Does the Use of ICT speed up the Pace of Life?

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ABSTRACT

Information and Communication Technologies (ICT) greatly facilitate the way we communicate, do shopping, organize our schedules, research information and so on. Hence, ICT help us 'save time', or more specifically, increase the time efficiency of doing things, including consumption. There is a realm of research on time use and social acceleration [e.g., 32 and many others]. Yet, only few articles have so far investigated the influence of ICT on time use [6,22,42,44]. This article reviews these findings and presents genuine own results from a representative consumer survey in the German population in order to address the following key questions: Does the use of ICT correlate with an increase of the pace of life? Do time efficiency improvements due to ICT lead to time rebound effects? The theory of the rebound effect postulates that efficiency improvements generally lead to an increase in consumer demand [see, e.g., 37]. However, only few articles have analyzed the rebound effect in relation to time, which means that time efficiency improvements may result in more things been done in a given period of time [e.g., 5,8,17]. This article brings together research on ICT, time use, social acceleration and time rebound effects.

CCS CONCEPTS

• Information systems~Information systems applications~Mobile information processing systems•General and reference~Cross-computing tools and techniques~Measurement•Social and professional topics~User characteristics~Cultural characteristics

KEYWORDS

Digitalization, Time Use, Time Wealth, Social Acceleration, Rebound Effects, Sustainable, Internet

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1 INTRODUCTION

In everyday life, it seems obvious that the use of information and communication technologies (ICT) impacts on individual time use. For instance, email and short message sending allows for quick and asynchronous communication; using navigation tools like 'Maps' enables people to find an unknown address without much friction; or online-shopping reduces the time needed to purchase an item to a few mouse clicks. So for one, it seems that the use of ICT may accelerate certain activities and hence, the pace of life. At the same time, individuals may 'play around' with their digital devices, spend time on games, or procrastinate by browsing the internet or social media. Such examples suggest that the use of ICT could impact on individual time use in a rather decelerating manner. Moreover, even if time is 'saved' by way of efficiency enhancing ICT, individuals could turn this 'saved time' into a decelerated pace of life, or into more down times of doing 'nothing', e.g. meditation or contemplation. This study aims at an empirical interrogation on the relationship between ICT usage and time use. Our overall research hypothesis is: Does the use of ICT correlate with an accelerated pace of life?

Time use in general has been a popular topic in various disciplines of the social sciences. Manifold studies approach the issue both from different theoretical angles, presenting theories of social acceleration, as well as empirically [1,3,14,15,21,23,24,27,30,31,40,41,45,48]. This study builds on the extensive literature of social acceleration and tries to intertwine that discourse with the more recent and evolving discourse on the societal megatrend of 'digitalization'. We broadly define digitalization as the increased use of ICT devices and digital applications in production, consumption and communications. If consumption patterns and production rates increase due to social acceleration, this would not only have effects on individual's stress level and well-being, but also the stress put on the environment, e.g., through increased resource and energy use. The overall question is: Does digitalization lead to social acceleration?

The structure of this article is as follows: In section 2, we review the existing literature on the matter. As we show, the relationship between ICT and time use has not yet been comprehensively researched, and the few studies at hand present ambiguous results. In section 3, we summarize core characteristics of Hartmut Rosa's theory of social acceleration [31], which serves as the theoretical framework of our empirical study. On the basis of Rosa's four particular ways for an acceleration of the pace of

life, as well as on the basis of literature on the (time) rebound effect, we develop a set of six hypotheses. We also develop a graphic visualization of our study design, which shows how ICT use may correlate both with objective acceleration, i.e., the total number of activities performed in a given time period, as well as with subjective criteria for acceleration, such as felt time pressure ('time stress'). Section 4 briefly outlines the empirical methodology of our survey, which is currently being prepared. Section 5 then highlights key results from a representative survey conducted in the German population in 2018, before section 6 formulates some concluding remarks.

2 STATE OF LITERATURE

To our knowledge, there are only few studies specifically investigating the relationship between ICT use and social acceleration. One of these studies is more than five, two other are even ten years old; yet the amount of use, the areas of use and the use patterns of ICT rapidly increased and diversified during those years. The four studies can roughly be separated into two studies on objectively perceivable aspects of social acceleration (objective acceleration) and two studies on felt aspects of social acceleration (subjective acceleration).

In the first study, Sullivan and Gershuny [43] examined whether an objectively noticeable social acceleration can be verified based on the analysis of an existing set of 20,000 time-use diaries from the years 2000 and 2015, they suggest that the amount of primary activities has not increased due to ICT use. The amount of multitasking, measured by the number of times when two or more activities were registered at the same time, had increased for men by only 2% and stayed the same for women. Overall the level of stress decreased by 8%. The correlation between the number of activities per day and the level of stress is positive and statistically significant, but the number of activities did not increase. People who were multitasking less seemed to be more stressed. These results partially contradict existing theories of social acceleration [43]. However, their methods of stress measurement were only represented by a single item.

