Predicted Unpredictability: Temporal Discounting as an Appropriate Response to Growing Up in Resource-scarce and Neglectful Environments - Unpredictability Schemas as a Potential Mediator

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Abstract

A growing body of literature suggests that adverse environments can produce a larger spectrum of outcomes than suggested by the traditional deficit approach. The present study investigated experiences of resource-scarce and neglectful environments, two aspects of deprivation, as predictors for temporal discounting in the decision-making of youth. Informed by the contextually appropriate response perspective (CARP), unpredictability schemas were investigated as a mediator between adverse experiences and temporal discounting. Regression and mediation analyses were conducted on questionnaire data of 534 youth from a middle school and five after-school clubs in Salt Lake City, USA. The 49% female sample had a mean age of 13.6 (range 12-18), it was socioeconomically and ethnically diverse but predominantly White and Hispanic. Results indicated evidence for childhood neglect and resource scarcity as predictors of unpredictability schemas. While childhood neglect predicted the use of temporal discounting, resource scarcity did not. There was no evidence for an unpredictability schema as a mediator, which was not aligned with predictions based on the CARP. Direct implications for the CARP are minor. Future studies should utilize the potential of the perspective and add to the evidence so that more impactful conclusions can be drawn. Several strengths, limitations, and recommendations for future research on the CARP are discussed. Investigating adversity exposure from multiple viewpoints is essential to find an adequate balance of impairment, strengths, and rationality in our view of adversity-exposed youth. Finding mechanisms of environmental adaptation is crucial to building policies and interventions that reduce socioeconomic gradients in adaptive developmental outcomes.

Keywords: Contextually appropriate response perspective, CARP, deprivation, childhood neglect, resource scarcity, unpredictability schemas, temporal discounting

Predicted Unpredictability: Temporal Discounting as an Appropriate Response to Growing Up in Resource-scarce and Neglectful Environments - Unpredictability Schemas as a Potential Mediator

Just recently, the Covid-19 pandemic has forced many to reflect on the desire for stability and certainty in an unpredictable world (Stanford University, 2020). The unpredictability of the pandemic let us feel the negative impact of a situation in that our financial security and social needs could be compromised from one day to another. However, it also forced many of us to adapt and respond accordingly.

Outside of recent events, unpredictability is a constant in the lives of many young people that live in adversity. In a 2018 national survey in the USA, 45% of children aged 17 or younger were found to have lived through adverse childhood experiences (Sacks & Murphey, 2017). These experiences describe potentially traumatic or overwhelming experiences that overextend the coping resources available to the typical child (Finkelhor, 2020). In 2020 alone, 20.713 accepted reports of child abuse were registered in Utah; 18.3% percent of them were related to child neglect (UTAHCJC, n.d.). Similarly, in 2021 the adverse experience of childhood poverty affected 8.1% of youth under 18 years of age in Utah (welfareinfo.org, n.d.). Many of these adversity-exposed youth live in deprived environments that make a prediction of what their near or distant future will look like very challenging (Ellis et al., 2009; Ellis et al., 2022).

If children grow up in neglectful and resource-deprived environments, they are also deprived of the security and consistency that usually gives us the ability to perceive the world as predictable (Ross & Hill, 2002). Unpredictability schemas are defined as pervasive belief systems that characterize people as undependable and the world as chaotic. They are commonly associated with both early experiences of deprivation and later increases in risk-taking behavior (Ross & Hill, 2002).

From early childbearing, over smoking, to getting into dept - a cluster of behaviors united by present-future trade-offs is consistently associated with harsh and unpredictable environments (Pepper & Nettle, 2017). Pepper and Nettle (2017) named this pattern of behavior the behavioral constellation of deprivation (BCD) and propose that individuals in low SES environments are more likely to value immediate rewards over investments in future rewards. This tendency to make decisions to obtain sooner outcomes over later ones, even if the later outcomes would be more rewarding in the long term when materialized, is called "temporal discounting". It has been linked to both adverse consequences like conduct problems, unhealthy and risky behaviors in youth (Story et al., 2014; Hill et al., 2008; Belsky et al., 2012), as well as cognitive enhancements under stress (Frankenhuis et al., 2016).

The Contextually Appropriate Response Perspective (CARP)

The traditional deficit approach investigates the developmental impact of such adverse childhood experiences as toxic to the developmental process (Finkelhor, 2020). Although this view is based on

established negative outcomes of adversity exposure, we should allow more nuance in our appraisal of developmental processes and outcomes (Frankenhuis et al., 2020). Limited control and high unpredictability of future outcomes seem to make the devaluation of the future and a focus on the now an appropriate response (Pepper & Nettle, 2017). In the present study, the contextually appropriate response perspective (CARP; Pepper & Nettle, 2017) will be essential. It assumes that developmental outcomes shaped by adversity exposure can be appropriate responses to a specific context. Although this investigation will focus on the CARP, there is a need to contextualize and understand individual development to make a balanced judgment (Frankenhuis et al., 2020). On the one hand, we cannot ignore the reality of impairments as outcomes of ACEs. However, on the other, we cannot prematurely label those in adverse conditions as bad decision-makers and need to reintroduce the notion of rationality in adversity-exposed populations (Sheehy-Skeffington, 2020).

