The Impacts of Motivational Framing of Technology Restrictions on Adolescent

Concealment: Evidence from a preregistered experimental study

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Abstract

Caregivers employ a range of motivational strategies to help regulate and protect adolescents using connective technologies. The present study explored a new conceptual model informed by self-determination theory (Deci & Ryan, 2000; Ryan & Deci, 2000) with a representative sample of 1,000 adolescents recruited nationwide within Britain, and using a confirmatory, pre-registered and open science methodology. In this experimental study we compared controlling (pressuring, coercive, or punitive) styles of restricting technology with neutral, and autonomy-supportive (empathic, choice-promoting) styles of restricting to predict adolescents' concealing their technology use from caregivers. We further tested two mechanisms which might explain the links of condition and concealment: perceiving caregivers to be trusting, and experiencing reactance or the desire to do the opposite of what was instructed. Findings are discussed in terms of the role of regulation styles on interpersonal outcomes and adolescent development, and implications for technology use policy and recommendations to caregivers and teachers.

Keywords: *Self-determination theory, technology use, restrictions, concealment, reactance, trust*

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One of the key challenges of preparing adolescents for adulthood is the task of setting rules and boundaries that balance risks of harm against burgeoning opportunities for personal and social development. This undertaking is made more complex in the digital age as access to ever changing technologies present young people with novel prospects and pitfalls which caregivers never faced themselves (Eynon & Malmberg, 2011). In terms of opportunities, Internet-based apps enable young people develop their social ties, self-concept, and hobbies in ways that would have been hard to imagine a generation ago (Lenhart, 2015). Weighing equally on caregivers and policymakers are concerns that the Internet provides easy access to violent and adult content (Stanley et al., 2016), enables sexting (Klettke, Hallford, & Mellor, 2014), and provides sexual predators and extremists a channel for grooming (Black, Wollis, Woodworth, & Hancock, 2015). Such concerns are amplified by the fact that youngsters can, and do, conceal some aspects of their technology use from caregivers, a common behavior in analogue adolescence (Cumsille, Darling, & Martínez, 2010) and one which makes it more difficult for caregivers to protect adolescents in the future (La Guardia, Ryan, Couchman, & Deci, 2000).

Research indicates that caregivers often respond to the challenges of the digital age by maintaining safety through instilling restrictions or limits set on the behaviors their children can enact online (Mounts, 2000). Importantly, studies in other domains such as school and social settings show that caregivers frame restrictions in different ways to motivate or drive youngsters to action (e.g., Soenens & Vansteenkiste, 2010), but these frames have not been applied to understanding how caregivers shape technology use where rules and restrictions are needed. Further, because motivational framings in non-technical domains tend to reflect the broader styles of caregivers (Soenens & Vansteenkiste, 2010), restriction setting in the

technological realm provide a useful and novel and increasingly relevant microcosm to understand the outcomes of caregiver regulation styles, more broadly.

Our aim in the present research was to experimentally evaluate the idea that motivational theory can inform how caregivers should implement restrictions in the digital age, and that motivational frames influence adolescents' communications related to their technology use. Although few analogue psychological theories of parenting or self-regulation have been applied to the challenges of digital era, there is good reason to think that the dynamics of online spaces can be studied by employing motivational theories (Przybylski, Rigby, & Ryan, 2010). In line with the motivational framework of self-determination theory (Deci & Ryan, 2000; Ryan & Deci, 2000), we expected that caregivers' attempts to increase their children's online safety can backfire if the steps they take when setting restrictions communicate psychological control and distrust. Of interest was whether manipulated perceptions of mothers' styles of restricting technology use would predict adolescents' concealment. To this end, we conducted an Internet-based experiment with a large and nationally representative sample of adolescents, wherein we preregistered theoretically informed hypotheses in advance of data collection. We further explored two potential mechanisms – perceived trustworthiness and adolescents' reactance, a desire to rebel or do the opposite of what caregivers ask (Brehm, 1966), which might explain why adolescents may conceal their technology use. Finally, we expected that our model (see Figure 1) would apply similarly regardless of the motivational strategies used by caregivers at home.

Motivational Rule Setting

Research informed by SDT has identified that caregivers use particular ways of framing rules outside of the technology context. First, caregivers can frame rules in a controlling way, using coercion or threat of force to motivate adolescents to comply. This way of regulating behavior can be further differentiated into whether, indeed, force or

coercion is used. This motivational frame known as *external control* reflects attempts to induce rule compliant behavior through the threat and/or actual use of punishments delivered by the caregiver. The second way caregivers can motivate youngsters to follow a rule, *introjected control*, operates by imposing punitive interpersonal styles which aim to induce shame and guilt (Soenens & Vansteenkiste, 2010). This form of regulation often involve communicating that the child is less loveable or acceptable if he or she behaves in certain ways (Assor, Roth, & Deci, 2004). The third motivational frame which is expected to offer a more positive motivational framing for rule-setting, *autonomy-supportive* rule setting, attempts to support children's sense they are volitional and collaborative members within the relationship. For example, caregivers may offer choice of how to behave within a clear set of boundaries, and they may try to understand youngsters' perspectives and emotions. A caregiver using this approach may aim to understand why a child wishes to engage a forbidden behavior or finds a restriction frustrating, and provide an empathic rationale for the reasoning behind certain rules being implemented (Grolnick, 2002; Soenens et al., 2007). Studies have shown that autonomy-supportive caregiving relates to youngsters' well-being (Grolnick et al., 1997), whereas controlling forms of motivation undermine it (Barber et al., 2005).

Concealment of Technology Use

Whereas past research has largely focused on the impacts of motivation on well-being and performance (Deci & Ryan, 2000), also important are interpersonal outcomes – how the ways in which caregivers set restrictions shape the behavior of adolescents *toward* these caregivers. Concealment of technology in middle adolescence is a particularly important outcome of caregiver regulation because adolescents vary in how much they actively conceal their technology use from caregivers (Lenhart, 2015; Padilla-Walker, 2006), and because concealment is used to regain freedom in a relationship that is controlling (Keijsers, Branje,

VanderValk & Wim Meeus, 2010). In our view, the intent to conceal information is an important outcome to study for three reasons. First, it is a key source of caregivers' knowledge of their adolescents' behavior, including their leisure time activities (Keijsers et al., 2010; Stattin & Kerr, 2000). Second, concealment provides adolescents latitude to shape the extent to which caregivers can implement future rules (Finkenauer, Engels, & Meeus, 2002). Finally, concealment undermines the ability of caregivers to have effective conversations with their youngsters, because it reduces understanding of daily experience which can inform feedback and guidance for future behaviors (Buhrmester & Prager, 1995).

