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The Economic Approach to Personality, Character and Virtue

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Abstract

This chapter presents an economic approach to character and personality traits with an application to the study of virtue. Economists interpret psychological traits, including character traits and virtue, as *strategies* that shape responses to situations (actions) determined by underlying endowments, preferences, resources, as well as incentives to act in situations. Philosophers of virtue consider it to be a certain kind of practice in pursuit of a worthy goal. Psychologists consider it to be a trait or endowment and many adopt this point of view. Character traits and personality are not considered immutable in any field. They are shaped by genetics, parents, peers, and schools, as well as by habituation, imitation, and life experiences. We develop economic models to interpret and give empirical content to virtue ethics and suggest what the study of virtue ethics contributes to the study of society.

JEL: D90, D91, I20, I31

Keywords: character, virtue development, self-control, ethics, personality, economic preferences

The goal of this essay is to conceptually unify notions of character and virtue across diverse fields and at the same time to give these ideas empirical content. Interpreting Aristotle through the lens of an economic model is challenging, provocative and fruitful for philosophy, psychology and economics.

1 How Economics Contributes to the Study of Personality, Character and Virtue

Economics provides a useful framework for examining the study of personality and character which underly philosophical concepts of virtue. It clarifies concepts and the empirical content of psychology. The models developed by economists reveal basic measurement problems in psychology. Psychologists often equate traits with measured behaviors. Our analysis shows that, at an empirical level, "cognitive" and "noncognitive" traits associated with reason and emotion are not easily separated when explaining behavior or when shaping the formation of traits (see, e.g., Phelps, 2009).

Economics gives precision and empirical content to the study of virtue ethics. At the same time, the study of virtue ethics introduces important distinctions that inform economic research. It introduces crucial concepts such as intention and deliberation into the measurement of behavior and personality. It emphasizes the distinction between intrinsic rewards associated with Aristotelian virtue and extrinsic rewards, which motivates much economic analysis and many policy prescriptions. Economics provides an empirical framework for the study of virtue and character, but, we will show that, it needs to be extended to be useful in philosophy.

We rely on recent work by economists on personality measurement and development. Psychology and economics have different measurement schemes for traits. Research is underway linking self-control with the preferences, constraints, and expectation mechanisms of economics. Scholars are busy answering the question of whether the two fields duplicate each

other or add new dimensions to the understanding of human differences. They are seeking to develop a common language and framework to promote interdisciplinary exchange. Many basic questions of content and measurement addressed by psychologists benefit from rigorous economic analysis.

Economics studies the choices and behaviors of individuals. Psychologists study "traits," sometimes defined as "enduring" behaviors (see Roberts, 2009). These behaviors are used by psychologists to define traits. Virtue is regarded as an enduring practice that is highly regarded in most societies. However, for Aristotle, it is not an immutable trait, although evolving traits influence practice. He discusses the acquisition of virtue (see Aristotle et al., 1980, Callard, 2020, 2022, Kraut, 2022 and Athanassoulis, 2013 on whom we draw extensively).

Economists view the act of being virtuous as a consequence of underlying preferences and external rewards and constraints ("situations"). Agents respond to the rewards and constraints they face. Rewards include externally acquired benefits, such as public recognition, approval, and personal satisfaction. Constraints include financial and social costs of taking actions.

Philosophers are less inclined to accept this notion of virtue. Agents make choices, but virtue is motivated from what economists would call internal goals and rewards–intrinsic preferences. Rational deliberation is an essential part of Aristotelian virtue. External influences may limit the pursuit of internally defined agent goals. These influences are readily described by the standard constraints of economics.

In philosophy, virtue is an acquired practice that may eventually become the dominant practice of agents that influences the behaviors of practitioners. Exhibiting virtue can be costly for a person and those they value.

The "person vs situation" debate initiated by Mischel (1968) and adopted in quarters of behavioral economics proposes a stark dichotomy between an invariant trait (the person) and the role of incentives (the situation) in shaping actions. Using economics and

Aristotelian notions, we sharpen the notion of invariant traits and consider invariant preferences. Treating virtue and personality as strategies encompasses both interpretations and suggests constructive approaches to understanding and measuring personality and virtue, but the goals of these strategies are not necessarily the same. Building on recent research on the technology of skill formation (Cunha and Heckman, 2007) and habit formation (Pollak, 1970, 1976; Becker and Murphy, 1988) traits that influence virtuous practice can be developed by imitation, practice, teaching, and investment, including mentoring. Economics offers a fruitful framework for conceptualizing and measuring personality and the practice of virtue and how they are fostered.