In this study, I will investigate the effects of childhood neglect and an upbringing in resource-scarce environments on the development of short-term preferences in the decision-making of youth. I will investigate whether the strength of youth's unpredictability schemas mediates this effect. This will allow important insights for understanding whether temporal discounting can be seen as a reasonable response to deprived environments. The following sections explore the relationship between early deprivation, unpredictability schemas, and temporal discounting.

Deprivation Exposure in Early Development

Deprivation is an essential dimension of early adversity exposure (Ellis et al., 2022). Examples of this adversity dimension include extreme forms of deprivation, like separation from parents and institutional rearing. Nevertheless, as presented initially, aspects of deprivation, like physical neglect and chronic material deprivation through scarce resources, are commonly experienced (Ellis et al., 2022). Resource scarcity is the perceived infrequency and low quality of financial or material resources in childhood environments (Fenneman et al., 2022). Physical childhood neglect is an inadequate supply of nutrition, clothing, hygiene, supervision, and medical attention by caregivers (Stoltenborgh et al., 2013).

Although they may vary in their individual impact on developmental outcomes, these deprivation experiences affect development through the same kinds of mechanisms. Dimensional models of adversity exposure propose global changes in stress response systems and changes in cognitive development to be mechanisms of development in adverse environments (McLaughlin et al., 2021). One of these changes in cognitive development is the formation of unpredictability schemas.

Resource Scarcity and Childhood Neglect as Cues for Unpredictability Schemas

A child develops predictability perceptions based on early life experiences. These experiences shape our cognition and perception of the environment through their storage and organization in cognitive schemas. Unpredictability schemas affect youth's cognition, attention, and interpretation of information.

As explored in later sections, they are also crucial for youth's decision-making. Past evidence has shown that both inconsistent caretaker responses to a child's needs and the constraints of resource-scarce environments are at the root of the development of unpredictability belief systems (see Ross & Hill, 2002 for a more extensive review).

An inconsistent fulfillment of needs and allocation of resources through an individual's caretakers in early years provides environmental cues that indicate an unpredictable environment (Dickerson et al., 2019). Resource-scarce environments are usually less predictable than resourceful environments (Mittal & Griskevicius, 2014). Although all levels of resource scarcity can lead to a predictable environment when stable, especially precarious financial and material situations are prone to escalate and become less stable over time. This could be caused by feedback loops in behaviors and decisions, as well as the general problem that financial constraints tend to perpetuate further financial constraints (Pepper & Nettle, 2017). High resource scarcity would therefore serve as a cue for an unpredictable environment. Both childhood neglect and resource scarcity are tightly interwoven as the availability of resources greatly affects the ability of parents to provide basic resources to meet a child's needs beyond personal factors (Ross & Hill, 2002).

The statistical learning approach proposes an evolutionary perspective on why these schemas might develop. It proposes that evolution shaped our cognitive development to dynamically build implicit predictions of the occurrence of events or the availability of resources in our environment (Frankenhuis et al., 2019; Young et al., 2020). These predictions are affected by the continuous sampling of environmental cues that inform a working model of the statistical properties of our environment. Having a statistical understanding of a deprived environment as being unpredictable might significantly increase the person's fit to their environment. A person's statistical learning history will influence their developmental outcomes. People with stronger unpredictability schemas are expected to be less future-oriented, less able to delay gratification, and more likely to expect an earlier death (Ross & Hill, 2002).

Changes in Time Preference as a Response to Unpredictability Schemas

Life history theory has been used to argue that youth calibrate their decision-making strategies to maximize adaptive fit in specific environments (Chua et al., 2016; Ellis et al., 2009). Certain life history traits (physiological aging and onset of puberty, mating strategies, reproduction, reward orientation) are thought to vary on a slow-fast spectrum in response to the harshness and unpredictability of the environment (Griskevicius et al., 2013; Ellis et al., 2009). An important aspect of the resulting life history strategy is its temporal preference for short- or long-term orientation (Frankenhuis et al., 2016). Here, present-orientation marks an adaptive response to environments that are perceived as harsh and unpredictable (Frankenhuis et al., 2016). Environments that are perceived as threatening and unpredictable by youth, therefore, direct their decision-making and development towards short-term goals

and urgent decision-making (Knowles et al., 2019). This adaptation perspective gives us insights into the "why" of temporal discounting. In this study, I will focus on the "how", the underlying mechanism of the relationship between adversity exposure and temporal discounting.

