

# Changes in negative urgency, positive urgency, and sensation seeking across adolescence



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## ABSTRACT

The development and potential co-development of traits related to impulsivity and sensation seeking across adolescence has garnered substantial attention within the extant literature. Some prior research suggests that facets show distinct patterns of change across adolescence and that intraindividual changes in these traits may be unrelated. However, the extant literature is somewhat hampered by measurement issues and inconsistent findings. Using an accelerated longitudinal design in a sample of adolescents ( $n = 1018$ ; ages 11–16), changes in negative urgency, positive urgency, and sensation seeking were examined. The three facets showed similar trajectories across time (i.e., increasing during early adolescence before leveling off). Across all facets, there was strong evidence of correlated change, suggesting these traits are, developmentally, strongly related phenomena.

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## 1. Introduction

Spanning multiple research domains and disciplines, there has been extensive interest in trait “impulsivity” and its relation to various outcomes. As noted by Cyders (2015), impulsivity is the most common criterion in the Diagnostic and Statistical Manual (DSM-5; APA, 2013) and is considered to be a key transdiagnostic endophenotype of risk for numerous clinical disorders (see Berg, Latzman, Bliwise & Lilienfeld, in press; Cyders, Coskunpinar & VanderVeen, in press; Verdejo-García, Lawrence, & Clark, 2008).

Although multiple approaches to defining and assessing impulsivity exist (see Evenden, 1999), recent research has increasingly focused on defining and assessing more narrow-band measures of impulsivity-like traits. This is based on the recognition that many measures of “impulsivity” appear to tap different behavioral tendencies (Cyders, 2015). Perhaps the clearest example of designing more refined measures of impulsivity is the work by Whiteside and Lynam (2001) and subsequently Cyders et al. (2007), which identified five distinct impulsivity facets (assessed via the UPPS-P Impulsive Behavior Scale; Lynam, Smith, Whiteside, & Cyders, 2006), including negative urgency (the tendency to act rashly in response to distress), positive urgency

(the tendency to engage in rash actions when in an unusually positive mood), and sensation seeking (the tendency to seek out novel and thrilling experiences). Negative and positive urgency appear to load on a higher-order factor reflecting emotion-based rash action, whereas sensation seeking appears to be a distinct trait that correlates moderately with trait urgency in undergraduate samples (Cyders & Smith, 2007). Notably, negative urgency, positive urgency, and sensation seeking have been linked to various outcomes related to psychopathology (see Berg et al., in press, for a recent meta-analytic review focused on the UPPS-P). Given the extensive psychometric evaluation of this scale, the UPPS-P is the recommended measure to assess “disinhibiting behaviors/impulsivity” for both the adolescent and adult protocols from the National Human Genome Research Institute funded PhenX Toolkit (Hamilton, Strader, Pratt, et al., 2011), which “provides the research community with a core set of high-quality, well-established, low-burden measures.” (Hamilton et al., 2011, p. 1).

Concurrently, there has also been extensive interest in documenting the development and potential co-development of traits related to sensation seeking and “impulsivity” during adolescence across various research domains (e.g., Burt, Sweeten, & Simons, 2014; Collado, Felton, Macpherson, & Lejuez, 2014; Harden & Tucker-Drob, 2011; Pedersen, Molina, Belendiuk, & Donovan, 2012; Quinn & Harden, 2013; Romer, 2010; Romer & Hennessy, 2007; Shulman, Harden, Chain, & Steinberg, 2014; Settles, Zapolski, & Smith, 2014; Steinberg et al., 2008). Neurodevelopmental changes evident during adolescence in both the prefrontal cortex and the limbic system appear to influence changes in

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phenomena related to impulsivity during adolescence (see Casey et al., 2010; Romer, 2010 for overviews). Further, cross-sectional, self-reported data indicate that sensation seeking increases through early adolescence before declining in later adolescence (e.g., Steinberg et al., 2008; Romer & Hennessy, 2007; see Collado et al., 2014, for a recent review), though the peak age of sensation seeking varies across studies (e.g., approximately at age 15 in Steinberg et al. and approximately age 17 in Romer and Hennessy). Steinberg et al. (2008) also demonstrated that a trait labeled impulsivity (in this work, a heterogeneous measure that included motor impulsivity, delayed gratification, and lack of perseverance) showed mean-level patterns distinct from sensation seeking, with a monotonic decline with age, such that impulsivity tended to be lower on average among older participants. Based on their findings regarding mean-level change in cross-sectional data, Steinberg et al. (2008) concluded that impulsivity and sensation seeking are distinct traits and hypothesized that they are strongly influenced by distinct neurodevelopmental processes in adolescence.

