Smartphone Zombies!

Pedestrians' Distracted Walking as a Function of their Fear of Missing Out

Markus Appel, Nina Krisch, Jan-Philipp Stein, & Silvana Weber

Human-Computer-Media Institute

University of Würzburg, Germany

Manuscript accepted to be published in the *Journal of Environmental Psychology*

Contact author: Prof. Dr. Markus Appel, Human-Computer-Media Institute, University of Würzburg, Oswald-Külpe-Weg 82, 97074 Würzburg, Germany, Phone: +49 (0)931 31-86176, Email: markus.appel@uni-wuerzburg.de.

Abstract

Smartphone use while walking (i.e., being a *smartphone zombie*) has become a prevalent phenomenon in many cities worldwide. Previous research shows that many pedestrians choose to interact with their phones as they walk around in cities, despite being aware that their behavior might be dangerous. To investigate potential reasons for the prevalence of distracted walking, the current study explores the construct Fear of Missing Out (FoMO) as a potential antecedent of pedestrians' smartphone use while walking. Hierarchical OLS and logistic regression analyses show that FoMO predicts distracted walking, the tendency to engage in virtual social interactions while walking, and dangerous traffic incidents—irrespective of participants' age and gender. Virtual communication might serve as a compensation for real-world company, thus sidelining the need to traverse safely.

Keywords: pedestrians; distracted walking; smartphone; fear of missing out

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1. Introduction

Walking in inner cities has been associated with many benefits for people's physical health and well-being (Abraham, Sommerhalder, & Abel, 2010). Not only does the act of walking contribute to energy expenditure (Manson et al., 2002), pedestrians' street interactions can also provide a sense of community and belonging, and therefore, are important factors for good mental health (Webb Jamme, Bahl, & Banerjee, 2018). Over the past ten years, however, human behavior when walking in cities has changed substantially: many pedestrians now interact with their mobile phones while walking on sidewalks, standing in front of traffic lights, or crossing the street (Basch, Ethan, Zybert, & Basch, 2015). With their altered state of attention and their distinct gait reminiscent of the 'walking dead', distracted pedestrians have since been called *smartphone zombies*, both in scientific (Duke & Montag, 2017) and in journalistic publications (Wang, 2018).

Despite its humorous denomination, distracted walking constitutes a serious psychological phenomenon that connects to harmful consequences. An observational study conducted at the 20 intersections with the highest number of pedestrian injuries in Seattle, WA (Thompson, Rivara, Ayyagari, & Ebel, 2013) indicated that pedestrians who used a mobile phone and texted while crossing the street took longer to do so and were less likely to look both ways before crossing. This finding is complemented by evidence from virtual reality (VR) experiments, in which pedestrians distracted by mobile phones missed more opportunities to cross a street safely and took longer to traverse (two lane suburban road scenario: Byington & Schwebel, 2013; two lane city road scenario: Chaddock, Neider, Lutz, Hillman, & Kramer, 2012; see also Stavrinos, Pope, Shen, & Schwebel, 2018). Biomechanic research shows that using the phone while walking leads to changes in gait, characterized by increased step width, decreased step length, longer standing on each leg, and a decrease in swing time (Parr, Hass, & Tillman, 2014). Lastly, cross-sectional research highlights a higher prevalence of walking accidents, such as slipping or collusions, for heavy users of smartphones than for low frequency or moderate users (Kim, Min, Kim, & Min, 2017). Acknowledging the emerging risks, traffic planners in cities like Xi'an in China and Cologne in Germany have responded by introducing special walking lanes or floor traffic lights for walking smartphone users; in Honolulu, Hawaii, it has become illegal to cross the street while viewing a mobile electronic device (Mohn, 2017).