The Present Study

To summarize the previous sections, it is proposed that early adverse experiences of deprivation, like resource scarcity and childhood neglect, facilitate the development of unpredictability belief systems. This belief system then informs developmental and decision-making processes to maximize the adaptive fit, which leads to temporal discounting.

The study's goals are twofold: First, I will investigate resource scarcity and childhood neglect as precursors of temporal discounting in a representative youth sample. Second, the suitability of unpredictability schemas as a mechanism of the proposed effect of deprivation aspects on temporal discounting will be investigated separately.

Both theory and evidence suggest that early childhood neglect and resource scarcity lead to increases in the later use of temporal discounting in decision-making. The first hypothesis is that the experience of resource scarcity and childhood neglect predicts the degree to which youth make use of temporal discounting. I expect higher levels of exposure to resource scarcity and childhood neglect to relate to stronger temporal discounting in the decision-making of youth.

Further, it is important to find mechanisms through which early adverse experiences influence temporal discounting that are not exclusively exploring deficits (Ellis et al., 2022; Frankenhuis et al., 2020). Informed by the CARP, I expect that a predictive effect of childhood neglect and resource scarcity on temporal discounting can be understood as a contextually reasonable response to unpredictability schemas. The second hypothesis is that experiences of childhood neglect relate to higher levels of temporal discounting and stronger perceptions of unpredictability. I predict that unpredictability schemas fully mediate the relationship between childhood neglect and temporal discounting. The third hypothesis is that exposure to resource scarcity relates to higher levels of temporal discounting and stronger perceptions of environmental unpredictability. I predict that unpredictability schemas fully mediate the relationship between resource scarcity and temporal discounting.

Methods

Ethical approval was obtained by the Utrecht University Ethical Review Board of Social and Behavioural Sciences (23-0410). Hypotheses, key variables, and statistical analyses have been preregistered (https://aspredicted. org/z3d4e.pdf) before the data was accessed. Due to its relevance for future publications, the data is currently not openly published. To gain access to the data, please contact Dr. Willem E. Frankenhuis, supervisor of this project.

Participants

　　　　The present study used data initially collected from spring 2018 until early 2020 for the "Hidden Talents in Youth" project (Young et al., 2022). Two main sources were used to collect data from a total of 618 students (M_{age} = 13.62, SD_{age} = 0.81, *range* = 12-18) across Salt Lake City, Utah, USA. The first sample was seventh and eighth graders from a local middle school (*n* = 540, 87.38% of total sample, 50.56% female), the second was five different after-school clubs (*n* = 78, 14.44% of total sample, 32.05% female). The middle school subsample had a narrow age range (M_{age} = 13.56, SD_{age} = 0.70, *range* = 12-15), was ethnically diverse with predominantly White and Hispanic participants (1.3% Asian, 0.4% Native American, 0.6% African American, 61.3% White, 22.4% Hispanic, 0.9% Pacific Islander, 7.8% multiple, 5.4% no information), and showed diverse socioeconomic backgrounds (39.8% economically disadvantaged, meaning they received financial support or experienced homelessness). The after-school club sample had a slightly wider range of ages (M_{age} = 14.22, SD_{age} = 1.36, *range* = 13-18), was more ethnically diverse (3.8% Asian, 1.3% Native American, 11.5% African American, 44.9% White, 26.9% Hispanic, 2.6% Pacific Islander, 3.8% multiple, 5.1% no information) and also showed diverse socioeconomic backgrounds (52.6% economically disadvantaged, meaning they qualify for a free lunch offer) as well. Both subsamples showed comparable demographics.

　　　　The two subsamples have been combined into one dataset. Before exploring the data, participants without recorded consent/assent form, incomplete responses for any of the relevant scales (Perceived Childhood SES, Childhood Trauma Questionnaire - Physical Neglect Subscale, Childhood Unpredictability Schema, Delay of Gratification), or missing demographics (age, sex, ethnicity) were excluded from the final dataset. Missing values on Item 7 of the resource scarcity scale did not lead to exclusion. This item was only recorded for the middle school sample. When comparing the internal consistency of the resource scarcity scale with and without Item 7 (see Appendix A), no significant differences ($\Delta\alpha$ = .01) were observed. No identified outliers were judged to be problematic or removed from the dataset. After exclusions, the final dataset contained 534 participants (49.06% female, M_{age} = 13.64, SD_{age} = 0.82, *range* = 12-18). The final sample is ethnically diverse (1.3% Asian, 0.6% Native American, 1.9% African American, 63.3% White, 23.4% Hispanic, 1.3% Pacific Islander, 8.2% multiple).

Procedure

　　　　This study used data from a larger data collection process that included cognitive testing and structured interviews (see Young et al., 2022). In the following, I will only focus on procedures used to assess variables relevant to the present study. In both subsamples, the data collection comprised consent, assent, and demographics forms. This was followed by the administration of questionnaires and a debriefing.

