Online Supplementary Material: Detailed Analytic Approach

We took advantage of recent developments in the multilevel modeling literature to estimate the unique effects of transitioning into and out of Internet use (i.e., asymmetrical fixed effects; Allison, 2019). We employed this approach based on the notion that the effect of transitioning into using the Internet (positive transition; presumed to take a value of coefficient *b*) is not qualitatively and quantitatively identical to, and will not be matched by, the effect in the opposite direction when one transitions out of using the Internet (negative transition; change of -*b* in cognitive functioning). The approach first takes the original internet use dichotomous variable (X_{ti}) and decomposes it into a positive and a negative component based on its sequential changes over time (*t*):

$$X_{ti}^{+} = X_{ti} - X_{ti-1}\ if\ (X_{ti} - X_{ti-1}) > 0, otherwise\ 0;\ X_{ti}^{-} = -(X_{ti} - X_{ti-1})\ if\ (X_{ti} - X_{ti-1}) < 0, otherwise\ 0.$$

Subsequently, Z^{+} and Z^{-} are defined as the following:

$$Z_{ti}^{+} = \sum_{s=1}^{t} X_{si}^{+}\ ;\ Z_{ti}^{-} = \sum_{s=1}^{t} X_{si}^{-}\ ,$$

where Z^{+}represents the accumulation up to time *t* of all previous positive transitions in Internet use, and Z^{-}represents the accumulation up to time *t* of all previous negative transitions in Internet use. The two terms Z^{+} and Z^{-} are then used in the models to capture the effects of transitions in and out of Internet use (for a detailed treatment of the topic, see Allison, 2019).

Second, all time-varying variables, including the Internet use variables, were decomposed into within-person and between-person components, whereby person-means for each predictor are included as a between-person component of the predictor and the within-person component is included as the deviation from this person-mean at a given wave (Bell & Jones, 2015). This approach yields within-person estimates that are independent of selection effects attributed to all stable between-person differences, both observed and unobserved. The interaction terms were

also decomposed so that within-person interaction effects were not biased by stable omitted characteristics.

The abbreviated multilevel equation for Model 1A predicting person *i*'s cognitive functioning at time *t* (i.e., Cog_{it}) was as follows:

$$Cog_{ti} = \gamma_{00} + \gamma_{10}\,(Time_{ti}) + \gamma_{20}\,(Z_{ti}^{+} - \overline{Z_{i}^{+}}) + \gamma_{30}\,(Z_{ti}^{-} - \overline{Z_{i}^{-}}) + \gamma_{40}\,(TVC_{ti} - \overline{TVC}_{i})$$
$$+ \gamma_{01}\,(\overline{Time}_{i}) + \gamma_{02}\,(\overline{Z_{i}^{+}}) + \gamma_{03}\,(\overline{Z_{i}^{-}}_{i}) + \gamma_{04}\,(\overline{TVC}_{i}) + \gamma_{05}\,(TIC_{i})$$
$$+ u_{0i} + u_{1i}\,(Time_{ti}) + e_{ti},$$

where γ_{00} and γ_{10} represent the fixed intercept and the effect of time (elapsed from baseline). The within-person effects of transitioning into and out of Internet use were captured with γ_{20} and γ_{30}, respectively. The within-person effects of time-varying covariates (TVC), which included marital status, household income, depressive symptoms, health conditions, and activities of daily living limitations, are represented by γ_{40}. Following Curran and Bauer (2011), γ_{01} (i.e., person-mean of time) was also added to the model to adjust for panel observations that were unbalanced with respect to time. The between-person effects of transitioning into and out of Internet use are given by γ_{02} and γ_{03}; the between person effects of TVCs are given by γ_{04}. The effects of time-invariant covariates (TIC), which included baseline age, gender, race/ethnic status, and education, are given by γ_{05}. Random intercept, random effect of time, and residual are represented by u_{0i}, u_{0i}, and e_{ti}, respectively.

Reference

Allison, P. D. (2019). Asymmetric Fixed-effects Models for Panel Data. *Socius*, *5*, 2378023119826441. https://doi.org/10.1177/2378023119826441.

Bell, A., & Jones, K. (2015). Explaining fixed effects: Random effects modeling of time-series cross-sectional and panel data. *Political Science Research and Methods*, *3*(1), 133-153.

Curran, P. J. & Bauer, D. J. (2011). The disaggregation of within-person and between-person effects in longitudinal models of change. *Annual Review of Psychology*, 62, 583

An Illustration of Transitions Around Internet Use and Cognitive Functioning from the HRS Data

ID	Time	Internet use (yes/no)	Positive transition indicator (X_{it}^{+})	Negative transition indicator (X_{it}^{-})	Positive transition (Accumulated positive changes; Z_{it}^{+})	Negative transition (Accumulated negative changes; Z_{it}^{-})	Cognitive functioning
A	0	1	0	0	0	0	31
A	1	1	0	0	0	0	18
A	2	0	0	1	0	1	20
A	3	1	1	0	1	1	26
A	4	0	0	1	1	2	17
A	5	0	0	0	1	2	12
B	0	0	0	0	0	0	25
B	1	1	1	0	1	0	18
B	2	1	0	0	1	0	22
B	3	1	0	0	1	0	24
B	4	1	0	0	1	0	23
B	5	0	0	1	1	1	20
B	6	1	1	0	2	1	23
B	7	0	0	1	2	2	20