Although a growing number of studies discussed the detrimental consequences of distracted walking, the motives and reasons underlying this behavior are not well understood. Acknowledging this research gap, the current study investigates individual differences in the *Fear of Missing Out* (FoMO) as a predictor of distracted walking and associated dangerous incidents on streets. FoMO describes people's individual disposition to experience anxiety when feeling left out of social interactions, events, or relationships (Przybylski, Murayama, DeHaan, & Gladwell, 2013). Although individuals with higher levels of FoMO consider situations of social isolation as highly distressful, some authors have re-purposed the acronym into "*feelings* of missing out," arguing that the criteria for fear as a psychological term are not necessarily met (Hayran, Anik, & Gurhan-Canli, 2016). Thus, FoMO may be interpreted as an umbrella term that encapsulates negative emotions following a perceived lack of desirable social contact. Przybylski and colleagues (2013) showed that FoMO is associated with younger age and lower satisfaction of basic psychological needs in terms self-determination theory (Need Satisfaction Scale, LaGuardia, Ryan, Couchman, & Deci, 2000). Regarding personality factors, FoMO was positively related to neuroticism and unrelated to extraversion (Blackwell, Leaman, Tramposch, Osborne, & Liss, 2017). Higher FoMO has been connected to several problematic outcomes, including higher alcohol consumption (Riordan, Flett, Hunter, Scarf, & Conner, 2015), and it is positively associated with depression (Baker, Krieger, & LeRoy, 2016). Furthermore, FoMO has been proposed as an explanation why people engage with their phones while driving (e.g., Przybylski et al., 2013).

According to previous research, pedestrians report significantly less physical exhaustion and anxiety, and stronger revitalization if they are accompanied by a friend while walking in urban environments (e.g., Johansson, Hartig, & Staats, 2011). In combination with the insight gained on FoMO, this suggests that distracted walking actually constitutes a compensatory mechanism to avoid the impression of missing out on social contact. Therefore, we hypothesize that FoMO predicts smartphone use while walking (Hypothesis 1) and pedestrians' engagement in virtual social interactions while walking (Hypothesis 2). Moreover, building upon previous studies that highlighted the dangers of distracted walking, we assume that FoMO is a predictor of pedestrians' experience of dangerous traffic incidents due to distracted walking (Hypothesis 3).

2. Method

2.1 Participants and Procedure

For an estimation of minimum sample size, we used the standardized coefficient obtained from a single linear regression in a conceptually similar study on distracted driving ($\beta = .28$; Przybylski et al., 2013). Due to the higher number of predictors in our study's hierarchical regression analysis (see below), we anticipated a reduction of the slope and used a small to medium effect (Cohen, 1988) of $f^2 = 0.07$ to estimate our sample size. Pursuing a test power of 95% and a type I error probability of $\alpha = .05$ in a four-predictor model with one target predictor, a minimum of 188 participants were required to uncover effects of this magnitude.

Participants were recruited via social media to take part in our online study. In total, 285 participants completed the questionnaire. All participants gave informed consent. We excluded six participants because the system did not record their response times, as well as five participants who spent less than 180 seconds with the survey, indicating careless responding. Two additional participants were excluded from further analyses, as they fell below our age cutoff of 16 years or declined to report their age. The final sample consisted of 272 participants (54.4% female) with a mean age of 37.87 years (*SD* = 13.66, range from 17 to 80). Participants' age was assessed with an open-ended question yielding continuous data. However, since we discovered a bimodal age distribution, we split the sample at 42 years, the low-frequency mid-point of the age distribution (Online Supplement, Figure S1). The younger adults group had an average age of 27.92 years (*SD* = 5.75, age range 17–41 years, *n* = 164), whereas the older adults group had an average age of 52.98 years (*SD* = 6.30, age range 42–80 years, *n* = 108). [1]

2.2 Measures

Fear of Missing Out (FoMO) was assessed with a German version of the FoMO Scale (FoMOS; Przybylski et al., 2013; please refer to the Online Supplement for the full scale). It consists of ten items with a 5-point response scale, ranging from 1 = *not at all true of me* to 5 = *extremely true of me* (e.g., "I fear others have more rewarding experiences than me."). The reliability of the scale was good (Cronbach's α = .74).