However, prospective studies that have examined the development and co-development of measures related to impulsivity and sensation seeking across adolescence (Burt et al., 2014; Collado et al., 2014; Harden & Tucker-Drob, 2011; Pedersen et al., 2012) suggests a more complicated picture regarding change in impulsivity and sensation seeking. In part reflecting different measurement approaches, findings for “impulsivity” appear to vary across studies, with some data indicating mean-level stability in impulsivity across adolescence (Pedersen et al., 2012), other work indicating decreases (Harden & Tucker-Drob, 2011), whereas other findings suggest a quadratic pattern similar to that of sensation seeking in earlier cross-sectional work (Burt et al., 2014; Collado et al., 2014). Not surprisingly given the relative consistency in measurement across studies, findings for sensation seeking appear to be more reliable, such that this trait appears to increase during adolescence (Collado et al., 2014; Harden & Tucker-Drob, 2011; Pedersen et al., 2012). Notably, data from Burt et al. (2014) indicated that sensation seeking *decreased* from ages 11 to 24 in a sample of 775 African American participants.

The extent to which individual differences in “impulsivity” and sensation seeking overlap varies across studies. Harden and Tucker-Drob (2011) demonstrated that linear growth in impulsivity and sensation seeking showed modest overlap ( $r = .21$ ) that was not statistically significant. Linear slopes for sensation seeking and impulsivity were significantly but moderately correlated in the Pedersen et al. data ( $r = .27$ ,  $p < .01$ ; Pedersen, personal communication). Using the data also utilized in the aforementioned Harden and Tucker-Drob study, Quinn and Harden (2013) modeled a non-linear slope of impulsivity and sensation seeking (rather than modeling linear and quadratic slopes, the approach used in Harden & Tucker-Drob, 2011) using identical measures across a similar timeframe (age 15–26) and found a strong correlation ( $r = .67$ ) between changes in sensation seeking and impulsivity. As opposed to prior work, the high magnitude correlation between sensation seeking and impulsivity slopes found in Quinn and Harden suggests individual differences in intraindividual change are strongly linked.

In sum, there has been an increasing interest in better understanding the development of traits associated with impulsivity and sensation seeking and whether individual differences in development are related across these traits. Overall, substantive conclusions from the extant literature examining change in impulsivity and sensation seeking appear to be influenced by approaches to design (cross-sectional vs. prospective), measurement (various operationalizations of “impulsivity”), and analysis (e.g., specific modeling approach for latent growth modeling). Although traits related to urgency (both positive and negative) seem to be the most predictive of numerous risky behaviors (see Berg et al., *in press*) compared to other impulsivity facets, only one prospective study (to our knowledge) has examined the urgency measures during adolescence. Settles et al. (2014) reported means of positive urgency, but these spanned a very short interval, from spring of 5th grade through spring of 6th grade.

Thus, using a sample of adolescents assessed from ages 11–16, we examined mean-level changes in negative urgency, positive urgency, and sensation seeking and the extent to which intraindividual changes in these traits correlate across time. We hypothesized that changes in positive and negative urgency would be strongly related, though we did not offer any hypotheses regarding the relation between changes in sensation seeking and these urgency facets given the limited extant literature.

## 2. Method

### 2.1. Participants

Data were drawn from an ongoing three-year study on alcohol initiation and progression (see Jackson et al., 2014, for more details) involving 1023 students from six Rhode Island middle schools; five participants did not complete UPPS-P measures, resulting in an overall sample size of 1018. In the current sample, 52% of participants were female, and 76% participants were White, 5% were African American, 8% were mixed race/ethnicity, and 11% were other race/ethnicity; 12% self-identified as Hispanic ethnicity.

Participants were recruited through the schools (see Jackson et al., 2014). Interested youth who had informed parental consent were scheduled to attend an in-person orientation session and complete a 45-min computerized baseline survey (Wave 1). Participants completed five subsequent web-based surveys, with a six-month interval between Waves 2–5 and the Wave 6 survey administered at the end of the three-year period. Data for the present study were taken from Waves 1, 3, 5, and 6, which were spaced annually; personality data were not available at Waves 2 and 4. Response rates for a given survey ranged from 92% (Wave 2) to 81% (Wave 6). The Institutional Review Board approved all project procedures.

