having many friends, doesn't "speak" digital, doesn't know how to make himself more attractive to other people, likes girls though, occasionally uses social networks but has no habit, doesn't change opinions easily, active in offline world.

DIGITAL RESILIENCE

Based on what characteristics, behaviors, habits can we describe Iris as resilient to the digital threats? (50 answers)

Answers shortened to keywords: lots of time online, conscious of online threats, avoid as many threats as possible, very learned when it comes to cyber threats, knows how to use online software, how to handle data, careful with suspicious web pages, doesn't use open WIFI's, backs her data up, uses different passwords, likes to learn about threats and dangers in online world, because of low confidence prone to cyberbullying.3

Based on what characteristics, behaviors, habits can we describe Christian as sensitive to the digital threats?(48 answers)

Answers shortened to keywords: knows little of the internet, because of overconfidence vulnerable to digital dangers, uses only one password for all, leaves digital footprint carelessly, little online experience, believes everything he sees online, does not use any protective tools, hard to adopt and to adapt to new technologies, fear of unknown.

DIGITAL DEXTERITY

Based on what characteristics, behaviors, habits can we describe Iris as digitally dexterous (skillful)? (52 answers)

Answers shortened to keywords: digitally savvy, active, experienced, fast, routine, shortcuts, well adapted to digital, finds everything she needs very quickly, follows trends, likes to learn, Google oriented, wide spectrum of online knowledge, early adopter.

Based on what characteristics, behaviors, habits can we describe Christian as digitally clumsy?(49 answers)

Answers shortened to keywords: Slow, inactive, no experience, trouble with finding his way, irritable, negative opinion about Google, intimidated by the amount of infor-

mation online, has difficulty to learn new things, doesn't know basic activities on social networks, consumes too much time on irrelevant things in general

DIGITAL HEALTH

Based on what characteristics, behaviors, habits can we describe Iris as digitally healthy during her rich digital presence? (46 answers)

Answers shortened to keywords (A type, positive answers): Is note easily charmed by the online world, knows when to take a break, follows trends, reads books, active runner, aware of screen time, makes breaks, knows how to differ right from wrong online, pursues her passions and dreams, not wasting time online, sense of self control, accepts critiques and comments, has a well determined goals,

Answers shortened to keywords (B type, negative answers): Spends lot of time online, high screen time, not digitally healthy, lets her self confidence be influenced by online world, and consequently on her general health.

Based on what characteristics, behaviors, habits can we describe Christian as digitally unhealthy while being at least for some time on the digital platforms? (42 answers)

Answers shortened to keywords: Easy to wander off in digital information, does not handle well lot of information, tends to be negative about everything, does not know digital culture, frustrated, victim of inappropriate content, has trouble distinguishing right from wrong online, physically fit, but mentally prone to influence, uses a great amount of time for simple tasks online, easily distracted, quickly loses his "compass".

GENERAL INFORMATION ABOUT THE PROPOSED MODEL

You have just worked on the developing of the five modules of the digital intelligence and have gotten to know them better. Please grade the importance of each module. (1 - not important at all, 5 - most important) (57 answers)

Table 3. Grading of the importance of each module

Module	Average position
Digital Integration	3,7
Digital Influence	3,5
Digital Resilience	4,0
Digital Dexterity	3,9
Digital Health	4,2

Are there any overlapping between categories, what are they?

• Digital Resilience and Digital Health (x5)

• Digital Influence and Digital Resilience

• Integration and Dexterity are basically the same just on bigger scale

• Integration and Dexterity

- Digital Influence and Digital Dexterity (x2) and Digital Integration
- Resilience and Dexterity (x2)

Did we miss anything, perhaps some other category, name your category, how would you grade its importance from 1 to 5?

- Digital Literacy, Digital Communication (4,5)
- Digital Independency (4)
- Digital Leisure (just spending good time in your free time – 3)
- Digital rights and ethics (3)

OTHER SOURCES OF ESSENTIAL INFORMATION

The need for a comprehensive model that will help people to better cope with digital world is further emphasized through correlative data from various independent sources that depict unquestionable trends in engaged samples. We would like to emphasize that the trends sharply correlate negative trends in the years of 2010-2012 with the wide emergence of touch screen smartphones and consequent internet availability.
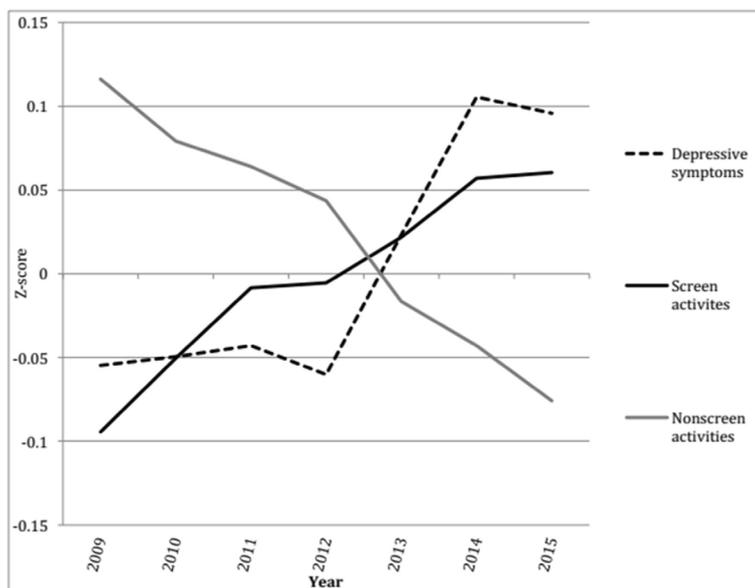