Distracted walking was assessed with the help of a two-item scale. Before the items were presented, a brief introduction was given, clarifying that they did not refer to mobile phone use while standing or deliberately retreating to secluded places. Both items ("While I walk in a

[1] The results of our analyses remained virtually unchanged for the sample without exclusions. Likewise, a re-analysis with age kept as a continuous variable did not substantially alter our results.

city/town, I use my smartphone…" and "When I am a pedestrian and I stand in front of a traffic light or cross the street, I use my smartphone…") were followed by a 5-point response scale, ranging from 1 = *never* to 5 = *very often* (Cronbach's $\alpha = .71$).

Engagement in virtual social interactions while walking was assessed with three items ("While I walk in a city/town, wait at a traffic light or cross a street, I read and write emails," "...use messengers," and "...use social media") on a 5-point scale (1 = *never*, 5 = *very often*). The reliability of the scale was good (Cronbach's $\alpha = .77$). The three items were embedded in a longer list of activities while using the smartphone while walking. Only participants who engaged in distracted walking at all (distracted walking score > 1) received these questions ($N = 236$).

Prior experience of *dangerous incidents* as a pedestrian due to smartphone use was examined with the help of one item ("Have you ever been involved in a dangerous situation due to smartphone use while walking in traffic?"). Originally presented in an ordinal scale four-point answer format, this variable was later dichotomized for a meaningful statistical analysis (0 = *never*; 1 = *once or more*).

To control for the potential influence of *social desirability* on participants' self-reports, we included a six-item scale assessing social desirable answering (Kemper, Beierlein, Bensch, Kovaleva, & Rammstedt, 2012). Its items (e.g., "Even when I am stressed, I always treat others with kindness.") were presented in a 5-point answer format ranging from 1 = *not true of me at all* to 5 = *completely true of me* (Cronbach's $\alpha = .63$).

Additional measures addressed the use of other smartphone features (which were not analyzed as part of this research), as well as sociodemographic data such as age, gender, and profession. Descriptive statistics of the study variables are presented in Table 1.

3. Results and Discussion

We conducted a hierarchical regression analysis that included age group, gender, social desirability, and FoMO in the first step, with interactions between FoMO and age group and between FoMo and gender entered in the second step (Table 2). Distracted walking was negatively related to age group and unrelated to gender. Social desirability was substantially associated with distracted walking, $B = -0.35$, 95% CI [-0.54, -0.15], $\beta = -.20$, $p < .001$, corroborating our assumption that distracted walking is considered a non-desirable behavior. Over and above these factors, FoMO was a positive predictor of distracted walking, $B = 0.15$, 95% CI [0.05, 0.25], $\beta = .16$, $p = .004$. As expected in Hypothesis 1, using the smartphone while walking instead of paying attention to environmental surroundings is motivated by an individual's fear of missing out on social contact. This relationship holds equally for men and women, and individuals in different age groups, with $\Delta R^2 = .00$, $p > .90$ for the interactions. In support of Hypothesis 2, FoMO also predicted the frequency of *engaging in virtual social interactions* while walking in urban environments, $B = 0.15$, 95% CI [0.04, 0.26], $\beta = .16$, $p = .01$ (see Table S1 in the online supplement). Age group was negatively related to this variable, while gender was unrelated. The link between FoMO and engaging in virtual social interactions while walking held equally for all participants regardless of their gender or age, $\Delta R^2 = .01$, $p = .31$, for the statistical interactions. Results obtained from a logistic regression analysis indicate that FoMO significantly predicted whether participants had ever been in a dangerous situation due to smartphone use while walking in traffic, Exp(B) = 1.60, 95% CI [1.13, 2.27], $p = .009$ (Hypothesis 3). Age group predicted prior experiences of dangerous incidents, Exp(B) = 0.32, 95% CI [0.13, 0.81], $p = .016$ (younger participants as the reference category), while gender and social desirability did not. The interactions between FoMO and the demographic indicators were not significant (Online Supplement, Table S2).