Consent, Assent, and Demographics

Before the first session, a primary parent or caregiver gave consent to participate in the data collection. At the start of the session, each participant gave their assent to participate. A demographics form was used to collect information on each participant's age, sex assigned at birth, and self-reported ethnic identity.

Questionnaire and Debriefing

The questionnaires relevant to the present study measured childhood physical neglect, perceived childhood SES, perceived childhood unpredictability, childhood unpredictability schemas, and delayed gratification. All procedures were completed in one session for the after-school club participants. The middle-school participants completed the cognitive tasks and interview in a one-on-one setting and completed the questionnaires two weeks later in a large computer testing room. After the data collection process finished, all participants were debriefed.

Measures

To facilitate reproductions, all questionnaire items are presented in Appendix A.

Resource Scarcity

Resource scarcity was measured with an adapted version of the Perceived Childhood SES Scale (Mittal et al., 2015). The adapted version used seven instead of four items to assess participants' perceived childhood SES. The perceived ability of the participant's family to cover basic needs was tapped by five items (e.g., "Your family had enough money to afford the kind of food you all needed." or "Your family struggled to make ends meet (get by financially)"). Perceived SES compared to peers was tapped by two items (e.g., "I felt well-off (rich, wealthy) compared to other kids in my neighborhood."). All items were scored on a 5-point Likert scale from 1 ("Never true") to 5 ("Very often true"). All seven items were averaged to create a mean perceived resource scarcity score. Higher scores indicated more perceived resource scarcity in the childhood environment ($M = 2.19$, $SD = .66$). The scale showed good internal consistency ($\alpha = .81$). Past studies using the same questionnaire also indicated appropriate internal consistency (Mittal et al., 2015; Young et al., 2022).

Childhood neglect

Childhood neglect was assessed using a modified, shorter version of the Physical Neglect Subscale from the Childhood Trauma Questionnaire (Bernstein et al., 1994). Childhood neglect and deprivation were measured retrospectively with six items (e.g., "I lived in a group home or a foster home." or "I knew that there was someone to take care of me and protect me."). All items were scored on a 5-point Likert scale from 1 ("Never true") to 5 ("Very often true"). The average of the six items was used as score for exposure to neglect in childhood. Higher scores indicate more exposure to neglect in childhood ($M = 1.26$, $SD = .38$). The complete Childhood Trauma Questionnaire has been shown to have convergent and discriminant validity (Bernstein et al., 1997). The unmodified Physical Neglect subscale

specifically has been shown to have high internal consistency, as well as good sensitivity for childhood trauma in adolescent psychiatric settings. In comparison, we have found a low internal consistency of the scale ($\alpha = .60$).

Unpredictability schemas

The presence of childhood unpredictability schemas was assessed using a modified Childhood Unpredictability Schema Scale (Cabeza de Baca et al., 2016). It measured the degree to which a participant holds a worldview characterized by perceptions of other people and overall outcomes as unreliable and unpredictable. Nine items were used (e.g., "I have a good idea about what is going to happen in my life." or "I have little control over the things that happen to me."). All items were scored on a 5-point Likert scale from 1 ("Never true") to 5 ("Very often true"). An average of all nine items was used to indicate the level of a participant's unpredictability schema. Higher scores indicate a stronger belief that other people and overall outcomes are unreliable and unpredictable ($M = 2.56$, $SD = .48$). The scale showed adequate internal consistency ($\alpha = .71$). In the study the scale was initially constructed for, the unmodified version of the scale was found to have an adequate inter-item correlation as well (Cabeza de Baca et al., 2016).

Temporal discounting

Temporal discounting was assessed using a modified Delay of Gratification Scale (Mittal & Griskevicius, 2014). A series of five financial decision-making tasks was used to assess temporal preference. Participants were asked to make a hypothetical decision between receiving a specific amount of money tomorrow or a specific larger amount of money in a month (e.g., "Receive $33 tomorrow or $81 in a month"). No financial rewards were distributed. All items were dichotomous forced-choice decisions scored as either 1 (Definitely option A) or 0 (Definitely option B). The five responses were aggregated to create a temporal discounting index ($M = .96$, $SD = 1.30$). Comparable to previous studies using similar approaches indicated adequate internal consistency (Mittal & Griskevicius, 2014), the internal consistency observed in this study ($\alpha = .73$) was adequate.

Results

All following analyses were conducted using IBM SPSS Version 27. The PROCESS macro extension v4.3 (Hayes, 2022) was used to run regression-based mediation analyses. The syntax of data exclusions and main analyses performed on the dataset can be found in Appendix B.