Reasons for Concealment

If, indeed, motivational framing influences adolescents' concealment, two constructs present themselves as strong candidates for explaining these links. The first is *perceived trustworthiness*, which can be understood as the perception by adolescents that their caregivers have confidence they will find what is desired, rather than what is feared, from their children (Deutsch, 1973). It is plausible that when caregivers regulate technology use through threats or emotional manipulations, they are communicating that adolescents are not trusted to safely regulate their own technology use. On the other hand, when providing autonomy support, caregivers may be communicating that they believe the adolescent can be trusted to participate in the process of rule setting. Although few studies have considered how caregiving affects perceived trustworthiness, theorists have convincingly argued that the experience of being trusted is an important part of the relationship between caregivers and youngsters which is critical for children's wellness (Rogers, 1965). In line with this, research has linked caregivers' own reports they trust their children will ultimately make healthy decisions to lower problematic behavior reported by children, even controlling for difficult temperament (Landry et al., 2008). Further, supportive communications of physicians and managers has been linked to patients and employees, respectively, perceiving they are trusted

by these motivators (Becerra & Gupta, 2003; Ommen et al., 2008). Finally, perceived

trustworthiness has been linked to cooperation in adult interactions (Loomis, 1959).

The second key factor that might drive adolescent concealment, and which may also

result from adolescents feeling a lack of trust from caregivers, is *reactance,* a desire to

respond in a way opposite to caregivers' rules (Vansteenkiste, Soenens, Van Petegem, &

Duriez, 2014). Findings from economic games suggest that feeling that one is seen to be a

trusted partner fosters the desire to cooperate rather than defect in exchanges with others

(Rabbie, 1991). More proximally, work expanding on psychological reactance theory

(Brehm, 1966) has shown that the use of controls which restrict freedom elicit reactance

(Vansteenkiste et al., 2014, see also Dillard & Shen, 2005; Quick & Stephenson, 2008),

perhaps due to a desire to restore independence in the absence of a feeling of choice (van

Petegem et al., 2017). Such feelings might lead to behavior in opposition to wishes

(Chartrand, Dalton, & Fitzsimons, 2007), and general behavior problems (Van Petegem et al.,

2015). In this context, a reactive adolescent may be more inclined to undermine further

technology use restrictions by concealing these behaviors from caregivers (Finkenauer,

Engels, & Meeus, 2002). Given this literature, it may be that psychological controls and the

absence of autonomy support may elicit reactance, either directly or indirectly through

perceiving oneself to be untrusted by others.

Match Effects for Parenting Approach by Child's Background.

Although outcomes of parenting styles are often studied in terms of stable patterns of

parental behavior, a growing body of work suggests that the motivational framing in a

particular situation is also important (see review in Joussemet, Landry, & Koestner, 2008).

Perhaps even more interesting is that the two influences may interact, such that responses to

motivating contexts vary as a function of more stable individual differences and background

factors where these may 'match' or fit the context to a greater or lesser extent (Sagiv &

Schwartz, 2000). An intriguing possibility is that adolescents whose mothers are generally

supportive will respond more negatively to a context where control is implemented, as they

are not accustomed to having harsh or firm restrictions placed on them (McIntosh, 1989).

The 'match' hypothesis has not yet been tested in terms of how stable patterns of

caregivers' motivational styles may have predisposed adolescents' to accepting, or

alternatively, reacting more harshly, to control in any given communication regarding a new

restriction. Yet, despite some evidence, cited above, in favor of this view in other domains,

studies of motivational framing in education and sports have failed to find support that

responding to context varies as a function of individual difference (De Meyer, Soenens,

Vansteenkiste, Aelterman, Van Petegem, & Haerens, 2016; Lynch, La Guardia, & Ryan,

2009; Timmermans, Vansteenkiste, & Lens, 2004; Vansteenkiste, Timmermans, Lens,

Soenens, & Van den Broeck, 2008). Thus, while the prospect is intriguing, we expected that

adolescents are sensitive to framings around their day to day technology use, irrespective of

their particular histories of interactions with their parents.

Present Study

The present research was conducted to evaluate the extent to which controlling and

autonomy supportive styles of applying restrictions on technology use would affect

concealment of technology use. Because the existing evidence base is largely correlational or

draws inferences from quasi-causal models of longitudinal effects, we used an experimental

paradigm which presented vignettes depicting hypothetical interactions with a caregiver.

Across four conditions, caregivers placed a restriction on a youngster's technology use after

some concern about the safety of the technology; in each of the four conditions caregivers

framed their approach with a different motivational strategies shown to be impactful in the

literature reviewed above (Figure 1). By taking this approach, we avoid the possibility that

the relations between caregiver strategies and concealment are in evidence because an

adolescent is behaving in problematic ways (Vansteenkiste et al., 2014). In the interest of simplicity, the experimental manipulation and corresponding outcome variables focused on maternal rule setting. This also brings the approach in line with research indicating that longitudinal associations of caregiving styles and adolescent concealment are in evidence primarily for mothers (Keijsers et al., 2010). Finally, we examined why these effects might occur by evaluating two potential mediators, adolescents' perceived trustworthiness and their reactive feelings, would explain the effects of mothers' regulation on concealment. Finally, we examined whether reactions to vignettes might depend on the motivational styles to which adolescents are accustomed.

In line with SDT and the literature reviewed above, we set out to test six confirmatory hypotheses outlined in Figure 1 (Hypotheses 1-5), and summarized in Table 1, that were preregistered in advance of data collection (https://osf.io/rcvkn/?view_only=b1a48bfbbc1b43d8bf80be3f64b28cfb).

Hypothesis 1: We expected condition would predict tendencies toward concealment; specifically, compared to the neutral condition, those in the *autonomy support condition* would show lower levels of concealment (H1A), whereas those in the *introjected control* (H1B) and *external control* (H1C) conditions would report higher levels.

Hypothesis 2: We predicted condition would predict inclination to reactance; compared to the neutral condition, those in the *autonomy support condition* (H2A) would show lower levels of reactance, and in contrast, those in the *introjected control* (H2B) and *external control* (H2C) conditions would report higher levels.

Hypothesis 3: We hypothesized that experimental conditions will have indirect effects on concealment by way of their effects on reactance.

Hypothesis 4: We predicted condition would predict perceived trust from the caregiver; compared to the neutral condition, those in the *autonomy support condition* (H4A)

would show higher levels of perceived trust, and in contrast, those in the *introjected control* (H4B) and *external control* (H4C) conditions would report lower levels.

Hypothesis 5: We hypothesized that experimental conditions will have indirect effects on concealment by way of their effects on perceived trust (H5A) and that these pathways, between trust and concealment, would themselves be mediated by reactance (H5B).

Hypothesis 6: We predicted that mothers' motivational styles would not moderate the effects of condition on concealment; in other words, participants would respond similarly regardless of their personal histories of being autonomy supported.

Method

Participants and Procedure

The sample was comprised of 1,000 British adolescents from England, Scotland and Wales (519 aged 14 years; 481 aged 15 years). This age range focuses on middle adolescence, a developmental period in which youngsters are particularly sensitive to dynamics related to independence and autonomy (Soenens, Vansteenkiste, Lens, Luyckx, Goossens, Beyers, & Ryan, 2007), and tend to exhibit behavioral problems under non-supportive conditions (e.g., Kaltiala-Heino, Fröjd, & Marttunen, 2010; Wills, McNamara, Vaccaro, & Hirkey, 1996).