In the second study, Ulferts, Korunka and Kubicek [44] tested Harmut Rosa's framework of social acceleration [31] in the fields of office work and aviation service. They were able to confirm a perceived acceleration of job and career demands in the three areas that form the basis of Rosa's theory: 'technological acceleration', 'acceleration of social change' and 'acceleration of the pace of life' [44]. Hence, Ulferts et al. confirm subjective aspects of acceleration. Yet contrary to Sullivan and Gershuny, they only measured relative acceleration within the last two years, such as the acceleration of a single activity ('The speed at which I am expected to respond to emails' ('has increased strongly' – 'has decreased strongly')), or changes in the amount of information related to an activity ('The amount of documents required' ('has increased strongly' – 'has decreased strongly'); [44]).

In a third study from 2008, Kenyon does not find a link between internet use and an increase in total time spent on multitasking [22]. However, she finds that the internet is often used as one activity during multitasking. While people are generally multitasking 45% every day, 65% of the time using the internet is accompanied by another activity. Kenyon supports these results with data from the survey, which suggests that online activities are often preferred because they can more easily be done parallel to other activities. Seeing the ambiguity here, Kenyon expresses doubts in the method of time-use diaries. She interprets that multitasking would affect the patterns of time use and of participation in activities, and that developments of the use of the internet would likely influence patterns of time use [22]. Note that a number of other studies investigating multitasking – although not with a view to ICT use – suggest an increase in multitasking for more recent generations ('net generation') compared to older generations [9] and ownership of media in bedrooms as one predictor of media multitasking frequency among adolescents [19].

In a fourth study from 2009, Bittman, Brown and Wajcman investigate the correlation between the use of mobile phones and several aspects of time pressure [6]. The investigation showed that the correlation between the density of logged calls or text messages and perceived time pressure was not significant. It also showed that mobile phone use during out-of-office hours was not substantially connected to work (e.g., extending working hours by work-related calls). Therefore, the author's hypothesis that the boundary between work and private life is diminishing was not confirmed. Yet somewhat similar to Sullivan and Gershuny [43], Bittman et al. also found a correlation between men who felt increasingly rushed and pressed for time and the use of mobile phones at work. Overall, however, Bittman et al.'s results do not affirm the thesis of social acceleration. The authors conclude that the use of mobile phones might reduce stress, because activities can be transferred into daily time periods that are less densely packed [6].

In a more recent study Schöneck [39] also empirically tested Hartmut Rosas theory with regard to the impact of macro indicators and individual level determinants on people's work-life-balance. She concluded: „The faster the spread of technologically enabled interconnectedness (via internet accesses), the more boundaries between work and private life become blurred and people get crunched by time-consuming distractions as well as multilateral social expectations […]". While Schöneck's study only addressed a minor part of Rosa's theory, it contributed some important findings on the challenge of empirically explaining social acceleration.

As of research on the rebound effect, the general assumption that an increase of efficiency leads to a growth in demand has been investigated in numerous articles since about 1980. Yet the vast majority of rebound research has mainly analyzed the effect of energy efficiency improvements on energy service demand [2,16,33]. Only lately, rebound research has been expanded to several other disciplines and multiple aspects of efficiencies [10,37]. Few publications have analyzed rebound effects with regard to time. Binswanger [5] and Jalas [17], who initiated this strain of rebound research, as well as more recently Brenčič and Young [7] or Druckmann et al. [11] have analyzed how time-saving technical innovations impact on energy service demand

[12]. Jalas has postulated the valuable insight that the analysis of "time-use rebound effects [...] combines the constraints of time and money and treats them as inter-changeable" [17:112].

To sum up, the state of empirical research on ICT, time use and time rebound effects is still weak. What's more, results from the above mentioned empirical studies somewhat contradict each other, while research questions and designs are not fully comparable. Given the logical arguments from various acceleration theories (see introduction), there is great need to further explore and empirically test the topic.

3 THEORATICAL FRAMEWORK AND HYPOTHESIS

This study is based on the theory of social acceleration by Hartmut Rosa [31], which we use as theoretical framework and reference point of our empirical survey. At the same time, our survey can serve as an empirical test of Rosa's theory, which he has developed on logical grounds but not verified empirically.