Taken together, feelings of missing out on social interactions increase the likelihood of becoming a *smartphone zombie*. FoMO predicts distracted walking, virtual interactions while walking, and related dangerous traffic incidents. These associations were controlled for participants' social desirability scores and were similar in size for men and women, as well as groups of younger and older adults.

As previous research has shown, people experience more psychological benefits when walking with a friend in urban environments (Johansson et al., 2011). Given the situation that no friends are physically present, yet people dislike solitary walking along streets, they aim for the best substitute available: social interactions on their smartphone screens such as social media and messengers. Social network sites may partly fulfill the desire to stay connected with what others are currently doing (Przybylski et al., 2013), and thus may serve as a substitute for social interactions while wandering the streets. However, the health risks related to this behavior likely outweigh the psychological benefits.

This work is meant to encourage future theory-guided research on distracted walking and the use of digital technologies in cities more generally. Before pointing out research directions, we need to acknowledge that the design of this study limits us to correlational conclusions. This is a serious limitation, as we assume that the frequency of distracted walking is a function of the interplay between rather stable individual differences and pedestrians' environment. In an early theoretical piece on the psychology of living in cities Milgram (1970) highlighted the challenge of being exposed to the plentitude of social stimuli and individuals' adaptation to this overload or 'urban stress' (Glass & Singer, 1972). From this perspective, distracted walking could also be conceived as a way to deal with the enormous amount of social stimuli in cities. In consequence, using the smartphone when walking in cities and crossing streets might serve as a means to avoid or reduce attentional fatigue resulting from the surrounding environment (Staats, Jahncke, Herzog, & Hartig, 2016). While it seems contradictory to counteract the social overload of cityscapes by striving for more social input from one's mobile phone, the virtual access to friends and acquaintances provided by mobile phones could serve psychological restoration (Johansson et al., 2011; Staats & Hartig, 2004). Unlike the abundance of unknown noises, visuals, and strangers populating the city, social media let pedestrians focus on things and people they know—and might therefore provide a comforting substitute for real-world company. However, not all cities are alike, and there are meaningful differences within city environments. Too little and too much social input likely increases the likelihood of using smartphones while walking. Future research is encouraged to examine smartphone use while walking in different environments and situations.

Based on the role of individuals' feelings of missing out on social contact, urban environments that facilitate offline social contacts while walking would likely reduce the dangerous smartphone use in cities. Means to reduce distracted walking could include walking with friends (e.g., to school or to work), increasing the breadth of walkways to allow for offline social interactions while walking, and the reduction of urban stressors such as noise.

Many societies worldwide are at the early stages of a digital transformation that will likely affect life in cities substantially in the coming years. Smartphone use is a ubiquitous characteristic of the digitalization processes, yet the impact of other technologies will likely increase. Big screens, for example, have become more prevalent in many cities and the displayed information will increasingly adapt to those urbanites looking at them in a given situation (Papastergiadis, Barikin, McQuire, & Yue, 2016). Despite the limited success of *Google Glass*, smart glasses may become popular in the future, allowing to add information to environmental stimuli. As a third imminent development, pedestrians will be faced with the challenge of interacting with autonomous vehicles in the coming years (Millard-Ball, 2018). Future research needs to account for urbanites' experience given these changing technologies and environments.

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Table 1. *Means and zero-order correlations (r) of the study variables*

	M (SD)	(1)	(2)	(3)	(4)	(5)	(6)
(1) Age Group [a]	0.40 (0.49)						
(2) Gender [b]	0.46 (0.50)	.193** [.076, .305]					
(3) Social Desirability	3.89 (0.51)	.298*** [.185, .402]	-.094 [-.210, .025]				
(4) FoMO	2.09 (0.55)	-.332*** [-.433, -.221]	-.063 [-.181, .056]	-.292*** [-.397, -.179]			
(5) Distracted Walking	2.31 (0.91)	-.481*** [-.567, -.385]	-.060 [-.178, .059]	-.354*** [-.453, -.245]	.341*** [.231, .442]		
(6) Virtual Social Interactions	2.28 (0.91)	-.416*** [-.516, -.304]	-.017 [-.144, .111]	-.145* [-.268, -.017]	.269*** [.146, .383]	.436*** [.326, .534]	
(7) Dangerous Incidents	0.16 (0.37)	-.207** [-.318, -.090]	-.012 [-.131, .107]	-.121* [-.236, -.002]	.228*** [.112, .338]	.231*** [.115, .340]	.109 [-.010, .225]