Figure 3. Trends in screen activities, non-screen activities, and depressive symptoms, 8th and 10th graders, Monitoring the Future (MtF), 2009-2015. Image: Jean M. Twenge
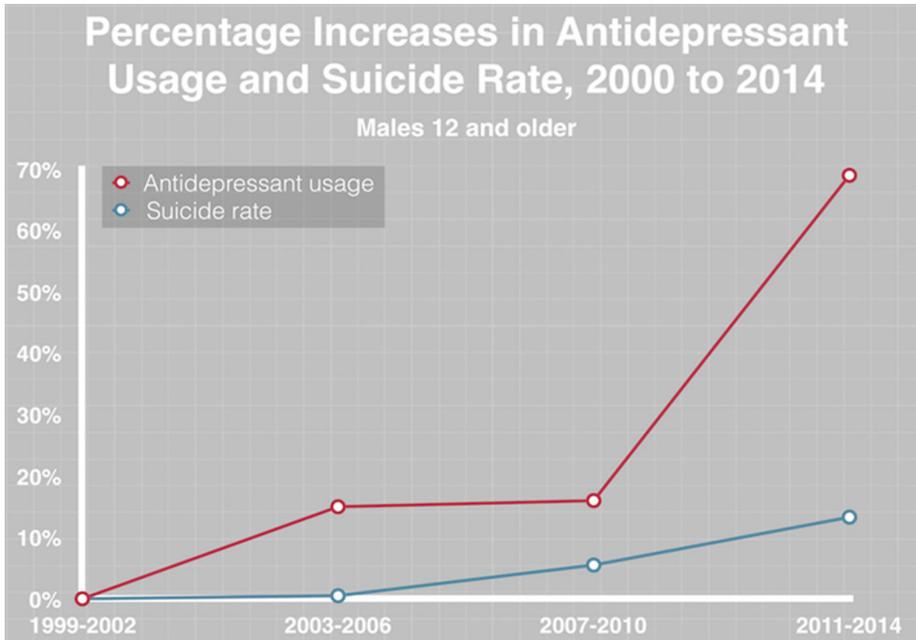
Figure 4. Increases in Antidepressant Usage and Suicide Rate, 2000-2014, Males 12 and older [10] [11]
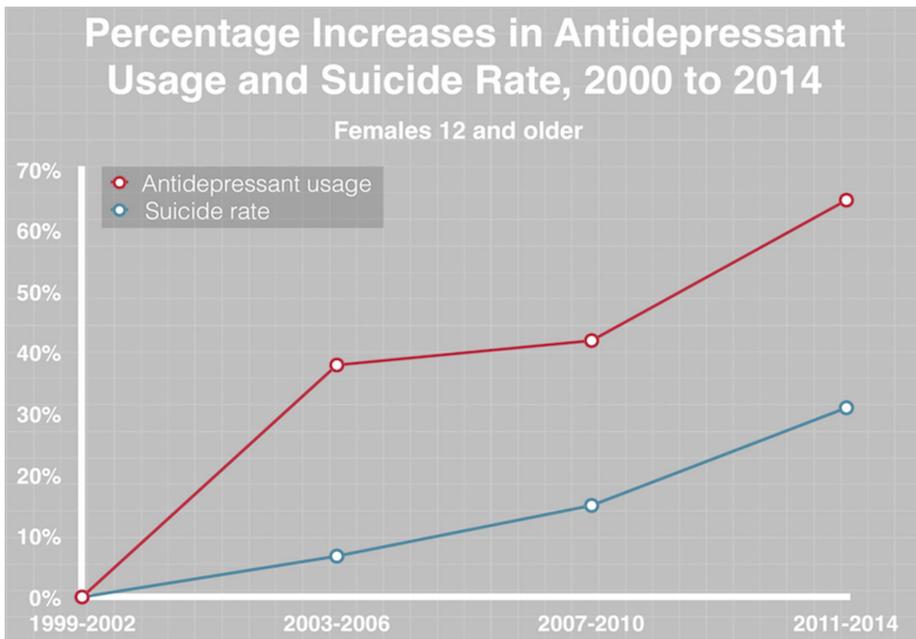