Economists venture into the study of preference formation. We describe economic models examining how preferences are formed. Economists study the process of habituation and preference formation that provides a formal framework for interpreting and operationalizing Aristotle's ideas on learning.

The flow of the rest of the chapter is as follows. In Section 2, we define personality and virtue. In Section 3, we discuss how the study of personality is integrated into economics. In Section 4, we introduce the model of choice. Sections 5 and 6 present measures of preference and personality, respectively. Section 7 discusses how virtue develops over the life cycle and Section 8 presents evidence from specific interventions designed to promote personality and cognition. Section 9 examines experimental evidence on how economic preferences and personality develop over the lifecycle. Section 10 examines the issue of development using longitudinal and cross-sectional data. Section 11 concludes.

2 Defining Virtue

We consider the practice of virtue as influenced by personality traits. The following definition of personality traits is widely cited in personality psychology.

"Personality traits are the relatively enduring patterns of thoughts, feelings, and behaviors that reflect the tendency to respond in certain ways under certain circumstances." —Roberts (2009), p.140

However, measured personality may evolve over lifetimes (as we document below) and may depend on circumstances of measurement, so Robert's definition is incomplete.

Robert's definition is not consistent with that of Aristotle who views virtue as a practice that can be cultivated. For Aristotle, virtue for an adult has the following five properties: (1) It is a relatively stable interrelated set of dispositions (precisely how stable it should be and in what situation is a matter for inquiry); (2) This disposition guides feeling, thinking, acting, and conceiving of one's situation; (3) It is admirable (to whom is a matter of debate); (4) It is beneficial to the agent and to society (self-sacrificing altruism is often perceived to be a virtue); (5) Furthermore, it is often assumed that virtue is widely applicable across an individual's life. It is "enduring" over activities at a point in time and over time. However, virtue can be cultivated, especially for the young, but not just for them.

For some, virtue is automatic: a person does not deliberate about virtuous acts. In Meno, Socrates argues that, while virtue can be taught, no one (at least in the Athens of his day) can do so. In that context, it is a gift of God. This is not, however, a consensus view, and Aristotle builds upon it. Deliberation and action are integral parts of the pursuit of the virtue of a worthy goal.[1]

3 Integrating Personality Psychology and Economics

Personality traits, including the traits that produce self-control, predict many behaviors sometimes with the same strength as conventional cognitive traits (see the evidence in Almlund et al., 2011 and Heckman et al., 2021). Economic analysis reveals basic identification problems that plague measurement in psychology. By this point, we mean that it is often challenging to find empirical counterparts to theoretical concepts. Our analysis shows that,

at an empirical level, traits are not easily identified separately from behaviors because multiple traits, as well as incentives affect behaviors. This finding challenges standard practice in psychology–that equates long run behaviors with traits.

3.1 An Economic Model of Personality and Its Implications for Measurement of Personality and Preference

Almlund et al. (2011) propose a framework in which personality depends on agent preferences, constraints, and expectations about uncertain events which account for the role of chance. Agents perform tasks with productivity P_j, $j \in \{1, \ldots, J\}$. "Productivity" is a general notion—performance on tasks, such as tests, in a workplace, at home in mothering, or observer reports of efficacy. All measurement systems in psychology are based on performance on various tasks, including IQ tests.

At a point in time, the productivity on task j depends on the "traits" of agents represented by $\boldsymbol{\theta}$, and the "effort" they expend on the task, $\boldsymbol{e_j}$:

$$P_j = \phi_j(\boldsymbol{\theta}\ , \boldsymbol{e_j}), \quad j \in \mathcal{J} = \{1, \ldots, J\}\ , \boldsymbol{e_j} \in \mathcal{E}, \boldsymbol{\theta} \in \boldsymbol{\Theta}. \tag{1}$$

Traits are thought of as endowments. $\boldsymbol{\theta}$ in this interpretation is viewed as the characteristics that agents manifest in all situations, but these characteristics do not necessarily operate with the same strength in all situations. $\boldsymbol{\theta}$ plays an important role in what follows. It is a capacity or capability to act. It can change with age, investment, and practice as we discuss below. For a trait to have an effect, effort $\boldsymbol{e_j}$ is required. If applied in one task, it may be less readily available to be applied in other tasks (Baumeister and Tierney, 2011). Formally, $\sum_{j=1}^{J} \boldsymbol{e_j} = \bar{\boldsymbol{e}}$, where $\bar{\boldsymbol{e}}$ is the endowment of total effort and $\boldsymbol{e} = (\boldsymbol{e_1}, .., \boldsymbol{e_j})$.