 Half of respondents were male (*n* = 486; 48.6%) and the other half were female (*n* = 514; 51.4%). Only participants who lived with their mother a majority or all of the time were included in the study (86% lived with both parents, whereas 14% lived with their mothers, only). This design step was taken so that the measure of mothers' autonomy-support and reactions to the mother in the experimental vignettes were reflective of adolescents' daily experiences. The sampling method for this research was a quota sampling approach undertaken by research and polling company ICM Research. An invitation email containing

the link to the survey was mailed out to a batch of panel sample, targeting by relevant variables. The online panel had been recruited through various methods, including at random via telephone, via random online sampling, and through active recruitment and engagement programs.

Ethical review was conducted at the University of Oxford. Because parental consent is required for any research with children aged under 16 years, the first part of the survey was targeted at parents who were asked whether they had adolescent children of the relevant age group (14-15 year olds), and if they would allow their child to take part in the research. The adolescent in question was then asked to complete the survey and provided their own consent. Caregivers were asked to be absent for this portion of the study. Adolescents not currently living with their mother most or all of the time were screened out of the study. Given the nature of the sample, no hard quota controls were set for the data collection. However, we set soft quotas to ensure a good spread of respondents by adolescent age (14- and 15- year olds), gender, and geographic region in England, Scotland, and Wales.

Participants completed a measure evaluating perceived autonomy-support from their [actual, rather than hypothetical] mothers, detailed below, followed by a series of questionnaires which were not relevant to the present study These items, part of an unrelated research, asked about emotions and learning outcomes; none which involved technology use or other characteristics of participants' parents. Further, this other research project determined the study sample size ($n = 1,000$) and a post-hoc sensitivity analysis indicated the design used in this experiment would be sensitive ($\alpha = 0.05$; $1\text{-}\beta = 0.80$) to detecting a small sized effect ($r = 0.08$). We report all measures, manipulations, and participant exclusions relevant to the present study in this paper and the supplemental materials on the Open Science Framework (OSF).

After completing all of these questionnaires, participants they were randomly assigned to one of four motivational frames describing of a short vignette that involved a mother who was restricting the technology use of her adolescent child (See Figure 2). These between-subject conditions: (1) External control, (2) Introjected control, (3) Autonomy support, or a (3) Neutral comparison framed the mother's motivational approach to restricting the use of a new smartphone app. Following this reading task, participants were asked to put themselves in the shoes of the adolescent in the story and use scales provided to rate how they would feel with respect to concealment, reactance, and perceived trustworthiness. The items representing these outcome measures were presented in a random order. Study data can be accessed via the OSF (https://osf.io/wcmk5/?view_only=c90021d582d243b8833c0f679f278de6).

Materials

Experimental manipulation. Participants read a scenario which they were told describes the experiences of a 15-year old boy (Robby) or girl (Tracy) who was gender matched to the adolescent participant (See Figure 2). The scenario described a situation in which a mother attempts to restrict technology use to protect her son's or daughter's safety. The remainder of the vignette depended on the condition to which participants were assigned (see Figure 2): the *External Control* condition described the use of threats as a motivational framing, the *Introjected Control* condition described the use of guilt and conditional regard to administer the restriction, the *Autonomy Support* condition described the use of perspective-taking, choice, and the provision of a rationale (Joussemet et al., 2008), and finally the *Neutral Comparison* merely applied the restriction.

Outcome Variables

The following items were paired with the query: "how much would you agree or disagree with the following statement if you were in the position that Robby/Tracy is in?",

and presented in a random order. Participants reported the extent to which "I would feel…".

Perceived Trustworthiness. A single item measure asked participants to rate how trusted they would feel: "I would feel…" "like I am not trusted to responsibly use technology". This item and all others on this scale (namely, reactance and concealment) were presented randomly and measured on a scale of 1 (*Fully disagree*) to 7 (*Fully agree*). For ease of interpretation, the item was reverse scored such that higher scores reflected more trustworthiness ($M = 3.22$, $SD = 1.67$).

Reactance. Reactance was measured with five items taken from (Van Petegem, Soenens, Vansteenkiste, & Beyers, 2015; Vansteenkiste et al., 2014). These included "I would feel…." "like my mum's response is an intrusion", "like I want to resist attempts to influence me". Internal reliability between these five items was high, $\alpha = .85$.

Concealment. Concealment was measured with three items adapted from the Self-Concealment scale to be appropriate to this context (Larson & Chastain, 1990), namely "…that I have to hide information about my AppMe use from my mum", "that I must pretend to use AppMe less than I really do", and "that I must try to make sure my mum doesn't really know what my AppMe use is really like". Once again internal reliability for these items was high, $\alpha = .86$.

Individual Difference Moderator

Mothers' general autonomy support was assessed by asking participants to report on their actual mothers' use of autonomy-support versus behavioral control, in general. Adolescents reported on the tendencies of their mothers to engage in a behaviorally controlling way through the use of firm expectations of behavior paired with monitoring of behavior as was used in (Soenens, Vansteenkiste, Luyckx, & Goossens, 2006). Items included "My mum listens to my opinion or perspective when I've got a problem" (autonomy support), "My mum watches to make sure I behave appropriately" (expectations of behavior),

and "My mum requires that I behave in certain ways" (monitoring of behavior). Items were paired with a scale ranging from 1 = *strongly disagree* to 7 = *strongly agree.* To construct a measure of mothers' relative support for autonomy balancing the contributions of autonomy-support and control, we computed autonomy support X 2 – expectations of behavior – monitoring of behavior. Higher scores reflected more autonomy support, in general, from mothers. Reliabilities within subscales were acceptable, α = .67-.85; higher order reliability was α = .69.

Results

Preliminary Analyses

Correlations are presented in Table 2. Adolescents' age and gender did not relate to outcomes of interest in this study, though 15-year old participants reported their mothers were more supportive of autonomy, in general. Perceiving mothers as being more autonomy supportive in general also related to lower reports of concealing from the mother in the vignettes, and linked to lower rates of reactance and more perceived trustworthiness in the vignettes. Across conditions, all three outcomes (concealment, perceived trustworthiness, and concealment) related to one another. To ensure that participants did not vary across conditions as a function of age, gender, or mothers' general autonomy-support we compared these variables across conditions, and found no differences across conditions for any of these three predictors, *ps* > .33.

Confirmatory Analyses

In line with the analytic plan registered prior to data collection on the OSF (https://osf.io/rcvkn/?view_only=b1a48bfbbc1b43d8bf80be3f64b28cfb), condition was contrast coded to compare each of the three experimental vignettes to the neutral vignette. This approach tested whether each motivational framing would impact outcomes in direct relation to not using any motivational framing at all. Regression analyses were used to

compare the effects of each of the three experimental conditions, using contrasts which are designed for this purpose (Cohen & Cohen, 1983). The External Control condition was coded 1 in the first contrast, Introjected Control was coded 1 in the second contrast, and Autonomy Support was coded 1 in the third contrast; the treatment condition was coded -1 in all contrasts. Two additional outcome were included in the preregistration. The findings largely mirrored those reported here in terms of effect size and direction but were not significant in some cases. These analyses are available on the OSF (https://osf.io/tx8zs/?view_only=abefe2b05f2d4a54b3455e96199afd7f). In all cases we tested the pre-registered Hypothesis 6, that participants will respond similarly across mothers' autonomy support (Vansteenkiste, Lens, & Deci, 2006), simultaneously to reduce the number of tests being carried out. Thus, three contrast codes and mothers' autonomy support were defined in Step 1 of the model, and their interactions were defined in Step 2 of the model. See Table 3 for a summary of results of confirmatory analyses.