Concerning modern social life, Rosa identifies three dimensions of acceleration. (i) Technological acceleration refers to the intentional increase in speed of target-oriented processes, particularly in transport, communication and production. (ii) Acceleration of social change represents the increasing rates of change in social patterns such as (social) norms and values, lifestyle and personal relationships and a shortening of predictable time periods. (iii) Acceleration of the pace of life, as a third dimension, describes an increase in the number of actions and experiences per unit of time. Following Rosa's [31] framework, technological acceleration and progress liberates time resources for the individual (e.g., sending an email instead of writing a letter allows responding to more messages in less time). Free time resulting from technological progress can be used to accomplish more activities, which again accelerates the pace of life.

Our study investigates the proposed influence of technological progress in the form of degree of digitalization on the pace of life. The degree of digitalization represents the nature and duration of digital information and communication technology usage. A higher degree of digitalization, on the one hand, should enable individuals to complete activities faster. In effect, they can either have more free time than individuals with a lower degree of digitalization; this would indicate a deceleration of the pace of life. Or the resulting free time could be used to perform more activities, which would lead to a higher total number of activities in a given time period (e.g., per day); this would indicate an acceleration of the pace of life.

According to Rosa [31:120], an acceleration of the pace of life can occur in four ways. First, activities can be performed faster; e.g. the lunch break can be shortened by eating faster, or time on the way to work can be shortened by walking faster. Second, breaks and down time can be shortened; e.g. by using waiting time to perform other activities. Breaks and down time refer to all time periods in which no activity is performed actively. Third, two or more activities can be carried out at the same time in a given time period, which is also considered as multitasking. For instance, an individual could combine the activities cooking dinner, checking Social Media, or talking on the phone. As a fourth way, time-consuming activities can be replaced by time-saving activities; e.g., by taking a plane instead of a train or bus to travel long distance.

This article presents results from an empirical survey in Germany, which investigated the relationship between the degree usage of ICT (as the independent variable), and its potential correlations with the aforementioned four ways of accelerating the pace of life. We assume that the higher the degree of digitalization, 1) the more activities are performed faster, 2) the more breaks and down times will be shortened by performing additional activities during these time periods, 3) the more multitasking will be performed, and 4) the more time-consuming activities will be replaced by time-saving activities. These assumptions lead to the following hypotheses:

H1: ICT usage is positively related to performing activities faster.
H2: ICT usage is positively related to filling original break or waiting time with activities.
H3: ICT usage is positively related to performing activities in parallel (multitasking).
H4: ICT usage is positively related to performing time-saving activities instead of time-consuming activities.

These processes lead to more activities and experiences in total:

H5a: The acceleration of the pace of life – i.e.

a) performing activities faster,
b) filling original break or waiting time with activities,
c) performing activities in parallel (multitasking),
d) performing time-saving activities instead of time-consuming activities –

is positively related to the total number of activities performed during a given period of time.

In addition to the number of activities and experiences as an objective parameter for the pace of life, experience of time and time stress can serve as subjective parameters of an accelerated pace of life [31:131]. Both an objective acceleration of the pace of life as well as the subjective component, feeling of time passing by faster and time stress, occur as results of time shortage. Studies on time use support this assumption and suggest that the experiences of feeling rushed and time stress increased between the 1960s and late 1990s [13,23,28]. Accordingly, a higher degree of the four different ways of acceleration should also manifest in a higher subjective acceleration, and perceived time stress:

H5b: The acceleration of the pace of life, i.e.

a) performing activities faster,
b) filling original break or waiting time with activities,
c) performing activities in parallel (multitasking),
d) performing time-saving activities instead of time-consuming activities –

is positively related to the level of perceived time stress.

Since we will check for cross-correlations between the four ways of acceleration and their impact on the total number of activities, we will also investigate whether time-efficient ICT use will generate so called 'time-rebound effects' [5,17,35,36]. Such time rebound-effects may be generated if individuals 'save' time by using technological devices, but use the 'extra' time to conduct more activities overall and hence, accelerate their pace of life. In principle, individuals could also use time-saving technologies for a deceleration of their pace of life, and use extra time for longer breaks, a slower pace of activities, or contemplation. However, Rosa suggests that due to psychological and cultural factors as well as particularly socio-economic framework conditions (i.e., a growth-oriented capitalist economy), the originally 'saved' time is likely being used to accomplish more activities instead. With this study, we aim to investigate whether it is the time-saving nature of ICT devices and applications that leads to an increase in the overall number of activities performed. Hence, we hypothesize:

H6: The intention of individuals to use ICT in order to save time is positively related to the total number of activities performed.