### 2.2. Measures

#### 2.2.1. UPPS-P impulsive behavior scale (Lynam et al., 2006)

A set of 18 items assessed the following three traits (6 items each): negative urgency (e.g., “I often get involved in things I later wish I could get out of”), positive urgency (e.g., “Others are shocked or worried about the things I do when I am feeling very excited”), and sensation seeking (e.g., “I quite enjoy taking risks”). Due to concerns regarding participant burden, the UPPS-P facets of lack of planning and lack of perseverance were not assessed in this dataset. Coefficient alphas ranged across the four waves from  $\alpha = .84$  to  $\alpha = .90$  for negative urgency,  $\alpha = .85$  to  $\alpha = .91$  for positive urgency, and  $\alpha = .82$  to  $\alpha = .88$  for sensation seeking.

### 2.3. Analytic approach

Because data were cohort-sequential and prospective, we created a person-period dataset, where each person contributed data for up to four of six waves, with a separate row for each person for each period observed (Singer & Willett, 2003). Due to sparse cells, assessments corresponding to age 10 and ages 17–18 were dropped. This resulted in dropping 60 of 3261 (2%) assessments; thus, age ranged from age 11 to age 16.

Piecewise latent growth modeling (PW-LGM), an extension of latent growth modeling (Baltés & Nesselroade, 1979; Li, Duncan, & Hops, 2001), was implemented. In this analytic framework, discrete patterns of change (e.g., increases in sensation seeking across early adolescence vs. relative stability in later adolescence) are modeled as separate change processes by estimating growth/slope factors for each process.

We chose this approach for several reasons. In addition to providing excellent fit to these data (see below), piecewise growth models allow for more nuanced examinations of developmental processes (e.g., examining whether correlated change between two traits is relatively general or specific to a certain timeframe). Compared to models

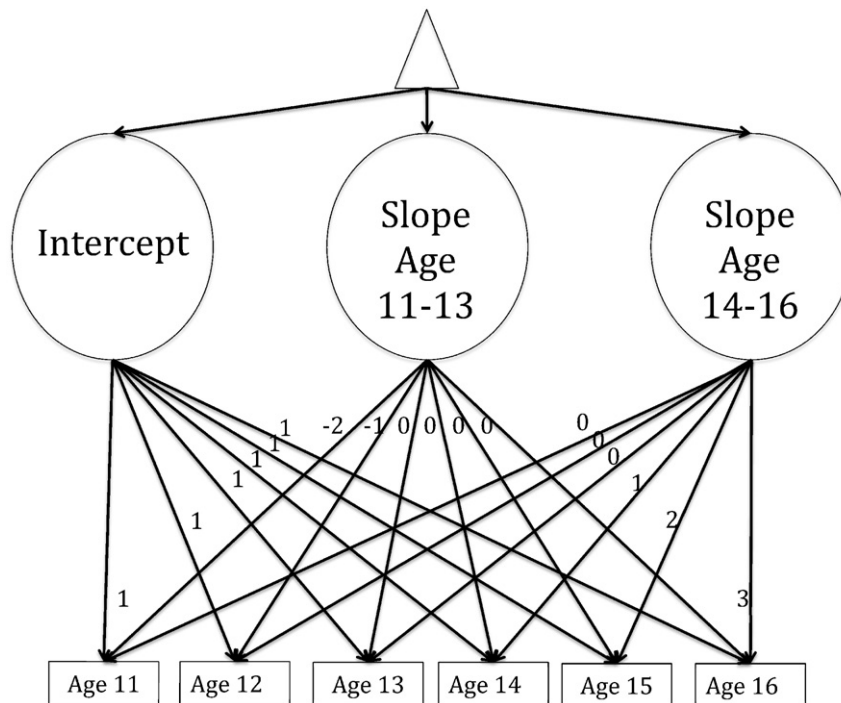


Fig. 1. Schematic of univariate piecewise latent growth model.  $\Delta$  = latent means.

that combine linear and non-linear change (e.g., latent basis models) or separate linear and non-linear trends in change across longer assessment windows (e.g., linear and quadratic slope models), PW-LGM can reduce interpretational ambiguity regarding the extent to which intraindividual differences in intraindividual change relate across traits.