Concealment. Our first hypothesis was that the autonomy-support condition would predict less concealment (H1A; see also Figure 3), and the controlling conditions would predict more concealment (H1B-C), and as compared to a neutral comparison. In line with our analysis plan, a first model regressed this construct onto general autonomy support from mothers and the three contrasts at Step 1, and the interactions between contrasts and individual differences in perceived mothers' support at Step 2. Findings showed that, across conditions, adolescents whose mothers were, in general, more supportive were less likely to conceal, $b = -.10$, $se = .04$, 95% CI for b[-.20, -.01], $\beta = -.06$, $t(995) = -1.98$, $p = .048$, $pr = .06$. Further, results for condition showed that, accounting for this, the Autonomy Support condition predicted less concealment than the neutral comparison, $b = -0.23$, $se = .09$, 95% CI for b[-.40, -.06], $\beta = -.10$, $t(995) = -2.67$, $p = .008$, $pr = -.08$. Unlike what was expected, no effects were identified comparing the controlling conditions to the neutral comparison,

External Control: $b = 0.10$, $se = .09$, $\beta = .04$, $t(995) = 1.09$, $p = .28$, Introjected Control: $b = 0.13$, $se = .09$, $\beta = .06$, $t(995) = 1.47$, $p = .14$.

At Step 2, mothers' autonomy-support did not interact with any of the three condition contrasts, $bs < +/-0.14$, $\beta s < +/-.06$, $ts(992) < +/-1.54$, $ps > .12$, suggesting a lack of support for a match hypothesis between the current motivational context and individual differences in motivating experiences, but supporting Hypothesis 6 that the effect is similar regardless of adolescents' experiences with maternal motivations.

Reactance. Our second hypothesis was that the autonomy-support condition would predict less reactance, while the controlling conditions would predict more reactance. At Step 1, individual difference analyses showed that adolescents whose mothers were more supportive were generally less likely to endorse reactance, $b = -0.13$, $se = .04$, 95% CI for b[-.20, -.05], $\beta = -.10$, $t(995) = -3.17$, $p = .002$, $pr = -.10$. Taking this into account and in line with Hypotheses 2A-C referring to each of the three motivational framings, the External Control condition elicited more reactance, $b = 0.15$, $se = .07$, 95% CI for b[.02, .29], $\beta = .08$, $t(995) = 2.19$, $p = .03$, $pr = .07$, as did the Introjected Control condition, $b = 0.16$, $se = .07$, 95% CI for b[.03, .30], $\beta = .09$, $t(995) = 2.38$, $p = .02$, $pr = .08$. In addition, the Autonomy Support condition predicted lower reactance, $b = -0.26$, $se = .07$, 95%CI for b[-.39, -.12], $\beta = -.15$, $t(995) = -3.78$, $p < .001$, $pr = .12$. As was the case predicting concealment, at Step 2, mothers' autonomy-support did not interact with conditions, $bs < +/-0.07$, $\beta s < +/-.04$, $ts(992) < +/-1.02$, $ps > .30$, further supporting Hypothesis 6 of a uniform effect of motivational context in these data.

Perceived trustworthiness. Hypothesis 4 (H4A-C) posited that the conditions would impact perceived trustworthiness, and Hypothesis 5 predicted this would further mediate previously identified effects on reactance (H5A) and concealment (H5B). Testing this first involved an evaluation of the direct effects of condition on trustworthiness. Findings showed

that External Control predicted adolescents feeling they are less trusted, $b = -0.18$, $se = .09$, 95% CI for $b[-.36, -.00]$, $\beta = -.08$, $t(995) = -2.00$, $p = .045$, $pr = -.06$, and Autonomy Support predicted more perceived trustworthiness, $b = 0.21$, $se = .09$, 95% CI for $b[.03, .39]$, $\beta = .09$, $t(995) = 2.31$, $p = .02$, $pr = .07$ (Introjected Control did not predict perceived trustworthiness, $b = -0.09$, $se = .09$, $\beta = -.04$, $t(995) = -1.02$, $p = .31$).

Though at Step 1 adolescents who perceived their mothers as being generally autonomy-supportive perceived more perceived trustworthiness in response to the vignettes, $b = 0.19$, $se = .05$, 95% CI for $b[.09, .30]$, $\beta = .12$, $t(995) = 3.68$, $p < .001$, $pr = .12$, testing Hypothesis 6 once again, there were no moderation effects present for any of the three contrasts, $bs < +/-0.08$, $\beta s < +/-.03$, $ts(992) < +/-0.90$, $ps > .37$.

Indirect Effects Through Trust and Reactance. In line with the approach detailed for Hypothesis 3, the indirect links between condition and concealment were examined by way of the former's effect on trustworthiness (Hypothesis 5A) and through both trustworthiness and reactance (Hypothesis 5B). An analysis for indirect effects using the PROCESS macro (Hayes, 2012) was conducted to obtain bias-corrected bootstrapped estimates based on 10,000 bootstrapping samples, defining the two mediators simultaneously to reduce the number of tests conducted. In all models we controlled for complementary contrast codes and mothers' general autonomy support for consistency with the approach taken in regression analyses presented above.

Thus, for each condition contrast, PROCESS tested three possible models simultaneously: (path 1) the effect of condition on concealment would be mediated by perceived trustworthiness, only; (path 2) the effect of condition on concealment would be mediated by reactance, only; or (path 3) the effect of condition on concealment would be mediated by perceived trustworthiness, which would in turn reduce reactance (See also Figure 1; Table 3). Although condition was manipulated, the two mediators (perceived

trustworthiness and reactance) were self-reports provided together with the outcome variable (concealment). As such causal interpretations for mediation models are tentative.

External control versus neutral comparison contrast. A first model defined outcomes specific to the External Control condition. Findings showed that only lower perceived trustworthiness indirectly linked external control to concealment, $b = .018$, $se = .012$, bootstrap 95% CI [.001, .048]. Conversely, reactance did not appear to be an important explanatory mechanism in this model (with the 95% confidence interval for the bs crossing 0 for both paths 2 and 3).

Introjected control versus neutral comparison contrast. A second model defining the outcomes of Introjected Control, showed mediation by reactance, $b = .093$, $se = .042$, bootstrap 95% CI [.012, .181], only (that is, path 2 described above was significant). In other words, when the mother described in the vignette imposed pressure through guilt and shame, adolescents felt more reactive, and as a result they were more likely to conceal their technology use.

Autonomy support versus neutral comparison contrast. In a final model we tested the effects of the Autonomy Support condition. Results supported indirect effects for autonomy-supportive parenting through both mediators as hypothesized: condition was indirectly linked to concealment through lower perceived trustworthiness, $b = -.021$, $se = .013$, bootstrap 95% CI [-.056, -.002] (path 1 described above), through less reactance, $b = -.120$, $se = .01$, bootstrap 95% CI [-.207, -.047] (path 2), and finally through the mediating effects of perceived trustworthiness on reactance and concealment, $b = -.087$, $se = .038$, bootstrap 95% CI [-.168, -.010] (path 3).