Figure 5. Increases in Antidepressant Usage and Suicide Rate, 2000-2014, Females 12 and older[10] [11]
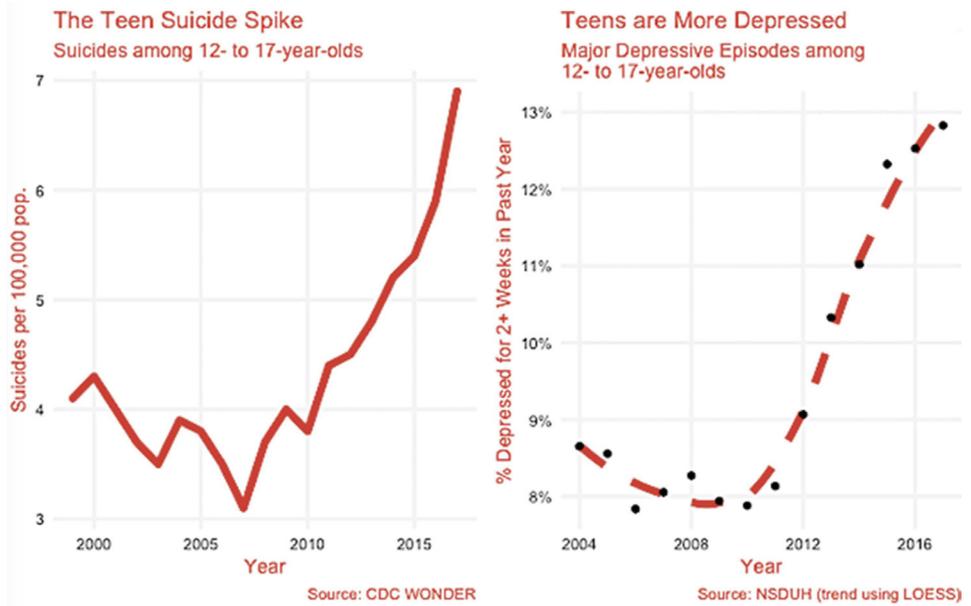
Figure 6. The Teen Suicide Spike compared to Major Depressive Episode among 12-17-years-olds [12]
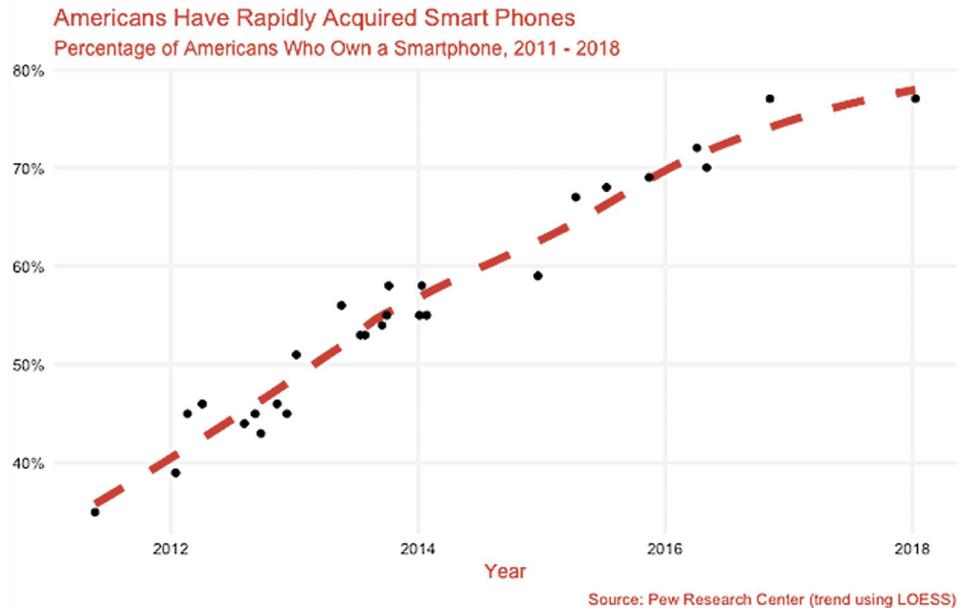

Figure 7. Smartphone acquisition among US population [12]

CONCLUSION BASED ON DONE RESEARCH

The conclusion based on the focus group, online quality research and available data is that the trends regarding digital penetration and evident raise in online activities since the emergence of touch screen smartphones and higher internet availability are worrying. Although given data may be scientifically insufficient, we allude to common sense and determine that there is unquestionable correlation between deterioration of general mental health and digitality. There is a definite causation too, but we shall sustain ourselves from stating that since we believe that further research has to be made. The goal of this paper is to determine a fundament for testing one's digitality and consequently give solution for people's wellbeing in consuming digital content, being on social networks and being digital in general, so we propose strictly based on our research the following modules.

DIGITAL RESILIENCE

DESCRIPTION

In the domain of digital resilience that measures one's ability to cope with various threats that are specific to the digital era, like stealing private data, impersonating, cyberbullying, vulnerabilities like not backing up one's data, legal threats online etc.

We shall call to explain some events and researches that point to privacy and security threats. *One is the infamous Cambridge Analytica scandal[13], which involves a third-party Facebook app that harvested data well beyond the scope of the 270,000 users who initially consented [14] to its terms of service for use in political campaigns (including Donald Trump's 2016 bid for the presidency), and highlights anew the vulnerability of consumer data in the digital age.*

In the research round-up regarding the state of internet privacy [15] it was found that in the US, the people are increasingly concerned about their privacy, but nevertheless continue to leave their digital footprint uncensored. *Further research show threats in evolving digital complexity increase in complexity and sophistication far beyond the knowledge and skills of an average person. For example, the author highlights the "self-conflicting" views consumers hold about their privacy, citing literature in which consumers give away personal data for small incentives despite attitudes that might indicate otherwise.*[13][16]. One paper investigates distortions in consumer behavior when faced with notice and choice which may limit the ability of a consumer to protect their privacy.[13][17]. Another paper looks at strategies mobile app developers use to collect data, which apps are most likely to practice intrusive data collection, and what factors predict problematic personal data usage. By examining the variations in data collection strategies of different apps created by the same developers over a period of four years, the researchers uncovered some worrying trends.[13][18]. Another paper

highlights how the economic analysis of privacy evolved over time, as advancements in information technology raised increasingly nuanced and complex issues associated with the protection and sharing of personal information.[13][19].