More specifically, two slopes for each impulsivity trait were estimated, with the first slope reflecting change from ages 11–13 and the second slope reflecting changes from 13 to 16. The intercept was centered to age 13 in all models given the maximal coverage at this age. A schematic of these models are shown in Fig. 1. Unless noted otherwise, sex was included as a covariate in all models given prior work suggests sex differences in the developmental trajectories of impulse control and sensation-seeking (Shulman, Harden, Chein, & Steinberg, 2015). Correlated changes among the growth processes of the three impulsivity facets were then examined within a trivariate LGM (see Results below).

All models were estimated using the statistical package Mplus Version 7 (Muthén & Muthén, 1998–2012) using full maximum likelihood estimation, allowing for analysis of data containing missing values. Across traits, residual variances at parallel age assessments were correlated in all models.

### 3. Results

#### 3.1. Univariate growth models

A PW-LGM was fit<sup>1</sup> for each UPPS-P measure. All three models appeared to fit the data well (i.e., RMSEA = .00–.03, CFI = .99–1.00).

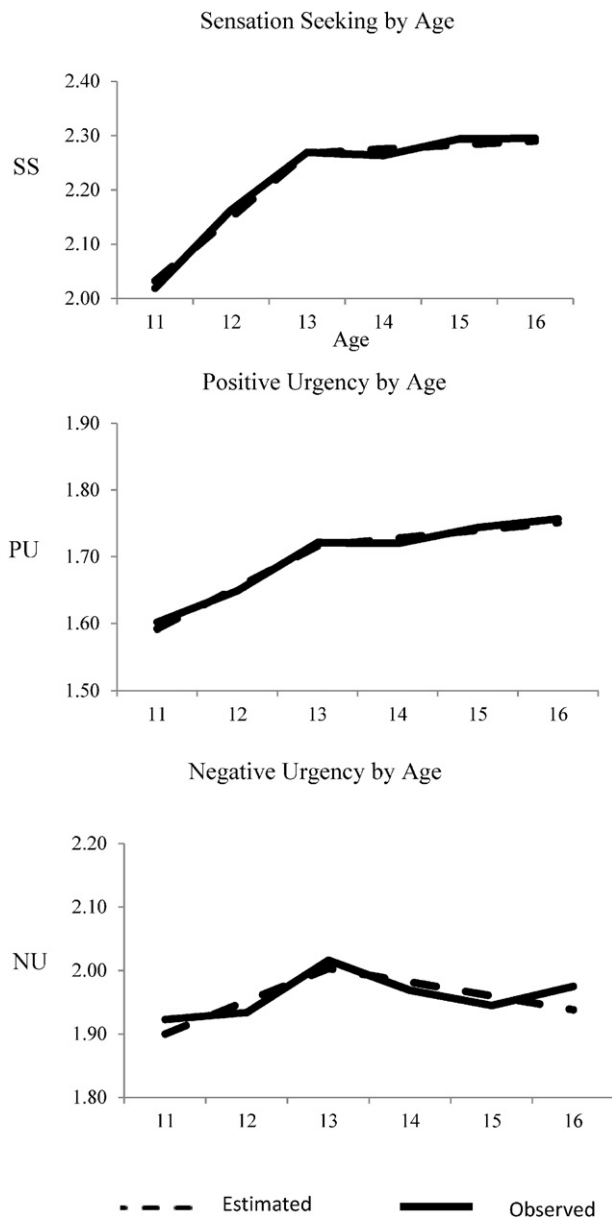
<sup>1</sup> To test for measurement invariance, three item parcels were constructed for each of the three scales in order to form latent variables of the three impulsivity facets at each of the six age groups. Due to a lack of coverage, tests of measurement invariance did not converge when including variables across the full age range (i.e., 11–16). Thus, for each facet, two models were analyzed: a model that included ages 11–14 and a model that included ages 13–16. For all three scales and across both age ranges, the models exhibited good model fit (i.e., CFI = .99–1.00; RMSEA = .02–.03; when assuming strong measurement invariance). Further, within-trait, the loadings and intercepts were similar across the 11–14 and 13–16 age ranges (available from the first author upon request). Taken together, these findings suggest the structure of the three personality traits was consistent across time.