Notes. $N = 272$, except for virtual social interactions ($n = 236$). [a] dummy-coded (0 = 41 years or younger; 1 = 42 years or older); [b] dummy-coded (0 = women; 1 = men); * $p < .05$; ** $p < .01$; *** $p < .001$; 95% confidence intervals are depicted in parentheses after the correlation coefficients

Table 2. *Distracted Walking Regressed on Demographics, Social Desirability, and the Fear of Missing Out (FoMO)*

	Main model				*Model with interactions*			
	$R^2 = .30, F\ (4, 267) = 28.90, p < .001$				$\Delta R^2 = .00, F\ (2, 265) = 0.02, p = .973$			
	B	*B* 95% CI [LL, UL]	β	*p*	*B*	*B* 95% CI [LL, UL]	β	*p*
Intercept (B_0)	3.92	[3.17, 4.67]		< .001	3.92	[3.16, 4.68]		< .001
Age Group[a]	-0.68	[-0.89, -0.48]	-.37	< .001	-0.68	[-0.89, -0.46]	-.37	< .001
Gender[b]	0.01	[-0.18, 0.19]	.00	.951	0.00	[-0.19, 0.20]	.00	.979
Social Desirability[c]	-0.35	[-0.54, -0.15]	-.20	< .001	-0.35	[-0.54, -0.15]	-.20	.001
FoMO[c]	0.15	[0.05, 0.25]	.16	.004	0.15	[0.01, 0.28]	.16	.033
FoMO x Age Group					0.02	[-0.20, 0.24]	.01	.862
FoMO x Gender					-0.02	[-0.22, 0.18]	-.01	.840

Notes. [a] dummy-coded (0 = 41 years or younger; 1 = 42 years or older); [b] dummy-coded (0 = women; 1 = men); [c] z-standardized

Online Supplement

Smartphone Zombies!

Pedestrians' Distracted Walking as a Function of their Fear of Missing Out

Fear of Missing Out Scale (FoMOS) – German Version

Im Folgenden finden Sie eine Auswahl an Aussagen zu Ihren alltäglichen Erfahrungen. Nutzen Sie bitte die angegebenen Antwortmöglichkeiten und geben Sie an, inwiefern jede der Aussagen auf Sie zutrifft. Bitte geben Sie an, was tatsächlich auf Sie zutrifft, nicht was wünschenswert wäre oder auf Sie zutreffen sollte. Bitte beantworten Sie jede Aussage für sich genommen.

Trifft gar nicht auf mich zu	Trifft etwas auf mich zu	Trifft mäßig auf mich zu	Trifft sehr auf mich zu	Trifft extrem auf mich zu
1	2	3	4	5

German language item	*Item No. in Przybylski et al. (2013, p. 1847)*
1. Ich befürchte, dass andere Menschen schönere Erlebnisse haben als ich.	1
2. Wenn ich herausbekomme, dass sich meine Freunde ohne mich amüsieren, beschäftigt mich das.	3
3. Es macht mich nervös, wenn ich nicht weiß, was meine Freunde gerade so treiben.	4
4. Manchmal frage ich mich, ob ich nicht zu viel Zeit damit verbringe, immer auf dem Laufenden zu bleiben.	6
5. Wenn ich Spaß habe, ist es mir wichtig, die Details online zu teilen (z.B. durch Statusupdates).	8
6. Wenn ich ein geplantes Treffen mit Freunden verpasse, ärgere ich mich.	9
7. Es ist wichtig, dass ich Insider-Witze meiner Freunde verstehe.	5
8. Es ärgert mich, wenn ich eine Gelegenheit verpasse, meine Freunde zu treffen.	7
9. Ich befürchte, dass meine Freunde mehr erleben als ich.	2
10. Auch im Urlaub beobachte ich, was meine Freunde zu Hause gerade machen.	10