Descriptive Statistics

As depicted in Table 1, the average child from the combined sample ($N = 543$) rarely experienced neglect ($M = 1.3$, $SD = .4$, $range = 2.3$) and rarely experienced resource scarcity ($M = 2.2$, $SD = .7$, $range = 3.7$) in their childhood. On average, the sample showed medium levels of unpredictability

schemas ($M = 2.6$, $SD = .5$, $range = 2.8$). The average participant chose the sooner smaller reward over the larger later reward once ($M = 1$, $SD = 1.3$, $range = 5$).

Table 1

Descriptive Statistics

	Median	M	SD	Min	Max	Range
Childhood Neglect	1.2	1.26	.38	1.00	3.33	2.33
Resource Scarcity	2	2.19	.66	1.00	4.67	3.67
Unpredictability Schemas	2.5	2.56	.48	1.00	3.88	2.88
Temporal Discounting	0	.96	1.30	.00	5.00	5.00

Secondary Results

Deviating from the preregistered analyses, bivariate correlations (Table 2) were run to gain further insights into the investigated relationships. The deprivation measures childhood neglect and resource scarcity showed a significant moderate association ($r(541) = .58$, $p < .001$). Unpredictability schemas showed significant moderate associations with both childhood neglect ($r(541) = .32$, $p < .001$) and resource scarcity ($r(541) = .33$, $p < .001$). Temporal discounting showed significant weak associations with childhood neglect ($r(541) = .19$, $p < .001$) and resource scarcity ($r(541) = .23$, $p < .001$). I found no association between unpredictability schemas and temporal discounting.

Table 2

Correlation Matrix

	1.	2.	3.
1. Childhood Neglect	-		
2. Resource Scarcity	.58*	-	
3. Unpredictability Schemas	.32*	.33*	-
4. Temporal Discounting	.19*	.23*	.07

Note. *$p<.001$.

Primary Results

Regression

Temporal discounting was regressed on resource scarcity and childhood neglect with a multiple linear regression model. Because the dependent temporal discounting variable showed severe violations of normality, a log transformation was applied (log(temporal discounting+1)). Subsequent statistical and

visual checks showed an acceptable normal approximation but, overall, still a non-normality. Due to the sample size, I expect the fitted model to be interpretable beyond observed violations of normality in the predictor variables.

The model showed a borderline non-significant relationship between resource scarcity and temporal discounting (*exp(B)* = 1.09, *SE* = .05, *p* = .06). Further, it indicated a significant positive relationship between childhood neglect and temporal discounting. For every unit increase in the frequency of exposure to childhood neglect, a child would show a 26.11% increase in the use of temporal discounting (*exp(B)* = 1.26, *SE* = .08, *p* < .001). Although the predictors showed acceptable amounts of shared explained variance (*VIF* = 1.51), the overall variance in temporal discounting explained by the model was extremely low (R^2 = .05, *SE* = .56). Overall, there was no evidence of a relationship between resource scarcity and temporal discounting and significant evidence of a positive relationship between childhood neglect and temporal discounting.
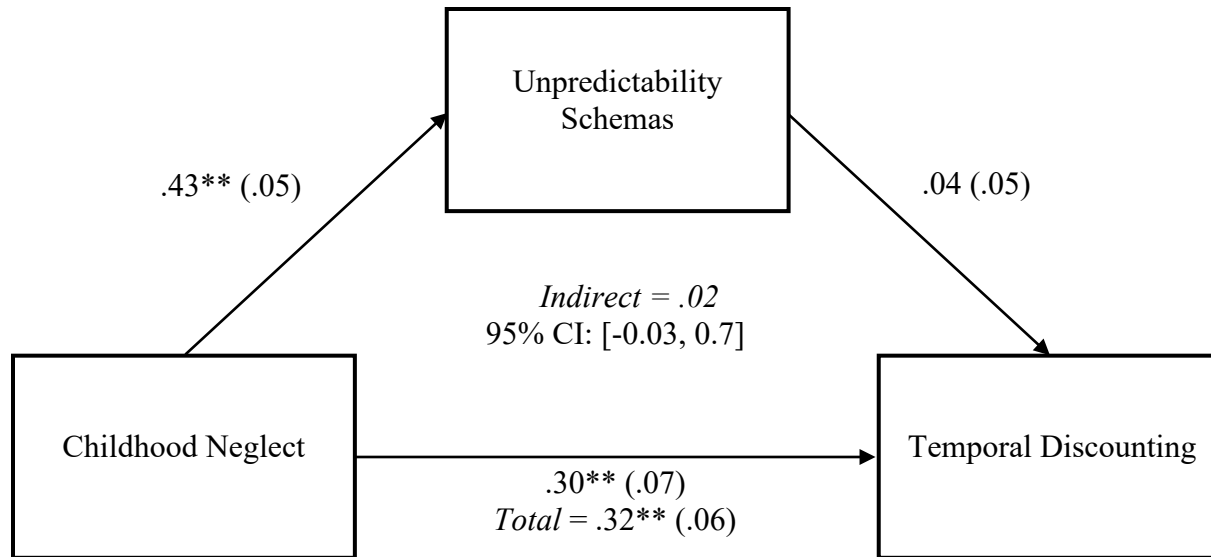
Mediation

To investigate the predictions that the strength of an unpredictability schema fully mediates the effect between both childhood neglect and temporal discounting (Hypothesis two) and the effect between resource scarcity and temporal discounting (Hypothesis three), two separate mediation models were computed. For reasons discussed previously, a log transformation of the outcome variable (*log*(temporal discounting+1)) has been performed.