Observed and model estimated mean-levels of sensation seeking, positive urgency, and negative urgency are shown in Fig. 2. All facets showed a similar pattern of mean-level change (i.e., increases from ages 11–13 and relative stability thereafter), although increases in sensation seeking were more pronounced. Consistent with this pattern, results of the growth models suggested significant increases for all traits from ages 11–13 (Piece 1 from the piecewise model; negative urgency mean = .08,  $p < .01$ ; positive urgency mean = .06,  $p < .05$ ; sensation seeking mean = .17,  $p < .01$ ) but non-significant mean-level changes from ages 13–16 (Piece 2 from the piecewise model; negative urgency mean = .00,  $p = .95$ ; positive urgency mean = .02,  $p = .36$ ; sensation seeking mean = .02,  $p = .40$ ). There was significant variability for all latent intercepts and slopes, with the exception of age 11–13 negative urgency slope. Sex was significantly related to negative urgency intercept ( $\beta = -.13$ ,  $p < .01$ ), such that males were lower in negative urgency at age 13; additionally, sex was significantly related to the ages 11–13 slope of sensation seeking ( $\beta = -.25$ ,  $p < .05$ ), indicating the males made less pronounced increases in sensation seeking compared to females during this timespan. Sex did not significantly relate to all other latent variables.

#### 3.2. Trivariate growth model

One trivariate PW-LGM that included assessments across ages 11–16 was then estimated to examine correlated change in the three measures. Parameters from the trivariate model are shown in Table 1. This model fit the data well (i.e., RMSEA = .02; CFI = .99). The variance parameters for the age 11–13 slope of negative urgency remained statistically non-significant (suggesting non-significant individual differences in intraindividual change in this trait across from ages 11–13); thus, parameters involving the age 11–13 slope for negative urgency are not reported or discussed.

Correlations between changes in all traits across parallel timeframes were large and statistically significant ( $p$ 's  $< .05$ ). Changes in sensation seeking were significantly correlated with changes in negative urgency from ages 13–16 ( $r = .67$ ), suggesting individuals who showed more pronounced increases (decreases) in sensation seeking are more likely to show marked increases (decreases) in negative urgency during this



**Fig. 2.** Observed and model estimated mean levels of negative urgency, positive urgency, and sensation seeking from ages 11–16, adjusting for sex. SS = sensation seeking. PU = positive urgency. NU = negative urgency.

timeframe. The slopes of sensation seeking and positive urgency from age 11–13 were significantly and strongly correlated ( $r = .82$ ). Sensation seeking and positive urgency slopes were also significantly correlated ( $r = .71$ ) from ages 13–16. Pronounced correlated changes also occurred between negative and positive urgency from age 13–16 ( $r = .81$ ).

#### 4. Discussion

There has been an increasing interest in examining the development of traits associated with sensation seeking and impulsivity across adolescence. Some research suggests some traits display distinct patterns of mean-level change across time and that intraindividual changes in these traits are largely unrelated (e.g., [Harden & Tucker-Drob, 2011](#), [Steinberg et al., 2008](#)) whereas some work suggests a relatively large overlap in trait change (e.g., [Quinn & Harden, 2013](#)). The current findings suggest substantial overlap of within-person changes in negative urgency, positive urgency, and sensation seeking during both early and middle adolescence, such that individuals who exhibited steeper increases (or reductions) in one trait were more likely to have displayed more pronounced increases (or reductions) in another trait.

The sizeable overlap between positive and negative urgency slopes is consistent with prior work that suggests these two facets load onto one higher order trait ([Cyders & Smith, 2007](#)). Findings from a recent meta-analysis ([Berg et al., in press](#)) noted marked similarity in the correlational patterns of the urgency facets with various outcomes, resulting in the conclusion that these “two dimensions may be separate but closely related ‘subprocesses’ of a broader dimension implicating strong emotion, regardless of valence, and impulsive action in response to that emotion” (p. 9). Consistently, our work supports combining these two urgency measures when examining these personality facets among adolescents, although some research endeavors (e.g., examining incremental validity) may warrant distinguishing between these two measures.

Individual differences in change in sensation seeking also showed substantial overlap with change in the urgency measures. Although this overlap may seem somewhat inconsistent with prior research ([Harden & Tucker-Drob, 2011](#); [Steinberg et al., 2008](#)), [Quinn and Harden \(2013\)](#) reported a large slope correlation ( $r = .67$ ) between impulsivity (that appeared to reflect lack of planning) and sensation seeking. Given this work examined change across a much longer time interval (i.e., approximately 11 years) than the time frame examined here (i.e., two slopes capturing change across approximately 6 years), the slope correlations between sensation seeking and the urgency measures (ranging from .67–.82) appear to be reasonable estimates and consistent with this prior study.