Discussion

The goal in this study was to provide a robust empirical test of the idea that motivational framing of rules can impact how adolescents respond to technology restrictions.

Findings from our confirmatory experiment with a large and representative sample of 14-15 year olds showed that motivational strategies for restricting adolescent technology use predicted the extent to which adolescents expected they would conceal technology use. The study and our findings relied on a preregistered design grounded in an open science approach and a growing human motivation literature concerned with how parents regulate children's behaviors in more or less effective ways (Mounts, 2001; Soenens & Vansteenkiste, 2010).

Vignettes describing mothers' use of autonomy-supportive behaviors reduced adolescents' expectations that they would conceal information about their technology use, a behavior which is not uncommon to this age group (Cumsille et al., 2010), and which interferes with the caregiver-child relationship (Keijsers et al., 2010; Stattin & Kerr, 2000) and reduces the likelihood that caregivers can effectively communicate and implement future rules to protect adolescents (Buhrmester & Prager, 1995). In contrast to the view that the act of concealment is directly motivated toward regaining freedom in a relationship which is controlling (Keijsers et al., 2010), here we found that adolescents were less inspired to conceal when they experienced caregiver behaviors as being supportive, suggesting that actively creating a positive relational climate is key to discouraging concealment, as opposed to merely lessening pressures on adolescents.

These finding extend previous studies indicating that autonomy-supportive motivational styles foster healthy relationships between caregivers and adolescents. In the absence of such support, adolescents appear to exhibit greater hostility and conflict (Soenens & Vansteenkiste, 2010), and they show more resentment (Assor et al., 2004), lower intimacy (Van Petegem, Beyers, Vansteenkiste, & Soenens, 2012), and more insecure attachment styles (Doyle & Markiewicz, 2005). Interestingly, given that disclosure reflects an active willingness to include the caregiver in future regulation of the adolescent's behavior (Marshall, Tilton-Weaver, & Bosdet, 2005), these findings suggested that adolescents were

actually more willing to be further regulated by mothers who were autonomy supportive than by those who imposed the same technology use restriction in a motivationally neutral way.

Applying a new model to understand how the relational costs of more controlling, and less autonomy-supportive parenting styles come about (Figure 1), the present study tested the role of two mediators on concealment: reactance - the desire to rebel and resist influence, and perceived trustworthiness. Results indicated these constructs were important outcomes of motivational framing of restrictions. All three conditions had robust effects on reactance. In line with longitudinal research (Missotten, Luyckx, Branje, & Van Petegem, 2017) and psychological theory (reactance theory; Brehm, 1966), controlling styles of imposing a restriction elicited more reactance; Adolescents who imagined a mother pressuring or threatening punishment to discourage using a potentially dangerous technology anticipated they would they would like to resist this restriction. Interpreting these findings in line with reactance theory would suggest it represents an attempt to reassert autonomy in the face of controls. Yet, we also found that autonomy-supportive parenting styles independently reduced reactance as compared to a motivationally neutral intervention, suggesting that by actively supporting autonomy, mothers may be able to engage otherwise rebellious adolescents and increase changes that adolescents will choose to comply with directives. The role of reactance was particularly strong in linking *introjected* controlling styles to concealment. In other words, when adolescents considered a mother using guilt and conditional regard to ensure her restriction is heeded, they were more likely to conceal because they felt rebellious in response to this pressuring social context.

In addition to reactance, we examined the role of perceived trustworthiness, the perception that caregivers had confidence in oneself (Deutsch, 1973). Although adolescents did not feel they were less trusted when mothers used introjected control, they did feel this way after reading a vignette which depicted external control, that is, when depicted mothers

used threats of punishment. This finding may suggest that using threats to ensure adolescents do not use technology communicates to adolescents that they are not trusted to make thoughtful or responsible decisions regarding their technology use. Such a finding is consistent with previous views suggesting hostile caregiving attitudes are in contradiction with a trusting parental relationship (Hoeve et al., 2009), and findings that caregivers who are more trusting use less controlling motivational styles (Belsky, 1984). Here, we saw that adolescents are sensitive to dynamics of trust, and given that perceived trustworthiness mediated the main effect on concealment, this appeared to have direct impacts on anticipated behavior in the form of a likelihood to conceal from caregivers.

Importantly, independent of the effects of control, autonomy-supportive parenting styles promoted perceived trustworthiness. In fact, the condition depicting an autonomy-supportive parenting style was the only one to fully support our hypothesized model; in this case, we expected and found that autonomy support would lead to more perceived trustworthiness, in turn reducing the likelihood that adolescents will feel reactive, and finally that these mediators would link autonomy-supportive parenting to lower concealment. When individuals feels trusted they also feel valued as part of a team who can contribute to responsible decision-making (Brower, Lester, Korsgaard, & Dineen, 2009), and thus it was sensible that feeling trusted reduced the desire to rebel, and through doing so discouraged concealment from caregivers.

Among other reasons described above, the present study findings are important because concealment may be a risk factor for delinquency (e.g., Soenens, Vansteenkiste, Luyckx, & Goossens, 2006). Possibly, based on the present findings, caregivers who use an autonomy-supportive style when restricting behaviors, such as those related to technology use, may indirectly discourage wrongdoings in other domains by creating a more open and responsive relationship. In addition, previous research has suggested that caregivers'

autonomy-support can reduce children's aggression toward peers (Clark & Ladd, 2000; Soenens et al., 2008), and selfish behaviors (Roth, 2008), even in particularly aggressive adolescents (Obsuth et al., 2006). The current study findings provide two intriguing possibilities building on this literature. First, it may be that implementing parental autonomy-support in the technology use domain may help to reduce children's aggression toward others online (e.g., cyberbullying; Smith, Mahdavi, Carvalho, Fisher, Russell, & Tippett, 2008). Second, the literature reviewed above may be further informed by tests of mediation which consider not only reactance (as has been done; Brauer, 2017; Van Petegem et al., 2015), but also trust and its implications for youths' behavior. It is not unlikely that delinquent teens lose the trust of their caregivers, and importantly, that the loss of trust foments further delinquency, creating a downward cycle which disrupts the child's development and relationship with the parents, as well as the caregivers' well-being.

Our final pre-registered hypothesis was that the three motivational framing conditions would lead to concealment similarly, independent of adolescents' perceptions of their own mothers' regulation styles. That is, in contrast to some previous research showing that motivational approaches impact differently as a function of the individual who is being motivated, a "match" hypothesis (e.g., McIntosh, 1989; Sagiv & Schwartz, 2000), we anticipated a uniform response to these regulation strategies such that adolescents would not be desensitized to them, or alternatively, particularly sensitive to them (De Meyer et al., 2016). Indeed, across findings we did not find support for interaction effects that would have suggested certain adolescents benefit more or less from psychological control or support. Yet future, well-powered, studies should be conducted to test the possibility that general autonomy-support and other aspects of the parent-child relationship may be moderating mediational paths identified in this study.