Mediation Model 1. The first mediation analysis examined the mediating effect of unpredictability schemas between childhood neglect and temporal discounting (see Figure 1). The mediation model yielded a significant total effect (*exp(B)* = 1.38, *SE* = .06, *p* < .0001). Considering the effect of the mediator, a one-unit increase in the frequency of exposure to childhood neglect is expected to relate to a 38% increase in temporal discounting. Since the model showed a significant direct effect (*exp(B)* = .1.35, *SE* = .07, *p* < .0001) and a non-significant indirect effect (*exp(B)* = 1.02, 95% CI: [-0.03, 0.07]), there is no mediation through the unpredictability schemas.

Figure 1

Mediation model one with regression coefficients for the relationship between childhood neglect and temporal discounting.
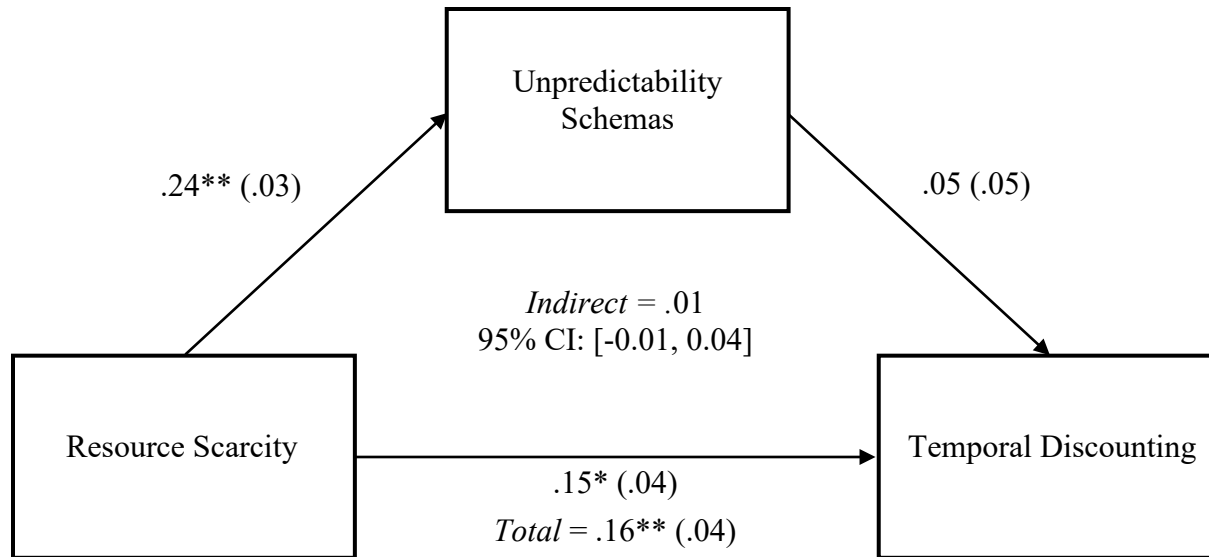

Note. *p<.001, **p<.0001; SE* in parentheses.

Mediation Model 2. The second mediation analysis examined the mediating effect of unpredictability schemas between resource scarcity and temporal discounting (see Figure 2). The mediation model yielded a significant total effect (*exp(B)* = 1.17, *SE* = .04, *p* < .0001). Considering the effect of the mediator, a one-unit increase in the frequency of exposure to resource scarcity is expected to relate to an 18% increase in temporal discounting. Since the model showed a significant direct effect (*exp(B)* = 1.16, *SE* = .04, *p* < .001) and a non-significant indirect effect (*exp(B)* = 1.01, 95% CI: [-0.01, 0.04]), there is no mediation through the unpredictability schemas.

Figure 2

Mediation model two with regression coefficients for the relationship between resource scarcity and temporal discounting.

Note. *p<.001, **p<.0001; *SE* in parentheses.

Discussion

I investigated whether early environmental and experienced deprivation is related to changes in the beliefs about environmental predictability that, in turn, predict reasonable short-term preferences in decision-making. More specifically, whether the experience of childhood neglect and resource scarcity is predictive of the use of temporal discounting in financial decision-making. Informed by the CARP perspective, I investigated unpredictability schemas as a potential mediator for this effect in a socioeconomically diverse sample of youth.