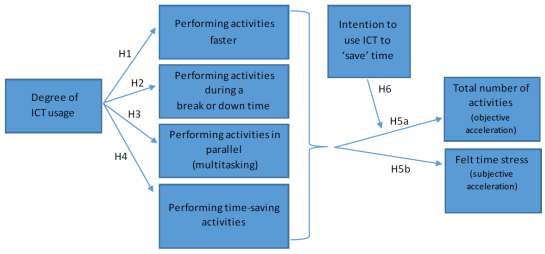

Figure 1: Graphic visualization of our study design and hypotheses.

4 BRIEF OUTLINE OF METHODOLOGY

To empirically test our hypotheses, we have conducted an online survey (n=1,393) in 2019 in Germany. The self-report questionnaire could be accessed from any computer with an internet connection. We followed a cross-sectional research design where participants completed the survey in their everyday environment. *Unipark* was used as an online survey tool ensuring standards of data security. We have commissioned a professional panel institute (https://norstatgroup.com/) to operate our survey. The institute had no relationship to this study other than recruiting participants based on screen-out criteria to ensure representation of the German population. In order to approach our hypothesis, we have developed a set of new 5-point Likert-type scales. Most notably, we developed a *General Acceleration Scale* (GAS), which consists of four items for each of Hartmut Rosa's four ways of accelerating the pace of life and hence, measures the overall pace of life in a comprehensive manner (see A Appendix A.1). For the iterative development of the scale, we have run four pretests (n=52; n=114; n=33; n=115) over the course of 1.5 years in 2018 and 2019. The detailed methodology of scale development and validation as well as the detailed results of the empirical time use measurement will be published separately (First author, forthcoming).

In addition, we have used several existing scales from time use surveys – for instance, to verify our own scales, and to measure the relationship between objective and subjective acceleration (scales have been taken from various sources [18,20,25,26,47,49]).

To measure the degree of ICT usage, questions about the duration and the areas of internet usage as well as questions about the number of ICT devices owned and applications used in everyday life have been included. Time pressure is measured using questions from previous time-use studies, such as how rushed participants feel and if they feel that they need more time for their friends and family [29]. The usual demographic variables (age, degree of education, family situation, level of income, urban/rural residence etc.) have been included to check for other impact factors.

To approach the issue of time rebound effects, we have developed a scale that asks individuals about their intention to use ICT, i.e., whether they use it to become more productive, to use time efficiently, to use waiting times more actively, and whether they intend to save time by way of ICT usage to later have more time for other things, etc. – or if they rather intend to use ICT to kill time, to relax (e.g., gaming), or not to be bored etc. Furthermore, we included other existing scales in our survey, which examine whether people assume that time and money are interchangeable ('time is money') and whether they pursue an *economical use* of their time (see, [46,47]).

Items/scales were measured using Likert scale answer types. We urged participants to record their scores only if they were certain of them and explicitly offered the option that items were not applicable. Due to this constraint, these answers were coded as incomplete questionnaire items. Specifically, the incomplete responses in measures of ICT usage were treated as missing by design. We checked if incomplete values were related to observed values on other variables and found no significant difference in the population mean for sociodemographic feature such as age and income. Yet, by using the standard methods to handle incomplete responses, even one missing value yielded missing cases list- and pairwise. The loss of observations because of missing items can reduce analytical power, increase variation in parameter estimates, and potentially lead to bias. Considering our sample size and the relatively small portion of missing values this decision may be regarded as only a small thread to validity. The sample of the final survey was refined to ensure minimum standards of data quality. Participants were excluded based on their answers on two control item questions [4]. Furthermore, we controlled for response time and excluded participants answering faster than two seconds per item. Additionally, a link between very quick responses and low data quality has been taken into account. Reasoning that our respondents were highly skilled and well trained with filling out online survey questions we also excluded participants that filled out the entire questionnaire in less

than half of the median time of all participants before conducting substantive statistical tests using SPSS.

5 RESULTS

The age of participants ranged between 18-89 years (M = 49.9; SD = 15,7 years). Exactly half of the participants considered themselves male and female, respectively. The socio-economic status of all participants, screened by income as well as achieved level of education, represented a normal distribution. The relationship of all variables involved in the analysis was approximately linear. Before conducting statistical tests, outliers where identified and removed from the analysis. The data contained approximately normally distributed errors, met the assumptions of homogeneity of variance and linearity and met the assumption of independent errors. The data also met the assumption of non-zero variances. Tests to see if the data met the assumption of collinearity indicated that multicollinearity was not a concern. Statistical analyses were conducted using IBM SPSS Statistics Version 25. Bivariate correlations were computed using Pearsons correlation procedure.