On the other hand, interestingly we did find main effects of adolescents' perceptions

of their own mothers' motivational style. Across all conditions, those who reported their mothers engaged in more autonomy supportive, less controlling, caregiving also perceived the mother depicted in the vignette to be more trusting of them, and they were less likely to react and conceal from the hypothetical mother. This finding is intriguing in showing that youngsters are not a 'blank slate' who are entirely influenced by the motivating situations in which they are currently; instead, they bring tendencies to respond in more adaptive and responsive ways as a function of their home environments, suggesting that caregivers can foster a resilience within children which can be carried across contexts. Such a finding further supports previous work showing that caregivers' involvement affects children's responses to school environments (Grolnick, 2009; Joussemet, Koestner, Lekes, & Landry, 2005; Turner, Chandler, & Heffer, 2009).

Caregivers often restrict technology use (Vaterlaus, Beckert, Tulane, & Bird, 2014), and at times to protect youngsters from legitimate dangers (Stanley et al., 2016). To date, research on caregiver rule setting around technology has been data driven. Growing out of work focused on regulating television use, researchers studying Internet use built on a three-factor approach for understanding the steps caregivers take to mediating children's technology use (Nathanson, 2001). Two forms of mediation involve engaging with children around their technology use: *active mediation* – talking with children and adolescents about programming, and *co-viewing* – watching programming together (independent of talking with young people). The findings of this study spoke to the third, *restrictive mediation* – setting rules that limit viewing to amount, time, and kind. The present study informs this literature by suggesting that caregivers can impose restrictive mediation using motivational strategies that encourage or discourage adolescents' likelihood of concealing further use. Given this, future work should directly consider the role of motivational styles within the context of mediation strategies applied in real-world relationships.

Limitations and Future Directions

The present study was limited in a number of ways. This experiment was a large-scale manipulation of adolescents' anticipated responses to hypothetical parental behaviors. This approach sacrificed external validity in the service of demonstrating strong causal evidence for our proposed theoretical model. This was especially important because the existing body of work has focused on using externally valid methods, and as a result findings relevant to the topic of concealment, reactance, and perceived trustworthiness are vulnerable to relations due to another factor such as children's unhappiness, delinquent behaviors, or poor relationships with parents, and are likely further complicated by bi-directionality in effects (Bell & Chapman, 1986; Darling, Cumsille, Caldwell, & Dowdy, 2006; Engels, Finkenauer, & van Kooten, 2006; Keijsers et al., 2010), and theoretical models suggesting that concealment actively undermines psychological need satisfaction, including the need for autonomy (Uysal, Lin, & Knee, 2009). As such, the previous findings have left some question to whether an adolescent who reports parents' use of controlling styles would have pulled these styles out because of concerning behaviors such as concealing information (Bell & Chapman, 1986). Yet, the cost of this approach is that we cannot confidently generalize to assume that adolescents would respond identically to their caregivers as they did to the mother depicted in the vignettes, or that their intention to conceal would correspond to actual concealment, given that previous research has shown the effects of manipulations on behavior intention to be more robust than on behavior itself (Webb & Sheeran, 2006).

Further in the present study we focused on mothers. In general, mothers play a more active role in rearing children (Crouter & Head, 2002; Furman & Buhrmester, 1985), and children are more likely to disclose to mothers than fathers (Crouter, Bumpus, Davis, & McHale, 2005; Smetana, Campione- Barr, & Metzger, 2006). Given the relationships between children and their mothers and fathers are quite different, future work should

examine effects with both parents to explore whether current findings would replicate. Given these two restrictions of the study, future research which relies on experience sampling approaches and field experiments, and which involves a broader representation of important adults in an adolescents' life, would deepen our understanding of how caregivers' motivational framing of restrictions plays out in practice.

Finally, here we considered one form of rule setting, namely restrictions of technology use. Future experiments could expand on the present approach by examining how the motivational dynamics of other technological rule types including co-use, active mediation (Nathanson, 2001), and technological limit setting (e.g. filters; Nikken & Jansz, 2014), play out with respect to adolescent concealment.

Importantly, with a few notable exceptions, technology research does not adopt a confirmatory frame in which the sampling, hypothesis testing, and analytic plans are preregistered prior to data collection (Elson & Przybylski, 2017). The approach we adopted here is promising for building and testing theoretical robust theoretical models (Munafò et al., 2010). Despite these limitations of the study, this confirmatory experiment was first to explore adolescents' responses to three motivational framings for technology restriction setting: external control, introjected control, and autonomy-support. We found that motivational framing may play an important role in shaping adolescents' concealment, and that perceived trustworthiness and reactance may help to explain the impacts of motivational framing.

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Table 1

Predictor and Outcome Variables for Each of Thirteen Anticipated Effects within Six Directional Hypotheses.

		Predictor Variable	**Influence**	**Outcome**
Hypothesis 1	A	Autonomy-Support	Direct Negative on	Concealment
	B	Introjected Control	Direct Positive on	
	C	External Control	Direct Positive on	
Hypothesis 2	A	Autonomy-Support	Direct Negative on	Reactance
	B	Introjected Control	Direct Positive on	
	C	External Control	Direct Positive on	
Hypothesis 3		Reactance	Mediate the Negative effect of condition on	Concealment
Hypothesis 4	A	Autonomy-Support	Direct Negative on	Trust
	B	Introjected Control	Direct Positive on	
	C	External Control	Direct Positive on	
Hypothesis 5	A	Trust	Mediate the Negative effect of condition on	Concealment
	B	Trust	Mediate the Negative effect of condition on	Reactance
Hypothesis 6		Perceived mothers' general support	Null: No moderation for condition	Concealment

Note. Autonomy-Support, Introjected Control, and External Control are the three experimental conditions. Each experimental condition is compared with the neutral comparison condition in analyses.

Table 2

Correlations and Descriptive Statistics for Major Study Variables

	M (SD) External	*M (SD)* Introject	*M (SD)* Auto.	*M (SD)* Neutral	1	2	3	4	5
1. Adolescents' age	---	---	---	---					
2. Gender	---	---	---	---	-.05				
3. Mothers' typical support	---	---	---	---	.07*	-.04			
4. Concealment	4.11 (1.58)	4.16 (1.58)	3.79 (1.67)	4.02 (1.54)	.05	.001	-.06*		
5. Reactance	4.63 (1.64)	4.66 (1.22)	4.23 (1.37)	4.42 (1.17)	.04	-.03	-.10**	.71***	
6. Perceived trustworthiness	3.04 (1.73)	3.10 (1.61)	3.43 (1.74)	3.30 (1.59)	-.04	.03	.12***	-.54***	-.69***

Notes: *p < .05, **p < .01, ***p < .001.

Means are split into condition for outcomes measured after the manipulation: External = external control, Introject = introjected control, Auto = Autonomy, Neutral = neutral comparison condition.

Table 3

Summary of Findings for Anticipated Effects within Six Directional Hypotheses.

Hypothesis		Outcome	Predictor	β	t
1	A	Concealment	Autonomy-Support	-.10	-2.67**
	B		Introjected Control	.06	1.47
	C		External Control	.04	1.09
2	A	Reactance	Autonomy-Support	-.15	-3.78**
	B		Introjected Control	.09	2.38*
	C		External Control	.08	2.19*
3		Concealment	Reactance	.84	20.58**
4	A	Trust	Autonomy-Support	.09	2.31*
	B		Introjected Control	.04	-1.02
	C		External Control	-.08	-2.00*
5	A	Concealment	Trust	.11	3.41**
	B	Reactance	Trust	.52	29.68**
6		Concealment	Perceived mothers' general support	+/-.06	+/-1.54

Notes. *p < .05; **p < .01.