Overall, the current findings indicate that the development of at least some facets may be influenced by common, rather than distinct,

**Table 1**

Covariances and correlations among sensation seeking, negative urgency, and positive urgency intercepts and slopes.

	SSI	SSS1	SSS2	NUI	NUS1	NUS2	PUI	PUS1	PUS2
SSI	<b>0.49**</b>	0.69	−0.33	0.53	–	−0.25	0.57	0.57	−0.41
SSS1	0.11**	<b>0.05*</b>	0.07	0.46	–	−0.37	0.57	<b>0.82</b>	−0.69
SSS2	−0.04*	0.00	<b>0.03**</b>	−0.32	–	<b>0.67</b>	−0.40	−0.47	<b>0.71</b>
NUI	0.22**	0.06**	−0.04*	<b>0.35**</b>	–	−0.37	0.84	0.57	−0.43
NUS1	–	–	–	–	<b>0.03</b>	–	–	–	–
NUS2	−0.03*	−0.01	<b>0.02*</b>	−0.04**	–	<b>0.03**</b>	−0.45	−0.62	<b>0.81</b>
PUI	0.22**	0.07**	−0.04**	0.28**	–	−0.04**	<b>0.31**</b>	0.75	−0.57
PUS1	0.10**	<b>0.05**</b>	−0.02	0.09**	–	−0.03	<b>0.11**</b>	<b>0.07**</b>	−0.62
PUS2	−0.04**	−0.02	<b>0.02*</b>	−0.04**	–	<b>0.02*</b>	−0.05**	−0.02	<b>0.02*</b>

Note.  $n = 1018$ . Covariances are shown below the diagonal, variances on the diagonal, and correlations are shown above the diagonal. SSI = sensation seeking intercept. SSS1 = sensation seeking slope for ages 11–13. SSS2 = sensation seeking slope for ages 13–16. NUI = negative urgency intercept. NUS1 = negative urgency slope for ages 11–13. NUS2 = negative urgency slope for ages 13–16. PUI = positive urgency intercept. PUS1 = positive urgency slope for ages 11–13. PUS2 = positive urgency slope for ages 13–16. Variances are underlined. Parameters of primary interest (i.e., slope covariances/correlations across traits within a given timeframe) are bolded. Given the variance of negative urgency from ages 11–13 was not significant, covariances/correlations involving this slope parameter are not reported.

\*  $p < .05$ .

\*\*  $p < .01$ .



mechanisms, including neurodevelopmental processes, common genetic influences (at least among men; see Ellingson, Verges, Littlefield, Martin, & Slutske, 2013), and environmental factors (Romer, 2010). For example, Romer (2010) noted several aversive childhood experiences (e.g., physical and emotional abuse) may impact risk-taking propensity generally, and other factors (e.g., peer influences) may shape the development of sensation seeking (and ostensibly other personality characteristics) through selection and socialization processes. Prior research has also suggested that contextual factors (such as exposure to violence, stress and parenting) may shape the development of impulsivity during adolescence (King, Lengua, & Monahan, 2013; Monahan, King, Shulman, Cauffman & Chassin, in press). Given the current results, future research should explore factors that may account for the overlap in individual differences in change across facets of related to disinhibition and impulsivity. Additionally, future work could examine the extent to which change in facets are correlated across other developmental timeframes (e.g., emerging adulthood) or in different populations to better elucidate the developmental link between these traits.

In the current prospective data, mean levels of negative urgency, positive urgency, and sensation seeking significantly increased from ages 11–13 before leveling off at later ages. Overall, the current findings for sensation seeking are similar to findings from previous prospective studies (e.g. Harden & Tucker-Drob, 2011, Pedersen et al., 2012), with robust evidence across studies (with the exception of Burt et al., 2014) that sensation seeking increases during early adolescence. The findings for negative and positive urgency are more difficult to frame within the extant literature, given that a) measures of “impulsivity” have varied among existing studies and yielded mixed findings and b) to our knowledge, the current study is the first to report changes in measures of urgency over a considerable portion of adolescence (i.e., from ages 11–16). Minimally, our data suggests mean-levels of negative and positive urgency follow a similar pattern as sensation seeking during adolescence (i.e., increasing early before leveling off). Taken together, the current findings suggest that though negative urgency, positive urgency, and sensation seeking load onto separate factors and have unique correlates (Smith et al., 2007), individual differences in change in these facets may show substantial overlap across adolescence.