5.1 The degree of ICT usage and the pace of life (H1-H4)

Analyzing the relationship between the degree/intensity of ICT usage and the pace of life (degree of acceleration), we correlated data from our General acceleration scale (GAS) with the various scales measuring ICT usage. We found positive correlations between the GAS and the hours spent in the internet per day using mobile data, $r(1038)=.215$, $p<.001$, the frequency and areas of online activities, $r(1026)=.197$, $p<.001$, the number of social media channels used, $r(1038)=.166$, $p<.001$, the hours spent on social media per day, $r(1004)=.205$, $p<.001$, the number of media subscriptions, $r(1038)=.185$, $p<.001$, the number of digital devices, $r(1035)=.171$, $p<.001$, the money spent on ICT during a year, $r(1034)=.177$, $p<.001$, and a moderate strong correlation with the frequency and number of apps used on peoples mobile phones, $r(898)=.349$, $p<.001$. The hours spent on stationary internet per day did not show a significant relation to the pace of life, $r(1038)=-.060$, $p=.052$.

A multiple regression was conducted to see if the degree of digitalization predicted the pace of life (GAS). The variables which were significantly correlated with the degree of acceleration were entered step by step into the model, resulting in an increase in R^2. The regression indicated that the model explained 12.8% of the variance in the pace of life and that the model was a significant predictor, $F(8, 875) = 22.518$, $p<.001$, $R^2 = .134$, $R^2_{Adjusted} = .128$. The number and frequency of apps used on peoples mobile phones ($B= .233$, $p<.001$) and the number of social media channels used ($B= .655$, $p=.004$) explained a particularly significant amount of the variance in this model. All other variables used to measure the degree of ICT usage, despite showing positive correlations, had only a small influence and did not significantly predict the degree of acceleration in this model.

The sequential multiple regression indicated that a model without the number and frequency of apps used on peoples mobile phones explained 10.1% of the variance in the pace of life. This model was also a significant predictor, $F(8, 1010) = 23.707$, $p < .001$, $R^2 = .105$, $R^2_{Adjusted} = .101$ and showed more significant determinants: the hours spent in the internet a day using mobile data ($B= .888$, $p<.001$), the frequency and areas of online activities ($B= .187$, $p=.039$), the number of social media channels used, ($B= .943$, $p<.001$), the number of digital devices owned ($B= .536$, $p=.006$) and the money spent on ICT during a year, ($B= .234$, $p=.005$). In a model where the other predictors were ignored, the number and frequency of smartphone apps ($B= .278$, $p<.001$) and the number of social media channels ($B= .614$, $p=.005$) significantly explained 12,3% of the variance in the GAS (pace of life) alone ($F(, 895) = 63.958$, $p < .001$, $R^2 = .125$, $R^2_{Adjusted} = .123$).

Looking at the four subdimensions of the GAS – i.e., at each of Rosa's four ways to accelerate the pace of life –, the variables being able to explain the variance differ in a few ways. Running the same regression models for each of the four ways indicated that app use on smartphones was a significant determinant for the variance in all of them. The number of social media channels used helped to predict a significant amount of the variance in performing activities in parallel (H3) ($R^2_{Adjusted} = .13$), filling original break or waiting time with activities (H2) ($R^2_{Adjusted} = .10$) as well as some of the variance in performing time-saving activities instead of time-consuming activities (H4) ($R^2_{Adjusted} = .05$). Additionally, the frequency and areas of online activities helped to predict performing activities in parallel (multitasking) (H3). The number and frequency of apps used, the hours spent in stationary internet and the number of media subscriptions were additional significant determinants of the variance in performing activities faster (H1) ($R^2_{Adjusted} = .04$).

5.2 The degree of acceleration is positively related to the total number of activities and experiences (H5a)

The relationship between the pace of life (i.e., the GAS) and the total number of activities and experiences was positively correlated, $r(771)=.282$, $p<.001$. We found positive correlations between the total number of activities and experiences and the GAS' subdimensions multitasking $r(821)=.265$, $p<.001$, filling original break or waiting time with activities, $r(803)=.282$, $p<.001$, performing activities faster, $r(828)=.216$, $p<.001$, and performing time-saving activities, $r(801)=.100$, $p=.005$. A multiple regression was conducted to see if the subdimensions of the GAS predicted the total number of activities and experiences. The results of the regression indicated that the model explained 10% of the variance of the total number of activities and experiences and that the model was a significant predictor, $F(4, 768) = 21.845$, $p<.001$, $R2 = .32$, $R^2_{Adjusted} = .10$. While multitasking ($B= .289$, $p=0.014$), filling original break or waiting time with activities ($B= .612$, $p<.001$) and performing activities faster ($B= .254$, $p=.044$) explained a significant amount of the variance, performing time-saving activities instead of time-consuming activities had only a small influence and did not significantly predict the model ($B= -.255$, $p=0.052$).