As predicted, childhood experiences of neglect significantly predicted the use of temporal discounting in later financial decision-making. Contrary to predictions, I found mixed evidence on whether growing up in resource-scarce environments predicts temporal discounting in later financial decision-making. Inconsistent with my hypothesis, unpredictability schema strength did not mediate the effect between the two measured aspects of deprivation and temporal discounting in financial decisions. Although no preregistered predictions were made, I did not find an association between the strength of an unpredictability schema and the use of temporal discounting in the administered decision tasks.

Childhood Neglect, Resource Scarcity, and Temporal Discounting

I found mixed results regarding the hypothesis that the experience of resource scarcity and childhood neglect is related to temporal discounting in the decision-making of youth. Therefore, findings are only partially consistent with the evidence concerning early adversity's positive effect on temporal

discounting in youth (Acheson et al., 2019; Levitt et al., 2021). Although further evidence is needed, these results suggest that future studies should investigate and appreciate the differential impact of different dimensions of adversity on temporal discounting. Many studies used cumulative adversity measures (Acheson et al., 2019; Knowles et al., 2019). In light of these results, adopting a dimensional conceptualization of the effects of different types of adversity and deprivation might be more accurate (McLaughlin et al., 2021).

Childhood Neglect

No studies with reported results on the relationship between childhood experiences of neglect and temporal discounting could be identified. Therefore, the present results are initial evidence for early experiences of neglect as a predictor for later temporal discounting that should be investigated further.

Resource Scarcity

Contrary to Allen and Nettle's (2021) previous results on the predictiveness of resource scarcity in childhood on later temporal discounting, I did not find a significant effect. One reason for the diverging results could be their use of objective neighborhood SES indices and retrospective perceived SES measures in the present study. Overall, retrospective measures might be less precise. Still, evidence suggests environmental perception measures are superior at predicting developmental adaptations to environments than objective deprivation measures (Frankenhuis et al., 2018; Johns, 2011).

The usefulness of objective and subjective measures of early deprivation when investigating temporal discounting should be investigated further before drawing more decisive conclusions about the relationships in question. Additionally, if future studies find similar results, this has implications for policymakers' and researchers' efforts to reduce the impact of early deprivation on discounting-related issues. Improvements might be highest when interventions target caregivers' abilities to meet the physical needs of children instead of just providing frequent and higher quality financial and material resources.

Unpredictability Schemas as a Mediator

Results did not align with my hypotheses, suggesting temporal discounting as a contextually appropriate response to early deprivation. I, therefore, did not find evidence aligned with predictions derived from the CARP. These results should be interpreted as an initial step toward testing hypotheses derived from the CARP. While my findings might only have small direct implications for the perspective, overall, there is much room for replications and alternative hypotheses based on it. The perspective of contextually appropriate responses to adversity could be an important factor in the earlier proposed balance of views on the impact of adversity on developmental outcomes. Its potential to stimulate new research should be utilized, and more substantiated conclusions should be drawn from a larger body of evidence.

Moreover, since no similar investigations have been conducted before, there are points of improvement that should be considered in conceptual replications and other studies of the CARP alike. Fennemann and colleagues (2022) integrated multidisciplinary formal models of impulsivity to identify contexts in which temporal discounting is adaptive. Their model suggests that the usefulness of temporal discounting in decision-making as a response to early resource scarcity depends on the predictability of resource availability over time. Other than initially assumed, temporal discounting in unpredictable environments is proposed to be an inappropriate response. Taking the CARP, we might see a more complex pattern of developmental responses than initially anticipated. This potential alternative explanation shows the importance of formal modeling in developing predictions based on the CARP.

Predictors of Unpredictability

Findings are consistent with previous results that suggest childhood neglect as a predictor of later unpredictability schemas (Dickerson et al., 2019). Other than previous results, resource scarcity was also found to be a predictor of later unpredictability schemas (Proffitt Levyva & Hill, 2018). This study's results suggest that early experiences of deprivation and deprived environments serve as cues for the development of unpredictability schemas.

Unpredictability Schemas and Temporal Discounting

The lack of a significant relationship between unpredictability schemas and temporal discounting is unexpected, considering past propositions and results (Frankenhuis et al., 2016; Ross & Hill, 2002). No preregistered predictions on this relationship were made; still, explanations for this observation could be connected to an overall limitation of the study's measurement of the outcome variable. There is a possible floor effect in the outcome variable. The Delay of Gratification Scale (Mittal & Griskevicius, 2014) uses forced-choice dichotomous items scored as 1 or 0, resulting in a limited variability around the center (*Median* = 0, *SD* = 1.3). Further, a contextless hypothetical forced-choice task might have limited success in producing the desired reliance on unpredictability schemas in decision-making. A real-world financial decision might be affected by various contextual factors that influence the weighing of present against future outcomes to prevent negative or even critical consequences.