In the field of digital emotional security, many studies show substantial impact, especially on the younger generations. One study "Cyberbullying in High Schools"[20] explores high school students' beliefs and behaviors associated with cyberbullying. Specifically, it examines this new phenomenon from the following four perspectives: (a) What happens after students are cyberbullied? (b) What do students do when witnessing cyberbullying? (c) Why do victims not report the incidents? and (d) What are students' opinions about cyberbullying? Further research "Cloud Computing: Benefits, Risks and Recommendations for Information Security" shows a connection between cloud computing and security benefits and risks.[21]. The amount of research done in the field of digital resilience is impressive, yet according to many pieces of research an average person does not benefit from the findings. That is exactly the reason to include this module in aggregate human digital resilience.

PROPOSED COMPONENTS BASED ON RESEARCH

- Behavioral threats
- Content threats
- Contact threats
- Password management
- Internet security
- Internet safety
- Device dependence
- Cloud information
- Information analysis
- Social network threats
- Incidental situations
- Critical thinking
- Privacy protection
- Intellectual property rights
- Digital footprint management
- Digital behavioral risk
- Digital value transfer
- Digital privacy management
- Content risk
- Financial risk

MEASUREMENT

By the means of online test composed of questions our aim will be to determine one's resilience to threats in the digital world. It includes digital safety, digital security, resilience to unacceptable online behavior, privacy protection, legal protection, communicational threats, and other online risks.

DIGITAL HEALTH

DESCRIPTION

Under the module name "Digital Health", we propose a set of skills and knowledge necessary to prevent health damage because of uncontrolled use of digital devices and platforms. The most threatened is mental health because of the mechanisms that are becoming more and more influential on our behavior.

One of the mechanisms is recognized as the Dopamine Loop [22][23] which is extremely powerful. It is the main culprit for addictive behavior, regardless of the object of addiction (alcoholism, drug abuse, gambling, Internet). Because of the change in behavior, our wellbeing is threatened as a consequence of not doing the necessary things that may help us, like socializing or exercising. There are series [24] of studies that show that person-to-person interaction heals anxiety and stress. The lack of it has the reverse effect.

When one lacks physical contact and spends a significant amount of time inside the virtual realm, the dopamine loop is closed and the chance of seriously damaging his/her health is increased. Another study shows that passive time spent on social networks do us damage [25]. Some studies show that if there is live communication, even by virtual means, it helps us psychologically [26].

Furthermore, another major problem is cyberbullying. It is severely damaging to mental health, especially to teenagers and young adults [27] as a great deal of research shows. Another approach is taking into account psychopathology of shame and guilt as sources of self-induced mental pain [28], and in the western, predominantly Christian world, connected with the concept of sin. Through that lens, we can associate the concept of seven sins to adequate platforms where we have: lust, gluttony, greed, sloth, wrath, envy, pride, and correlating platforms as follows: Tinder, Yelp, LinkedIn, Netflix, Twitter, Facebook, Instagram. These digital platforms cover usual human behavior and the natural needs of a human being. Overuse of these platforms leads to poor mental health [29][30]. The consequences of giving in to "sinful" behavior online are researched in the scientific work of Zoltan Janka, University of Szeged, Hungary. The work is titled "Serotonin dysfunctions in the background of the seven deadly sins" [30]. Due to shortness

and format of this article, we shall sustain from numbering further sources and areas of digital downsides for mental health and just add that the lack of physical activity leads to poor mental and physical health [31][32][33].

PROPOSED COMPONENTS BASED ON RESEARCH

- Digital time quality and management
- Inappropriate digital communication
- Inappropriate digital content
- Social exposure
- Addiction level
- Personality traits prone to negative influence
- Offline time quality
- Digital behavior prone to negative effect
- General screen time
- Screen time quality
- Cyberbullying
- Addiction
- Mental health threats awareness
- Offline activities
- Digital detox

MEASUREMENT

By the means of online test composed of relevant questions, we shall determine cognitive, emotional and behavioral patterns that give insight into one's state of digital health. In simple words, we will determine how endangered is the person's health (both physical and psychological) in regards to her/his attachment, relationship, and actions toward the digital realm.

DIGITAL INTEGRATION

DESCRIPTION

To paraphrase the hdi.vision intro, "To what extent is our life digitally integrated? We are all in the midst of the explosion of digital technology which changed the way we communicate with the world. How much actively are we involved in digital, do we know how to stay competitive in the race to the digital future?" [34]. We emphasize the importance of detecting one's digital integration as a measure of how we present our-

selves digitally and how active we are digitally. Furthermore, is our digital signature a fair and authentic reflection of who we really are? Are we a truthful asset for our (future) employers (LinkedIn), are we the right person to fall in love with (Tinder), does our presence on Facebook truly represent who we are? Do we benefit from being digital citizens? Are we familiar with government and state internet and mobile platforms that save us time - to get administrative chores done, from medical, ownership, identification, legal, purposes to financial and commercial activities? A good example is the Estonian e-residency concept and a tool for digitizing our life for our benefit [35]. The trends of making ourselves more and more digital are measurable and easy to follow [36]. Serious impact of these trends is further discussed among the professionals that are part of the digital world and active contributors [37]. Continuous research about e-citizenship trends are done and publish so we have a pretty good idea what is going on and what will affect our digital lives in the near future [38]. If we want to be active contributors and persons who benefit from contemporary digital society, we have to be digitally integrated. The measure of which contributes to our human digital intelligence.