#### 4.1. Strengths and limitations

The current paper has several strengths. This study utilized reliable, contemporary, and recommended self-report measures to prospectively examine the development of key traits across adolescence among a large, diverse sample of youth using an appropriate analytic approach. To our knowledge, this is the first paper to examine changes in facets from the broadly used and well-validated UPPS-P measure across adolescence.

The current study also has several limitations. This study did not include the lack of planning and lack of perseverance measures from the UPPS-P Impulsivity Scale. Prior prospective analyses (e.g. Harden & Tucker-Drob, 2011, Pedersen et al., 2012) have utilized measures that, broadly, appear to reflect “lack of planning”; ongoing and future prospective studies examining adolescent development should incorporate contemporary, refined measures of other impulsivity facets. This study did not assess behavioral measures of impulsivity (e.g., Steinberg et al., 2008). Future studies could examine the development and co-development of traits related to impulsivity using a multi-method approach, though is little evidence that behavioral measures overlap with self-report assessments of impulsivity traits (see Cyders & Coskunpinar, 2011). Finally, this study used an abbreviated version of the UPPS-P, though this shortened assessment exhibited excellent reliability.

#### 4.2. Conclusions

In sum, the current findings suggest negative urgency, positive urgency, and sensation seeking show similar trajectories across

adolescence and individual differences in these normative changes appear to be strongly related. Thus, from a developmental perspective, these traits appear to be strongly related phenomena that may be influenced by common, rather than distinct, factors, at least during adolescence.

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#### References

- Baltes, P. B., & Nesselroade, J. R. (1979). History and rationale of longitudinal research. In J. R. Nesselroade, & P. B. Baltes (Eds.), *Longitudinal research in the study of behavior and development* (pp. 1–39). New York: Academic Press.
- Berg, J. M., Latzman, R. D., Bliwise, N. G., & Lilienfeld, S. O. (2015). *Parsing the heterogeneity of impulsivity: A meta-analytic review of the behavioral implications of the UPPS for psychopathology*. Psychological Assessment (in press).
- Burt, C. H., Sweeten, G., & Simons, R. L. (2014). Self-control through emerging adulthood: Instability, multidimensionality, and criminology significance. *Criminology*, 52, 450–487.
- Casey, B., Jones, R., Levita, L., Libby, V., Pattwell, S., Ruberry, E., ... Somerville, L. (2010). The storm and stress of adolescence: Insights from human imaging and mouse genetics. *Developmental Psychobiology*, 52, 225–235.
- Collado, A., Felton, J. W., Macpherson, L., & Lejuez, C. W. (2014). Longitudinal trajectories of sensation seeking, risk taking propensity, and impulsivity across early to middle adolescence. *Addictive Behaviors*, 39, 1580–1588.
- Cyders, M. A. (2015). The misnomer of impulsivity: Commentary on “choice impulsivity” and “rapid-response impulsivity” articles by Hamilton and colleagues. *Personality Disorders: Theory, Research, and Treatment*, 6, 204–205.
- Cyders, M. A., & Coskunpinar, A. (2011). Measurement of constructs using self-report and behavioral lab tasks: Is there overlap in nomothetic span and construct representation for impulsivity? *Clinical Psychology Review*, 31, 965–982.
- Cyders, M. A., & Smith, G. T. (2007). Mood-based rash action and its components: Positive and negative urgency. *Personality and Individual Differences*, 43, 839–850.
- Cyders, M. A., Coskunpinar, A., & VanderVeen, J. D. (2015). Urgency — A common transdiagnostic endophenotype for maladaptive risk-taking. Invited chapter in press. In V. Zeigler-Hill, & D. Marcus (Eds.), *The dark side of personality*. American Psychological Association (in press).
- Cyders, M. A., Smith, G. T., Spillane, N. S., Fischer, S., Annun, A. M., & Peterson, C. (2007). Integration of impulsivity and positive mood to predict risky behavior: Development and validation of a measure of positive urgency. *Psychological Assessment*, 19, 107–118.
- Ellingson, J. M., Verges, A., Littlefield, A. K., Martin, N. G., & Slutske, W. S. (2013). Are bottom-up and top-down traits in dual-systems models of risky behavior genetically distinct? *Behavior Genetics*, 43, 480–490.
- Evenden, J. (1999). Impulsivity: A discussion of clinical and experimental findings. *Journal of Psychopharmacology*, 13, 180–192.
- Hamilton, C. M., Strader, L. C., Pratt, J. G., et al. (2011). The PhenX Toolkit: Get the most from your measures. *American Journal of Epidemiology*, 174, 253–260.
- Harden, K., & Tucker-Drob, E. M. (2011). Individual differences in the development of sensation seeking and impulsivity during adolescence: Further evidence for a dual systems model. *Developmental Psychology*, 47, 739–746.
- Jackson, K. M., Roberts, M. E., Colby, S. M., Barnett, N. P., Abar, C. C., & Merrill, J. E. (2014). Willingness to drink as a function of peer offers and peer norms in early adolescence. *Journal of Studies on Alcohol and Drugs*, 75, 404–414.
- King, K. M., Lengua, L. J., & Monahan, K. C. (2013). Individual differences in the development of self-regulation during pre-adolescence: Connections to context and adjustment. *Journal of Abnormal Child Psychology*, 41, 57–69.
- Li, F., Duncan, T. E., & Hops, H. (2001). Examining developmental trajectories in adolescent alcohol use using piecewise growth mixture modeling analysis. *Journal of Abnormal Psychology*, 110, 199–210.
- Lynam, D. R., Smith, G. T., Whiteside, S. P., & Cyders, M. A. (2006). *The UPPS-P: Assessing five personality pathways to impulsive behavior (technical report)*. West Lafayette: Purdue University.
- Monahan, K. C., King, K. M., Shulman, E. P., Cauffman, & Chassin, L. (2015). *The effects of violence exposure on the development of impulse control and future orientation across adolescence and early adulthood: Time specific and generalized effects in a sample of juvenile offenders*. Development and Psychopathology (in press).
- Muthén, L. K., & Muthén, B. O. (1998–2012). *Mplus user's guide* (Seventh Edition). Los Angeles, CA: Muthén & Muthén.
- Pedersen, S. L., Molina, B. S., Belendiuk, K. A., & Donovan, J. E. (2012). Racial differences in the development of impulsivity and sensation seeking from childhood into adolescence and their relation to alcohol use. *Alcoholism: Clinical and Experimental Research*, 36, 1794–1802.
- Quinn, P. D., & Harden, K. (2013). Differential changes in impulsivity and sensation seeking and the escalation of substance use from adolescence to early adulthood. *Development and Psychopathology*, 25, 223–239.
- Romer, D. (2010). Adolescent risk taking, impulsivity, and brain development: Implications for prevention. *Developmental Psychobiology*, 52, 263–276.