Items of the original English language FoMO-scale (Przybylski, Murayama, DeHaan, & Gladwell, 2013)

1. I fear others have more rewarding experiences than me.
2. I fear my friends have more rewarding experiences than me.
3. I get worried when I find out my friends are having fun without me.
4. I get anxious when I don't know what my friends are up to.
5. It is important that I understand my friends "in jokes".
6. Sometimes, I wonder if I spend too much time keeping up with what is going on.
7. It bothers me when I miss an opportunity to meet up with friends.
8. When I have a good time it is important for me to share the details online (e.g. updating status).
9. When I miss out on a planned get-together it bothers me.
10. When I go on vacation, I continue to keep tabs on what my friends are doing.

Table S1. *Engagement in Virtual Social Interactions While Walking Regressed on Demographics, Social Desirability, and the Fear of Missing Out (FoMO)*

	Main model $R^2 = .20, F\ (4, 231) = 14.45, p < .001$				*Model with interactions* $\Delta R^2 = .01, F\ (2, 229) = 1.19, p = .307$			
	B	*B* 95% CI [LL, UL]	β	*p*	*B*	*B* 95% CI [LL, UL]	β	*p*
Intercept (B_0)	2.47	[1.61, 3.33]		< .001	2.40	[1.54, 3.27]		< .001
Age Group[a]	-0.73	[-0.98, -0.49]	-.38	< .001	-0.78	[-1.03, -0.52]	-.40	< .001
Gender[b]	0.12	[-0.10, 0.34]	.07	.287	0.14	[-0.08, 0.37]	.08	.201
Social Desirability[c]	-0.00	[-0.22, 0.22]	-.00	.977	0.01	[-0.21, 0.23]	.00	.950
FoMO[c]	0.15	[0.04, 0.26]	.16	.011	0.19	[0.04, 0.34]	.20	.016
FoMO x Age Group					-0.21	[-0.48, 0.06]	-.12	.126
FoMO x Gender					0.06	[-0.18, 0.29]	.04	.644

Notes. [a] dummy-coded (0 = 41 years or younger; 1 = 42 years or older); [b] dummy-coded (0 = women; 1 = men); [c] z-standardized

Table S2. *Logistic Regression Analysis: Dangerous Incidents Regressed on Demographics, Social Desirability, and the Fear of Missing Out (FoMO)*

	Main model Nagelkerke $R^2 = .128$					*Model with interactions* Nagelkerke $R^2 = .132$				
	B	SE_B	Exp(B)	Exp(B) 95% CI [LL, UL]	p	B	SE_B	Exp(B)	Exp(B) 95% CI [LL, UL]	p
Constant (B_0)	-1.55	0.26	0.21		< .001	-1.49	0.27	0.23		< .001
Age Group[a]	-1.13	0.47	0.32	[0.13, 0.81]	.016	-1.17	0.48	0.31	[0.12, 0.79]	.014
Gender[b]	0.22	0.36	0.81	[0.61, 2.53]	.554	0.15	0.39	1.17	[0.55, 2.49]	.693
Social Desirability[c]	-0.06	0.19	0.94	[0.65, 1.35]	.736	-0.08	0.19	0.93	[0.64, 1.34]	.689
FoMO[c]	0.47	0.18	1.60	[1.13, 2.27]	.009	0.38	0.23	1.46	[0.92, 2.29]	.105
FoMO x Age Group						0.32	0.45	1.38	[0.57, 3.31]	.475
FoMO x Gender						0.05	0.38	1.05	[0.50, 2.21]	.905

Notes. [a] dummy-coded (0 = 41 years or younger; 1 = 42 years or older), reference category = 0; [b] dummy-coded (0 = women; 1 = men), reference category = 0; [c] z-standardized