Autonomy-Support, Introjected Control, and External Control are the three experimental conditions, and findings represent comparisons with the neutral condition. Analyses defining coded conditions as predictors controlled for mother' general autonomy-support. Findings representing the effects of mediators on one another and on concealment (Hypotheses 3, 5A, and 5B) are taken from the PROCESS model defining the external control contrast, but results are similar in strength and direction regardless of the contrast being tested. Hypothesis 6 results reflects a summary of all moderation tests by mothers' general support (none of which were significant).
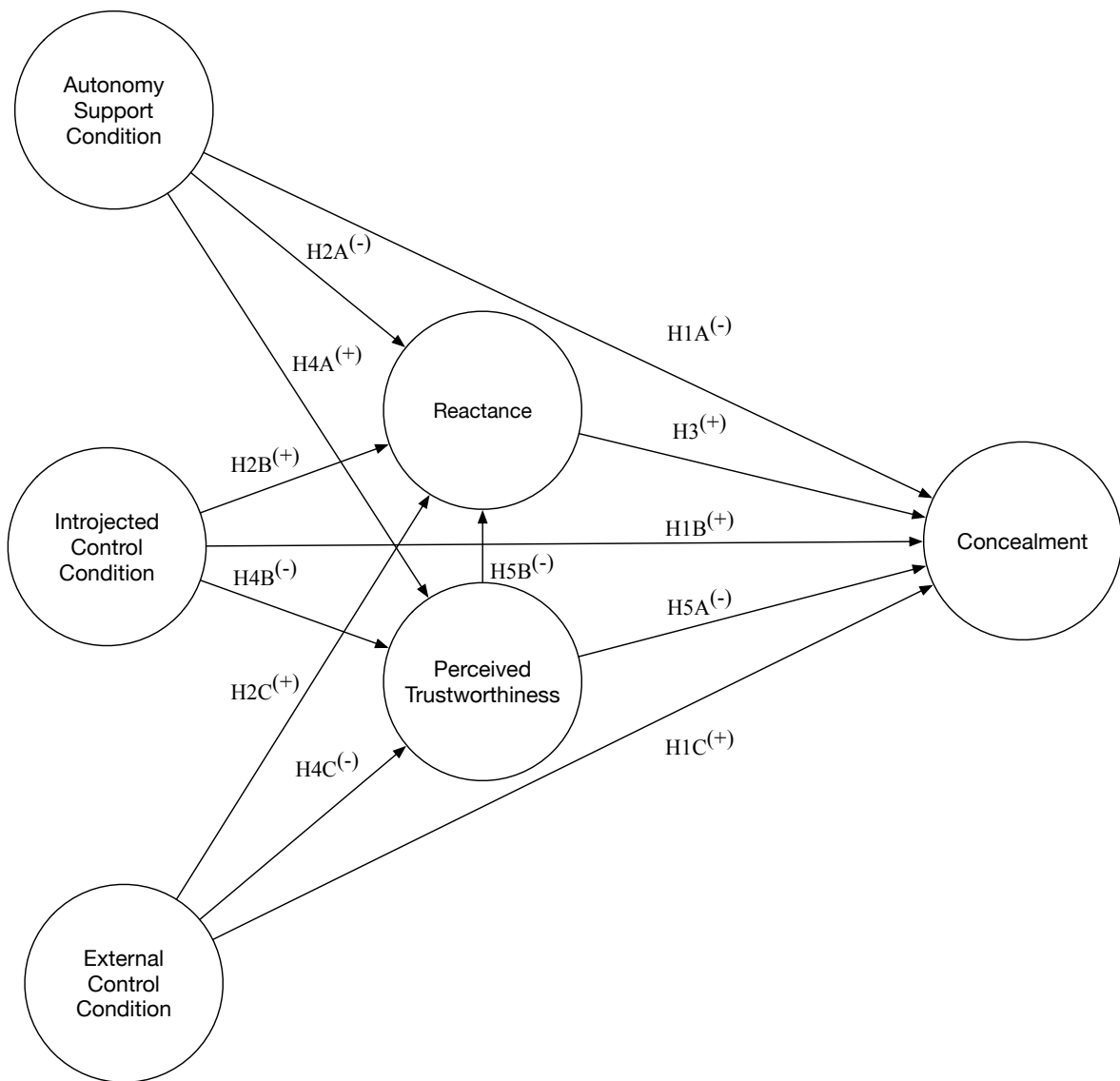
Figure 1. Theoretical model and hypothesized relations. Hypotheses 1 (A, B, and C), 2(A, B, and C), 3, 4(A, B, and C), and 5(A and B). H6 concerned the role of mothers' general autonomy support as a moderator of the effects linking experimental conditions to concealment (H1A, H1B, H1C), reactance (H2A, H2B, H2C), and perceived trustworthiness (H3A, H3B, H3C). Direction of effect is denoted by + for a hypothesized positive relation and − for a hypothesized negative relation.

Experimental Paradigm

Scenerio Frame

Narrative Stem

Imagine that Robby has just learned about a new social media site called AppMe, and wants to try it out. He'd like to start by setting up his profile and seeing which of his friends are on AppMe. Yet his mum doesn't like the idea; she feels she doesn't know nearly enough about AppMe, and she worries about Robby's safety logging onto this new site. To try to convince Robby to wait before logging on, she…

Randomly Assigned Conditions

Autonomy Support Condition

… gives Robby a clear and sensible reason why she wants him to wait. She is prepared to listen to his opinion on the matter, and she shows understanding of his situation and explains why it is important to wait.

Introjected Control Condition

… tells Robby she will be very disappointed if he opens an account, and makes him feel guilty for planning to do it. She acts a little less friendly when Robby argues with her, and avoids looking at him for a while.

External Control Condition

… becomes angry with him, and tells Robby he will be punished if he opens an account on AppMe. Robby knows that unpleasant consequences will follow if he does not do what she wants.

Neutral Comparison Condition

… asks Robby not to log onto AppMe at this time.

Outcome Measures

Perceived Trustworthiness

"I would feel I am not trusted to responsibly use technology"

Reactance

"I would feel like my mum's response is an intrusion"