PROPOSED COMPONENTS BASED ON RESEARCH

- Citizenship
- Footprint
- Education
- Information
- Identity
- Ownership
- Finance
- Commerce
- Collaboration
- Entertainment
- Rights

MEASUREMENT

By the means of online test composed of questions, we will aim to determine how the tested person resonate digitally based on her/his digital footprint, digital integration into formal and non-formal entities available online such as digital citizenship, digital finance, online legal affairs, compatibility between real and virtual personal presentation, tendency to solve problems by digital means, digital education, digital ownership, digital commerce.

DIGITAL INFLUENCE

DESCRIPTION

Being connected and present digitally does not measure the impact of the individual on the digital society or civilization. Digital influence consists of three measures: reach, resonance, relevance [39]. We enhanced that model as a new, unique one that consists of the following dimensions:

DIGITAL REACH

- Popularity,
- digital geography,
- platform,
- momentum,

where popularity is a measure of numbers of followers and further down the network a measure of followers' followers. The digital geography [40] takes into account geographic gravity of the measured person as well as language, penetration of language and geography of the followers. The momentum [41] is a dimension that takes into account factors, such as: the subject of social activity, content, the geographic and dynamic popularity of hashtags, the fluidity of the subject. The platform is an explicit and inherited dimension of the social/digital application in regard to a general audience it covers and provides interaction to.

DIGITAL RELEVANCE

- Authority,
- likeness,
- authenticity, interest,
- occurrence,
- duration

where authority is the inherited power of authority [42] of the source upon the subject that is being communicated. The likeness is any point of social interaction where the source is similar and attractive to the receiver. Authenticity is a dimension that measures the originality of the source subject. Interest is a measure of an impact the shared communication has on the receiver because of personal interest in the subject. Occurrence is a frequency of the subject spread across the digital platforms. Duration measures the time in which the subject lives across the digital platforms.

DIGITAL PERLOCUTION

- Emotional capital,

- amplitude,

- persuasion,

where emotional capital [43] measures the emotional power of the subject. The amplitude measures interaction with the subject while persuasion [44] measures the inclination or probability of the receiver to act according to the message.

PROPOSED COMPONENTS BASED ON RESEARCH

- Popularity

- Geography

- Platform

- Momentum

- Authority

- Likeness

- Authenticity

- Interest

- Occurrence

- Emotional capital

- Amplitude

- Persuasion

MEASUREMENT

By the means of online test composed of questions, we will aim to determine one's influence through the potential of three main dimensions that are the digital reach, digital relevance, digital perlocution. All three dimensions possess sub-dimensions that will be determined through the question system.

DIGITAL DEXTERITY

DESCRIPTION

While preceding modules covered more of the personal attributes of the person to be tested, digital dexterity combines digital activities, skills, and knowledge with business potential. It basically describes whether the person can benefit from her/his digital abilities or not. It covers a wide range of tools, means, and methods that empower a person

to earn money or lead a better life in comparison to the next person that is not that digitally dexterous[45]. In the latest research by LinkedIn within The Most Promising Jobs of 2018[46]. The vast majority requires digital skills, some of the top 20 are: Software Engineering Manager(2nd), Data Scientist (9th), Data Engineer (13th), Frontend Engineer (14th), etc. Furthermore, LinkedIn regularly publishes research result based on their biggest business database in the world (467M users). According to their article, Top 10 Job Titles That Didn't Exist 5 Years Ago[47],the majority is strictly digital. That gives us the direction of this module to grant higher scores to people who earn their living using demanding digital skills. The bottom line is that we can compare people who earn their living by digital means to people who earn their living by non-digital means and thus giving them adequate differentiated scores.

PROPOSED COMPONENTS BASED ON RESEARCH

- Digital literacy
- Digital creativity
- Digital content creation
- Online collaboration
- Digital tools usage level
- Digital tools spectrum
- Digital thinking
- Digital problem solving
- Search engine literacy
- Typing speed and precision
- Online information grasping
- Technological literacy
- Professional dependence to digital

MEASUREMENT

By the means of online test composed of questions, we will aim to determine the amount of the person's digital knowledge which can be used for personal benefit and wellbeing. The test will not grade one's knowledge in myriad digital tools but the consequence of that knowledge. That is personal, social and business outcome based upon that knowledge.

CONCEPTUALIZATION AND TRENDS

According to Daniel H. Pink [48], one of the leading psychologist in the world of business, we have experienced four different ages of economic development:

1. Agricultural Age (farmers)

2. Industrial Age (workers)

3. Information Age (workers with knowledge)

4. Conceptual Age (creators and empathizers)

One of the reasons for entering the fourth age is that the knowledge is safe and sound online and we can concentrate on problem-solving, creative and innovative thinking without the need to be human databases anymore. But the current reality is not that Utopian. For example, our formal education has too much inertia and the new generations of children are being held hostage by the very same outdated educational system. The new generations are not being taught how to deal with so much online activity. In her book [49], Jean M. Twenge references on substantial research results that show how digital unpreparedness is doing much harm to our societies.

The situation is comparable to giving a highly addictive substance to a naïve population that has no previous or any knowledge of the substance. The substance being, in short, the digital. To paraphrase the lecture [50] Tomislav Krištof held on LEAP Summit 2018. Zagreb, Croatia, we are living the Digital Apocalypse and are completely unaware of it.