Strengths & Limitations

The study's strengths lie in, first, its preregistered predictions. Second, its large, ethnically, and economically diverse sample is important to support and generalize this study's claims. It should be considered that Asian and African American Youth are underrepresented when compared to 2020 census data (US Census Bureau, 2021). On average, African American subpopulations might be exposed to more childhood adversities than Hispanic and White populations (Slopen et al., 2016). Third, much previous research on temporal discounting outcomes after adversity exposure was conducted on young adult

samples, while the current study was able to address this limitation of the existing literature and investigate these effects in youth (Hilbert et al., 2022; Acheson et al., 2019; Allen & Nettle, 2019).

The first of several limitations is the potential noise created by the extensive one-day testing in the after-school club subsample, compared to the separated testing situations in the middle school subsample. Second, childhood neglect and resource scarcity are two types of deprivation included in the initial data collection. Possible replications could extend the range of deprivation measures to make more meaningful conclusions about the deprivation adversity dimension. Third, the modified Physical Neglect Subscale from the Childhood Trauma Questionnaire (Bernstein et al., 1994) showed limited internal consistency. It was initially validated for psychiatric samples that might have experienced multiple consistent extreme aspects of neglect. The investigated general sample might have had less consistent experiences regarding, for example, co-occurring low parental support and homelessness or dirty clothes. Fourth, the computed MLR model only accounted for 5% of the total variance in temporal discounting. Future studies should consider including more aspects of the deprivation adversity dimension and control for other factors and adversity dimensions to allow better predictions of temporal discounting.

Implications for Future Research

Based on the results and limitations, there are several open questions and suggestions for future studies. First, based on evidence concerning the impact of different aspects of the deprivation adversity dimension, future studies on temporal discounting should investigate the effect of different types of deprivation on development. Further, in doing so, the benefits of dimensional approaches to adversity exposure should be considered (McLaughlin et al., 2021). Second, formal models of adaptive responses should be used to guide predictions about contextually appropriate responses. Integrated formal models of adaptive responses like Fennemann and colleagues' (2022) exist for resource-scarce environments. Still, there are currently none to evaluate temporal discounting as an adaptive response in neglectful environments. Third, to improve temporal discounting assessment, measures that allow for a higher dispersion should be considered. Further, real-world consequences in the form of actual monetary rewards might increase the ecological validity of the decision-making task. Raising the stakes of a decision potentially facilitates the reliance on unpredictability schemas. Fourth, replications based on open data are suggested to make use of the benefits of multiverse analyses. This way, arbitrary decisions like the tolerance of missing values on the resource scarcity measure or data transformations made in the current study could be balanced against equally defensible multiversal datasets. Lastly, I want to stress the importance of future research identifying cognitive mechanisms that explain how deprivation affects temporal discounting in youth. Their value for building effective interventions could show high importance to counteract socioeconomic inequalities in health and general life outcomes after adversity exposure (Ellis et al., 2022; Pepper & Nettle, 2017; Ludwig et al., 2019).

Conclusions

At its core, the present study aimed to add to a growing body of evidence that challenges the societal and scientific conviction that the sum of early adversity exposure leads to the development of cognitive deficits. I found initial evidence for the predictiveness of childhood neglect and resource scarcity for the development of unpredictability schemas. Further, I observed a differential impact of aspects of deprivation on temporal discounting in the decision-making of youth. There was no evidence for an unpredictability schema as a mediator. Although these findings and their implications should be seen in the light of present limitations, they leave questions on the diverging influence of different types of deprivation on temporal discounting in youth. Identifying the "how" of developmental adaptations to adversity remains essential to identify which dimensions of adversity and what corresponding mechanisms interventions should target (Pepper & Nettle, 2017; Ellis et al., 2022). Lastly, the lack of evidence aligned with the CARP should not discourage future research from identifying and testing other potential mechanisms of adversity exposure. We need to restore an adequate balance of impairment and rationality in our view of adversity-exposed youth when conceiving policies and interventions to reduce socioeconomic gradients in adaptive developmental outcomes.

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Appendix A
Measures

Perceived Childhood SES Scale (modified; Mittal et al., 2015)

Childhood Trauma Questionnaire - Physical Neglect Subscale (shortened, Bernstein et al. 1994)

Childhood Unpredictability Schema Scale (modified, Cabeza de Baca et al., 2016)

Delay of Gratification Scale (modified, Mittal & Griskevicius, 2014)

To gain access to the used measures, please contact the author of this project (noah.tapper@web.de).

Appendix B

IBM SPSS Version 27 Syntax

The used syntax will be provided on request to the author (noah.tapper@web.de) and is to be performed on the unmodified dataset that will be shared on request to Dr. Willem E. Frankenhuis, supervisor of this project.