Concealment

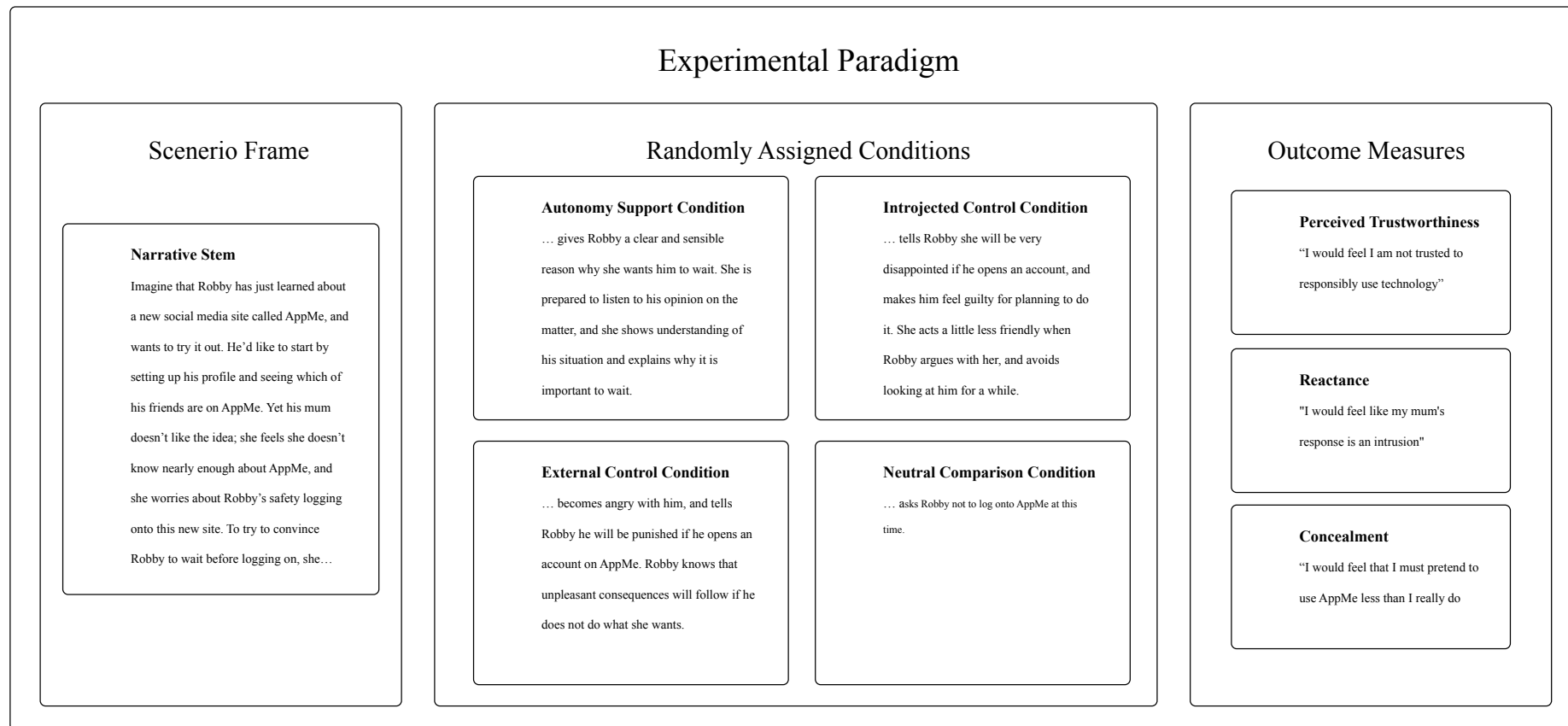"I would feel that I must pretend to use AppMe less than I really do

Figure 2. Experimental paradigm with instructions for participants (scenario framing read by all, followed by randomly assigned conditions), and sample items from outcome measures.
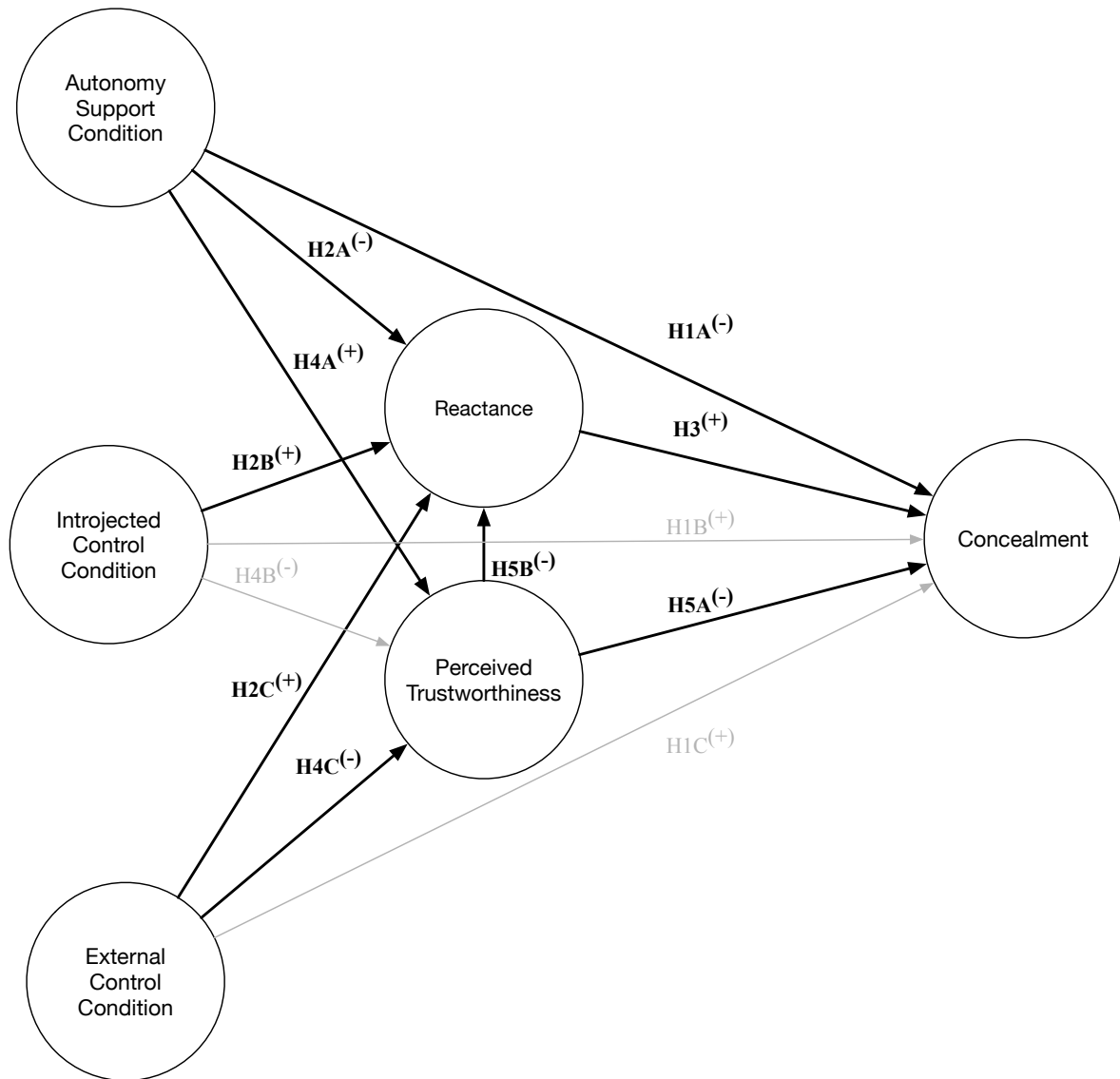
Figure 3. Observed relations between major study variables. Black paths denote significant relations in line with expectations, whereas grey paths represent non-significant paths. H6 concerned the role of mothers' general autonomy support as a moderator of the effects linking experimental conditions to concealment, reactance, and perceived trustworthiness; none of the moderation paths were significant. Direction of observed effects is denoted by + for a positive relation and – for a negative relation; In all cases the observed directions were consistent with study hypotheses.