We analyzed the relationship between the total number of activities and experiences and the degree of digitalization and found positive correlations with the hours spent with mobile data, r(838)=.068, p=.049, the frequency and areas of online activities, r(829)=.103, p=.003, the number of social media channels used, r(838)=.103, p=.003, the number of digital devices owned, r(835)=.219, p<.001, the money spent on ICT, r(834)=.269, p<.001, the number of media subscriptions, r(838)=.209, p<.001, and the frequency and number of apps used on peoples mobile phones, r(735)=.230, p<.001. The hours spent using stationary internet access showed a significant negative correlation, r(838)=-.094, p=.006 and the hours spent on social media did not correlate significantly, r(817)=.068, p=.051. A sequential multiple regression was employed to see if the degree of ICT usage predicted the total number of activities and experiences. On a first step, all variables that were significantly correlated were entered into the model. In a second step, variables which did not significantly predict the model were excluded, resulting in an increase of R^2. The results of the regression indicated that the final model explained 11,7% of the variance of the total number of activities and experiences and that the model was a significant predictor, F(6, 717) = 17.016, p<.001, R2 = .125, $R^2_{Adjusted}$ = .117. The hours spent using stationary internet (B=-.692, p=0.001), the hours spent with using mobile internet (B= -.818, p=0.002), the frequency and areas of online activities (B= .261, p=0.018), the number of digital devices (B= .419, p=0.050), the money spent on ICT devices (B= .482, p<0.001), and the frequency and number of apps used on smartphones (B= .154, p<0.001) were significant determinants for the variance in the total number of activities and experiences.

5.3 The degree of acceleration is positively related to the level of perceived time stress. (H5b)

The pace of life was positively correlated to the level of perceived time stress, r(1028)=.302, p<.001. We found positive correlations between perceived time stress and the GAS' subdimensions multitasking, r(1108)=.349, p<.001, filling break or down times with activities r(1078)=.290, p<.001), performing activities faster, r(1120)=.114, p<.001 and performing time-saving activities, r(1073)=.138, p<.001. A multiple regression was conducted to see if the subdimensions of the GAS predicted the level of subjective time stress. The results of the regression indicated that the model explained 13,6% of the variance of perceived time stress and that the model was a significant predictor, F(4, 1025) = 41.370, p<.001, R2 = .139, $R^2_{Adjusted}$ = .136. While multitasking (B=.618, p<.001), filling break or down time with activities (B=.352, p<.001) and performing activities faster (B=-.226, p=.009) explained a significant proportion of the variance, performing time-saving activities had only a small influence and did not significantly predict subjective time stress (B=.008, p=.928).

Feeling hurried was negatively correlated to the hours spent on stationary internet, r(1134)=.302, p=.003, while it positively correlated with the hours spent on mobile internet, r(1134)=.157, p<.001, the frequency and areas of online activities, r(1122)=.110, p<.001, the hours spent on social media, r(1100)=.130, p<.001, the number of social media channels used, r(1131)=.121, p<.001, the number of digital devices owned, r(1131)=.074, p=.013, the money spent on ICT devices, r(1132)=.082, p=.006, the number of media subscriptions, r(1134)=.114, p<.001, and the frequency and number of apps used on peoples mobile phones, r(981)=.201, p<.001. A multiple regression was conducted to see if the degree of digitalization predicted the level of subjective time stress. The results of the regression indicated that the model explained 5,5% of the variance in perceived time stress and that the model was a significant predictor, F(8, 959) = 7.976, p<.001, R^2 = .062, $R^2_{Adjusted}$ = .055. The hours spent on stationary internet (B= -.537. p=.001), the number of social media channels used (B=.410, p=.026) and the frequency and number of smartphone app usage (B=.090, p=.002) were significant determinants for the model.

5.4 The intention of individuals to use ICT in order to save time is positively related to the total number of activities and experiences performed (H6)

The intention of individuals to use ICT in order to save time had a moderately strong positive correlation with the pace of life (GAS), r(1000)=.388, p<.001 and a low (positive) correlation with the total number of activities and experiences performed, r(808)=.074, p=.034. We double-checked the intention of individuals to use ICT in order to save time with the tendency to view money and time as interchangeable and found a moderate strong positive correlation between these two variables, r(997)=.422, p<.001. We also conducted variables measuring the intention of individuals to use time-saving technologies for relaxing or to 'kill time'. They were positively correlated with the pace of life (GAS), r(998)=.203, p<.001, the intention of individuals to use ICT in order to save time, r(1077)=.449, p<.001 and with the tendency to view money and time as interchangeable r(999)=.163, p<.001. The intention of individuals to use time-saving technologies for relaxing/killing time showed no significant correlation with the total number of activities and experiences performed.