The consequence is the disappearance of the 3D world the older generations grew up with and the tide of the predominant 2D world of touch screens. Children don't want to play with 3D toys whether they are basic or complex objects. Some insight into that matter follows.
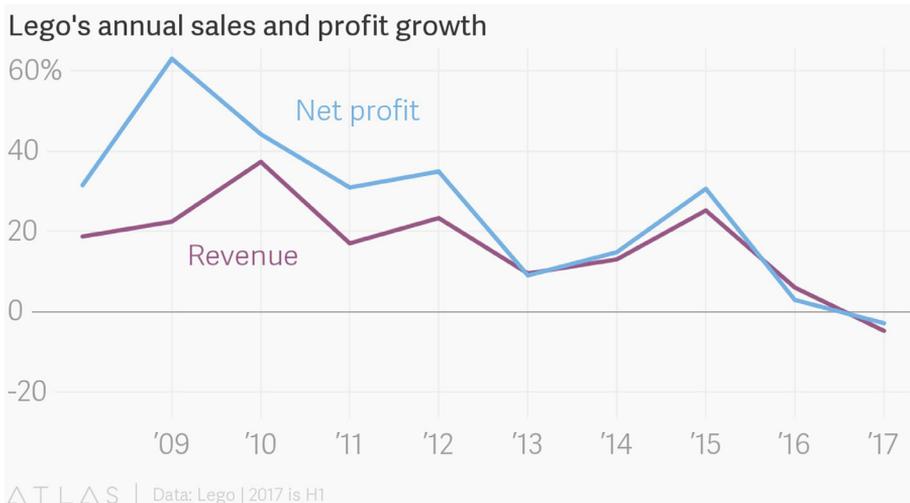
Figure 8: The fall of Lego annual sales and profit, Source: www.theatlas.com/charts/SJIVqlhtW

Furthermore, Lego has announced considerable layoffs at the time of crisis in 2017. But that is not the only indicator, the digital unpreparedness ruined the largest toy retailer in the US, Toys'R'Us which closed all of its stores in the US [51]. People lost the habit of going to the stores because of websites like Amazon, and children don't want to play with toys anymore. In the following examples, we will show how modern kids are too shy when it comes to socialization and activities in the 3D world. The already mentioned dopamine loop closed in the 2D world is the culprit for much of this state.
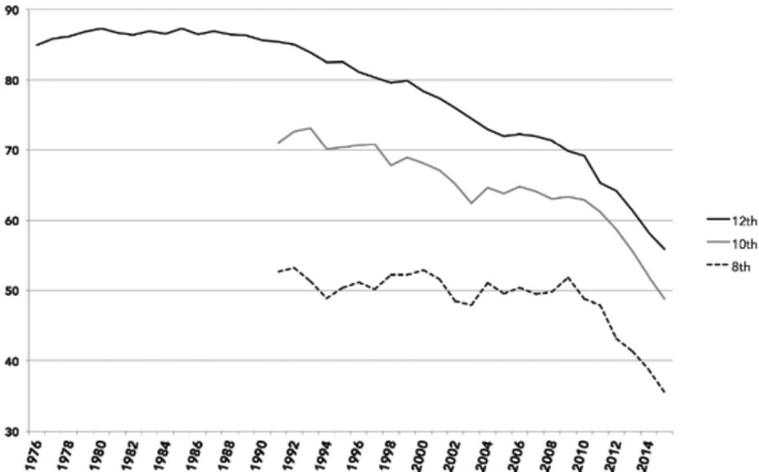

Figure 9: Percentage of 8th, 10th, and 12th graders who ever go out on dates, Source: Monitoring the Future, 1976-2015.

Figure 10: Percentage of 12th graders who drove at all in the last year and who have a driver's license, Source: Monitoring the Future, 1976-2015.

It is essential to notice that in both figures we see a dramatic decline in 3D activities that conveniently correlates with the emergence of the wide use of touch screens around 2010. Unfortunately, some consequences are more severe than others: a huge increase of teenage suicides has been recorded. In just five years, between 2010 (the emergence of touch screens) and 2015, the number of U.S. teens who felt useless and joyless — classic symptoms of depression— surged by 33 percent in large national surveys. Even more troubling, the number of 13-to-18-year-olds who committed suicide increased by 31 percent[52]. The seriousness of situation can best be seen by looking at the measure the French government took - banning all smartphones in schools in the autumn of 2018[53].

The proposed HDI model covers all aspects of digital self and is going to be developed with the aim to fertilize processes that lead to a better digital life, both personal and professional. The next step is conducting a research that will either confirm or reject the elements of each module and the final step before developing a comprehensive test for each of the five modules.

The HDI quotient is going to be a dynamic measure of one's human intelligence with floating average calculated each time a user does the test. Inherited by the classic IQ measurement, the average will always be presented as 100. The test will be available online on the platform https:/hdi.vision. It will consist of questions, rather than automated software that gathers information from, for example, social networks. Thus, it will be independent of other platforms. It will also be a platform for big data analysis, so that we can recognize patterns and trends based on the sample of all participants worldwide. In time, we will have an insight into the digital "blood test" of the world population.

At the moment of writing the model has won a participation in start-up incubator of Algebra Lab [54] among many applications of other teams. This participation will include many experts from domestic area (Croatia), but as well as international experts. Aside from the HDI team [55], they will bring the model closer to scientifically based operational use.

CONCLUSION

At the time of writing no similar model does a more comprehensive insight into digital self, digital footprint, digital awareness, digital health, digital dexterity.

So far a great deal of online research has been done in order to build a strong foundation for the model and in a great part the result of this research is presented in this paper.