- Romer, D., & Hennessy, M. (2007). A biosocial-affect model of adolescent sensation seeking: The role of affect evaluation and peer-group influence in adolescent drug use. *Prevention Science*, 8, 89–101.
- Settles, R. E., Zapolski, T. C., & Smith, G. T. (2014). Longitudinal test of a developmental model of the transition to early drinking. *Journal of Abnormal Psychology*, 123, 141–151.
- Shulman, E. P., Harden, K. P., Chein, J. M., & Steinberg, L. (2014). The development of impulse control and sensation-seeking in adolescence: Independent or interdependent processes? *Journal of Research on Adolescence*, 1–8.
- Shulman, E. P., Harden, K. P., Chein, J. M., & Steinberg, L. (2015). Sex differences in the developmental trajectories of impulse control and sensation-seeking from early adolescence to early adulthood. *Journal of Youth and Adolescence*, 1–17.
- Singer, J. D., & Willett, J. B. (2003). *Applied longitudinal data analysis: Modeling change and event occurrence*. New York: Oxford University Press.
- Smith, G. T., Fischer, S., Cyders, M. A., Annus, A. M., Spillane, N. S., & McCarthy, D. M. (2007). On the validity and utility of discriminating among impulsivity-like traits. *Assessment*, 14, 155–170.
- Steinberg, L., Albert, D., Cauffman, E., Banich, M., Graham, S., & Woolard, J. (2008). Age differences in sensation seeking and impulsivity as indexed by behavior and self-report: Evidence for a dual systems model. *Developmental Psychology*, 44, 1764–1778.
- Verdejo-García, A., Lawrence, A. J., & Clark, L. (2008). Impulsivity as a vulnerability marker for substance-use disorders: review of findings from high-risk research, problem gamblers and genetic association studies. *Neuroscience & Biobehavioral Reviews*, 32, 777–810.
- Whiteside, S. P., & Lynam, D. R. (2001). The five factor model and impulsivity: Using a structural model of personality to understand impulsivity. *Personality and Individual Differences*, 30, 669–689.