To test our time rebound hypothesis, we conducted a linear regression to see if the intention of individuals to use ICT in order to save time predicted the pace of life. The model was a significant predictor and explained 16,3% of the variance, F(1, 996) = 194.652, p<.001, R2 = .163, $R^2_{Adjusted}$ =.163.

Furthermore, we employed a linear regression to see if the intention of individuals to use ICT in order to save time predicted the total number of activities and experiences performed. The results of that regression indicated that although having statistically significant explanatory power, F(1, 808) = 4.499, p=.034, R2 = .074, $R^2_{Adjusted}$ =.004, the model explained only 0,4% of the variance of the total number of activities and experiences performed. The direct influence of the intention of individuals to use ICT in order to save time on the total number of activities and experiences performed was very low (B=.133, p=.034). Adding the tendency to view money and time as interchangeable and the

intention of individuals to use time-saving technologies for relaxing/killing time did not improve the results of the model. Both variables were no significant determinants predicting the number of activities and experiences performed.

5.5 Demographics

Checking the impact factor of demographic variables, we found significant positive correlations of the pace of life (GAS) with the amount of work-time per week, r(1045)=.131, p<.001, the number of people in the household, r(1041)=.140, p<.001, the number of children in the household, r(1044)=.188, p<.001, the hours spent doing care-work for family members, r(552)=.182, p<.001, and a significant negative correlation with age, r(1037)= -.220, p<.001.

A one-way analysis of variance yielded a main effect for gender, F(1, 1030) = 79.234, p< .001, such that the pace of life was significantly higher for women (M= 51.47, SD= 8.40) than for men (M= 46.53, SD= 9.39). The Eta² was 0.07 indicating a moderate effect of gender explaining 7% of the variance in the pace of life.

A sequential multiple regression was employed to see which demographic variables predicted the pace of life. In a first step, all variables that had a significant relationship with the GAS were entered into the model. In a second step, variables that did not significantly predict the model were excluded, resulting in an increase of R^2. The results of the regression indicated that the final model explained 13,3% of the variance and that the model was a significant predictor, F(5, 1022) = 32.551, p<.001, R2 = .137, $R^2_{Adjusted}$ = .133. Gender, level of education, number of children in the household, and number of working hours per week were significant determinants for the model.

6 SUMMARY AND CONCLUSION

In a nutshell, our results show that there is a significant correlation between an individual's degree of ICT usage ("degree of digitalization"), measured in various different dimensions, and that individual's pace of life ("degree of acceleration"). Most notably, there is a stronger correlation between ICT usage and filling break and down times with activities, and likewise with performing activities in parallel (multitasking). Accordingly, our hypotheses H2 and H3 can be verified. With a lower, although significant correlation our data also verifies our hypotheses H1 and H4; namely, that ICT usage correlates with performing activities faster, and performing time-saving activities instead of time-consuming activities. Regarding these hypotheses, the number of smartphone apps used had the largest influence on the pace of life in our study. Hence on the basis of our General Acceleration Scale (GAS), we can postulate: The more people are digitalized, the faster is their pace of life.

Our analysis suggests that mobile internet use is more strongly correlated with an accelerated pace of life than stationary internet use. This seems plausible as mobile internet use enables individuals to perform and to organize activities in nearly all locations and under various circumstances. In contrast to the findings of Bitmann and Brown [6], our data suggests that intensive use of mobile connectivity options is speeding up peoples' pace of life. Hence, very carefully we may presume: The better mobile internet speed and access will get, e.g. by introducing 5G, the faster people's pace of life may become.

Besides these correlation between ICT usage and pace of life, our results also show that there is a moderately strong correlation between the pace of life and the number of activities performed per day (objective acceleration). Correlations were moderately strong for 'filling waiting and break times with activities' and 'multitasking', but also with performing activities faster. Hence, we can verify our hypothesis H5a and can postulate: The faster people's pace of life, the more activities do they perform during a given period of time. And because our data also showed a moderately strong direct correlation between the degree of ICT usage and the number of activities performed during a given period of time (objective acceleration), we can also postulate: The more people are digitalized, the denser is their daily schedule.