Keeping in mind the disturbing results from the contemporary research, especially in the field of digital health, the HDI team has no time to lose and wants to contribute to the world's digital wellbeing and thus wellbeing in general.

To summarize, With the use of big data, artificial intelligence and the fact that the project is non-commercial and with the generous contribution of goodwill, expertise and time of the contributors we shall build a comprehensive, data driven model that will with great fidelity project the current digital state of on individual and, in time, different societies around the world.

The phases of the project are:

1. Research and development (current phase)
2. Building an AI model and programming of the platform (HDI test)
3. Publishing the platform
4. Improving of the platform and data mining
5. Promoting the platform worldwide

We are more than confident that such a model will greatly contribute to the world digital culture and help prevent negative aspects of digital behavior presented in this paper.

The HDI team is in a process of founding a NGO situated in Croatia but will include and engage international experts to further and continuously develop the model. The project is under development to engage financial support from the available funds of EU.

REFERENCES

[1] Hunt, Earl (2011). Human Intelligence. Cambridge: Cambridge University Press. ISBN 978-0-521-70781-7. Lay summary (28 April 2013).

[2] Tirri, Nokelainen (2011). Measuring Multiple Intelligences and Moral Sensitivities in Education. Moral Development and Citizenship Education. Springer. ISBN 978-94-6091-758-5.

[3] Duckworth et al., 2007; Duckworth & Seligman, 2005; Moffitt et al., 201

[4] Duckworth, A. L., Quinn, P. D., Lynam, D. R., Loeber, R., & Stouthamer-Loeber, M. (2011). Role of test motivation in intelligence testing. Proceedings of the National Academy of Sciences, 108(19), 7716-7720.

[5] Rothmann S, Coetzer EP (24 October 2003). "The big five personality dimensions and job performance". SA Journal of Industrial Psychology. 29. doi:10.4102/sajip.v29i1.88. Retrieved 27 June 2013

[6] 8.11.2018., https://www.statista.com/statistics/736727/worldwide-teen-average-online-time-devices/

[7] 22.11.2018. https://www.dqinstitute.org/dq-framework/

[8] 8.11.2018., https://www.prizmacpi.hr/

[9] 22.11.2018. https://blog.globalwebindex.com/chart-of-the-day/76-percent-of-millennials-exercise-at-least-once-a-week/

[10] 22.11.2018. https://www.cdc.gov/nchs/data/databriefs/db309.pdf

[11] 22.11.2018. https://www.madinamerica.com/2018/08/suicide-in-the-age-of-prozac/

[12] 23.11.2018. https://ifstudies.org/blog/are-smartphones-and-social-media-hurting-our-kids

[13] 8.11.2018. https://journalistsresource.org/studies/society/internet/data-digital-privacy-cambridge-analytica

[14] 8.11.2018. https://www.nytimes.com/2018/03/19/technology/facebook-cambridge-analytica-explained.html

[15] 8.11.2018. https://journalistsresource.org/studies/society/internet/the-state-of-internet-privacy-in-2013-research-roundup

[16] "Artificial Intelligence and Consumer Privacy", Jin, Ginger Zhe. National Bureau of Economic Research working paper, 2018. DOI: 10.3386/w24253

[17] "The Digital Privacy Paradox: Small Money, Small Costs, Small Talk", Athey, Susan; Catalini, Christian; Tucker, Catherine. National Bureau of Economic Research working paper, 2017. DOI: 10.3386/w23488.

[18] "Mobile Applications and Access to Private Data: The Supply Side of the Android Ecosystem", Kesler, Reinhold; Kummer, Michael E.; Schulte, Patrick. SSRN Electronic Journal, 2017. DOI: 10.2139/ssrn.3106571.

[19] "The Economics of Privacy", Acquisti, Alessandro; Taylor, Curtis R.; Wagman, Liad. Journal of Economic Literature, 2016. DOI: 10.2139/ssrn.2580411.

[20] https://www.tandfonline.com/doi/full/10.1080/10926771003788979

[21] Catteddu D. (2010) Cloud Computing: Benefits, Risks and Recommendations for Information Security. In: Serrão C., Aguilera Díaz V., Cerullo F. (eds) Web Application Security. IBWAS 2009. Communications in Computer and Information Science, vol 72. Springer, Berlin, Heidelberg

[22] Kent C. Berridge and Terry E. Robinson, What is the role of dopamine in reward: hedonic impact, reward learning, or incentive salience?: Brain Research Reviews, 28, 1998. 309–369.

[23] 21.11.2018. https://www.psychologytoday.com/us/blog/brain-wise/201209/why-were-all-addicted-texts-twitter-and-google

[24] 21.11.2018. https://www.medicalnewstoday.com/articles/321019.php

[25] Verduyn, P., Lee, D. S., Park, J., Shablack, H., Orvell, A., Bayer, J., . . . Kross, E. (2015). Passive Facebook usage undermines affective well-being: Experimental and longitudinal evidence. Journal of Experimental Psychology: General, 144(2), 480-488.