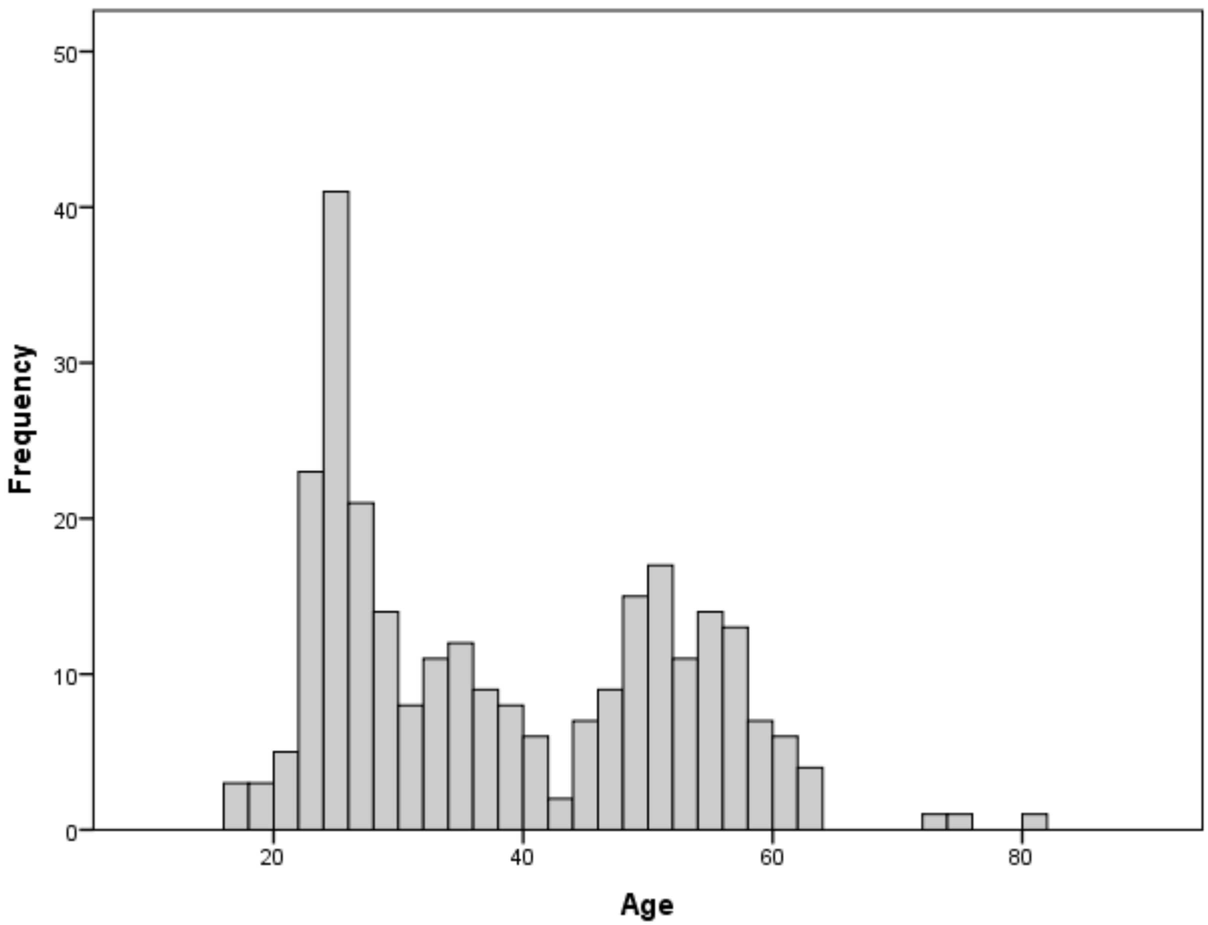

Figure S1. Age distribution in the sample. The low-frequency mid-point of the bimodal age distribution is at 42 years.