These correlations between pace of life, degree of digitalization and objective acceleration can also be observed for subjectively felt acceleration, i.e., perceived time stress. As there is a moderately strong correlation between the general level of acceleration and perceived time stress, our data verifies our hypothesis H5b. Again, correlations are strongest between perceived time stress on the one hand, and filling waiting and break times with activities as well as multitasking on the other. These correlations empirically prove a classic hypothesis of many theories of social acceleration: that a faster pace of life with more activities performed during a given period of time is also perceived as a more stressful life. If a high degree of ICT usage is responsible for speeding up people's pace of life, then it is to be expected that making frequent use of ICT contributes to a sense of increased time stress. No significant association between the use of digital devices and time pressure would be inconsistent with our acceleration hypothesis. Because we observed a direct correlation between overall ICT usage and perceived time stress, we can also postulate: The more people are digitalized, the more stressful is their life. Again, the frequent use of the mobile internet, smartphone apps and the number of social media channels contributed most significantly to feeling stressed and hurried in everyday life. However, interestingly, we would like to point to one opposing correlation, namely, a negative correlation between hours spent on stationary internet and felt time stress.

With regard to ICT-borne time rebound effects, our results are ambivalent. On the one hand, we found a moderately strong correlation between the intention to use ICT in order to save time and the pace of life. However, the direct effect of the intention to use ICT for saving time and the total number of activities is very weak. So we can only postulate: The more people use ICT to save time, the faster they act. But this does not entail that they have a denser schedule – neither does it entail that they save time to do less, or to have more time off for relaxing or contemplation.

6.1 Critical reflection of methodology and operationalization

Note that our analysis contains a couple of potential weaknesses that need to be reflected when drawing straightforward conclusions. First of all, all our data is one-time self-reported information. Factors such as common method variance could have influenced the data in this study. However, this may have unequal effects on different measures used in this study. This holds true not only for respondents' declaration on ICT usage, some of which (i.e., number of devices, social media channels used) can be presumed to be pretty reliable, while others (i.e., hours on mobile internet versus stationary internet) might be less reliable as some respondents may have difficulties to clearly distinguish. Likewise, we only have self-reported data on respondents' perception of their pace of life, and their self-assessment whether, e.g., they perform activities faster or slower. Although common precautions to address method bias have been addressed in the design of the survey, bivariate linear relationships could be inflated (or deflated) by influences that haven't been controlled. That the world is speeding up is as much a matter of contemporary theoretical importance as it is a popular cultural concern. Measuring items such as general acceleration strategies in everyday life could potentially be influenced by social desirability.

Second, we gathered our data from an online survey. Although we cooperated with a professional panel institute, this does not entirely ensure that respondents, who receive financial incentives for cooperation, filled out our survey with great care. Moreover, note that the fact that we conducted the survey online might bias our results towards some basic extend of ICT usage (degree of digitalization). We have not included a control group that does not use ICT at all, or does not have a smartphone or the like.

Third, the results presented here can only verify correlations, and not causalities. Therefore, we have formulated our conclusions carefully in order not to suggest, for instance, that the degree of ICT usage causes a faster pace of life in a straightforward manner. As most of the theoretical literature on time use and social acceleration suggests, we rather assume an interrelated relationship: ICT might lead to a faster life, but at the same time, people favoring or performing a fast life may be particularly prone to a high degree of ICT usage.

Finally, besides our ambivalent results regarding ICT-borne time rebound effects, note that our approach to analyze those effects contains a particular challenge. This, however, is due to the inherent general challenge to clearly measure rebound effects – be it energy rebounds or time rebounds. As noted in earlier publications, all rebound research faces the problem of a "cause-effect-relativity" [34,38]. By asking respondents for their intention to use ICT, we cannot resolve the question whether the time efficiency improvements are the actual cause for people's faster pace of life, and their increased number of activities performed per day.

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A APPENDIX

A.1 GAS (General Acceleration Scale)

The GAS consists of 16 items, with four subscales. All items of the GAS were measured on a 5-point Likert scale, ranging from "never" to "always" containing the item stem "During a typical hour of my leisure time …". Additionally, participants could mark the option "does not apply to me". Note that the scale was originally developed (and empirically tested) in German. The items have been translated for information in this article only. The English translation has not been empirically verified.

Multitasking

a) I do several things at a time
b) I perform more than one activity
c) I do multi-tasking
d) I handle several tasks simultaneously

Replacing time-consuming by time-saving activities

a) I decide to do time-saving rather than time-consuming activities
b) I replace time-intensive tasks, in order to save time
c) I try to replace time-consuming activities by activities that save time
d) I chose activities that do not last long rather than time-consuming act.

Performing activities faster

a) I do things very quickly
b) I perform activities most speedy
c) I bring things to an end as quickly as possible
d) I get things done as fast as possible

Filling waiting times with activities

a) I use waiting times for other activities
b) I use down times and breaks for additional activities
c) I try to fill breaks with as productive occupations as possible
d) I make use of transfer times to get things done