[26] 21.11.2018. https://newsroom.fb.com/news/2017/12/hard-questions-is-spending-time-on-social-media-bad-for-us/

[27] 21.11.2018. https://www.bullying.co.uk/cyberbullying/effects-of-cyberbullying/

[28] 21.11.2018. https://www.sciencedirect.com/science/article/pii/S0191886901001246
Assessment of shame and guilt in a psychiatric sample: a comparison of two measures Patricia M Averill(a), Gretchen J Diefenbach (b), Melinda A Stanley (b), Joy K Breckenridge(a) Beth Lusby(a)

(a)Department of Psychiatry and Behavioral Sciences, Harris County Psychiatric Center, University of Texas-Houston Medical School, 2600 South MacGregor Way, Houston, TX 772250249, USA (b) Department of Psychiatry and Behavioral Sciences, Mental Sciences Institute, University of Texas-Houston Medical School, USA

[29] 21.11.2018. https://gigaom.com/2018/02/15/the-seven-deadly-sins-of-the-digital-world/

[30] 21.11.2018. https://www.ncbi.nlm.nih.gov/pubmed/14743592, [Serotonin dysfunctions in the background of the seven deadly sins]. Janka Z. Ideggyogy Sz. 2003 Nov 20;56(11-12):376-85. Review. Hungarian. PMID: 14743592.

[31] 21.11.2018. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4911759/, Physical activity, and mental health: evidence is growing., Biddle S., World Psychiatry. 2016 Jun;15(2):176-7. doi: 10.1002/wps.20331., PMID: 27265709

[32] Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research., C J Caspersen, K E Powell, and G M Christenson, PMID: 3920711

[33] 21.11.2018. https://health.gov/paguidelines/second-edition/pdf/Physical_Activity_Guidelines_2nd_edition.pdf, Physical Activity Guidelines for Americans 2nd edition, U.S. Department of Health and Human Services

[34] 21.11.2018. www.hdi.vision

[35] 21.11.2018. https://e-resident.gov.ee/

[36] 21.11.2018. https://www.forbes.com/sites/danielnewman/2017/06/29/top-6-digital-transformation-trends-in-government/#5ead6e0f7efc, Daniel Newman, Contributor, CMO Network - Exploring all things Digital Transformation

[37] 21.11.2018. https://blog.summitlearning.org/2017/09/digital-citizenship-trends/, 5 Digital Citizenship Trends to Watch this School Year

[38] 21.11.2018., Kennedy, Kerry. (2012). Global Trends in Civic and Citizenship Education: What are the Lessons for Nation States?. Education Sciences. 2. 121-135. 10.3390/educsci2030121., https://www.researchgate.net/publication/274432989_Global_Trends_in_Civic_and_Citizenship_Education_What_are_the_Lessons_for_Nation_States

[39] https://www.slideshare.net/Altimeter/the-rise-of-digital-influence © 2012, Altimeter Group, Attribution, Non-commercial, Share Alike 3.0, United States.

[40] Mapping the global Twitter heartbeat: The geography of Twitter by Kalev H. Leetaru, Shaowen Wang, Guofeng Cao, Anand Padmanabhan, and Eric Shook., First Monday, Volume 18, Number 5 - 6 May 2013, 22.11.2018. https://firstmonday.org/article/view/4366/3654#fig7

[41] 22.11.2018. Advocacy, Gregory D. Saxton, Jerome N. Niyirora, Chao Guo, Richard D. Waters,(2015), #AdvocatingForChange: The Strategic Use of Hashtags in Social Media.

[42] Morgan Glucksman, (2017), The Rise of Social Media Influencer Marketing on Lifestyle Branding: A Case Study of Lucie Fink, Strategic Communications, Elon University, 22.11.2018. https://www.elon.edu/u/academics/communications/journal/wp-content/uploads/sites/153/2017/12/08_Lifestyle_Branding_Glucksman.pdf

[43] Maryam Hasan, Elke Rundensteiner, Emmanuel Agu, EMOTEX:Detecting Emotions in Twitter Messages, Computer Science Department, Worcester Polytechnic Institute. 22.11.2018. https://pdfs.semanticscholar.org/0f4d/f38e308a65ff3fe42878c7fdfa68e17f9212.pdf

[44] Kevin H. Govern, (2011),The Twitter Revolutions: Social Media in the Arab Spring, Ave Maria School of Law; California University of Pennsylvania; John Jay College, 22.11.2018. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2093434

[45] By Sarah K. White, Senior Writer, CIO, The 7 most in-demand tech jobs for 2018 — and how to hire for them, 22.11.2018., https://www.cio.com/article/3235944/hiring-and-staffing/hiring-the-most-in-demand-tech-jobs-for-2018.html

[46] 22.11.2018. https://www.linkedin.com/jobs/blog/most-promising-jobs-2018

[47] 22.11.2018. https://business.linkedin.com/talent-solutions/blog/2014/01/top-10-job-titles-that-didnt-exist-5-years-ago-infographic

[48] Pink, Daniel H. (2006): A Whole New Mind: Why Right-Brainers Will Rule the Future, NY, Riverhead Books, Rep Upd edition

[49] Tweng, Jean M. (2017): iGen: Why Today's Super-Connected Kids are Growing Up Less Rebellious, More Tolerant, Less Happy and Completely Unprepared for Adulthood.m ATRIA books.

[50] 23.11.2018. https://hdi.vision/wp-content/uploads/2018/06/HAZ_3.pdf

[51] 23.11.2018. http://fortune.com/2018/06/25/toys-r-us-closing-friday/

[52] 24.11.2018. https://www.thelily.com/teenage-depression-and-suicide-are-way-up-and-so-is-smartphone-use/

[53] 24.11.2018. https://amp.theguardian.com/world/2017/dec/11/france-to-ban-mobile-phones-in-schools-from-september?__twitter_impression=true

[54] 24.11.2018. https://www.algebra.hr/lab/

[55] 24.11.2018. https://hdi.vision/the-team/