Notice that $\boldsymbol{\theta}$ can be a vector. The components of $\boldsymbol{\theta}$ produce the measured behaviors psychologists call traits. Most behaviors depend on multiple components of $\boldsymbol{\theta}$. That is one reason why it is difficult to operationalize Roberts' definition because there is no one-to-one

mapping between $\boldsymbol{\theta}$ and behaviors. Preferences and goals also shape effort by valuing output and effort. These attributes are central features of "social-cognitive" theories of personality as in Bandura (1999) and Mischel (1968). In Aristotelian ethics, worthy goals play a central role in characterizing virtue.

Preferences capture the notion of "goals." Direct value might be attached to the productivity in tasks arrayed in vector $\boldsymbol{P} = (P_1, \ldots, P_J)$ and to outcomes $\boldsymbol{X}$, resulting from productivity and effort: $(\boldsymbol{X} = \boldsymbol{\Lambda}(\boldsymbol{P}, \boldsymbol{e}))$.

The basic preference parameters for the agent's utility are $\boldsymbol{\psi} \in \boldsymbol{\Psi}$. "Utility" U need not necessarily be associated with "happiness" or the pursuit of any material reward. It need not fit into a Benthamite schema. It may depend on ethical goals (intentions) of interest in themselves. U characterizes personal motivation from whatever sources. $\boldsymbol{\psi}$ motivates choices made (behaviors). It may be shaped by mental states, including intentions. Formally, we write preferences as

$$U\left(\boldsymbol{X}, \boldsymbol{P}, \boldsymbol{e} \mid \boldsymbol{\mathcal{I}}, \boldsymbol{\psi}\right), \tag{2}$$

where $\boldsymbol{X}$ is the flow of outcomes that result from actions and $\boldsymbol{\mathcal{I}}$ is the information that agents act on in an uncertain and ambiguous world. Effort $\boldsymbol{e}$ may be valued as an end in itself as in striving. "Flow" may be valued as an end in itself (Csikszentmihalyi, 2008). Outcomes $\boldsymbol{X}$ depend on $\boldsymbol{P}$ and $\boldsymbol{e}$, but each may be separately (or jointly) valued if agents value outcomes associated with e. Striving – trying to beat the odds or achieve a goal – may be on end in itself. A person may value actions if they come to no good ends.

Preference specification (2) captures the notion that (a) agents have preferences over outcomes ($\boldsymbol{X}$) which may be ordinary material goods or virtuous practices; (b) agents may value the output of tasks in their own right $\boldsymbol{P}_j$ (the output of the action, examples would be acts of charity); and (c) agents may value the effort $\boldsymbol{e}$ devoted to tasks ("doing good deeds"). In models where the act of striving plays a primary role, $\boldsymbol{e}$ is the main focus.

In this notation, **personality traits** are components of $\boldsymbol{e}$, $\boldsymbol{\theta}$ and $\boldsymbol{\psi}$ that affect behaviors. Agents seek to attain the highest possible values of U. We observe behaviors influenced by

these components.

Actions taken by agents are the basic data of psychology. In virtue ethics, self understanding of actions and deliberations are central features involving motivations, intentions, and reflections.

It is useful to refine the preceding model by introducing actions taken. We also introduce the notion of *situations* (see, e.g., Mischel, 1968). Situations are indexed by $\boldsymbol{h} \in \mathcal{H}$. They define the context in which actions are taken. For a person with traits $\boldsymbol{\theta}$ and effort vector $\boldsymbol{e_{i,j,h}}$ for person i on task j in situation $\boldsymbol{h}$, action functions are defined to depend on situation $\boldsymbol{h}$:

$$a_{i,j,h} = \nu_{i,j}(\boldsymbol{\theta}, \boldsymbol{e_{i,j,h}}, \boldsymbol{h}). \tag{3}$$

Actions are taken guided by their impacts on U. Productivity on a task for person i (suppressing the "i" subscript) is

$$P_{j,h} = \tau_j(a_{1,j,h}, ..., a_{K_j,j,h}) \tag{4}$$

where, in this notation, K_j actions are taken to produce $P_{j,h}$. More generally,

$$P_{j,h} = \tau_j(\boldsymbol{\theta}, a_{1,j,h}, ..., a_{K_j,j,h}, \boldsymbol{h}).^2 \tag{5}$$

Failure to control for situations $\boldsymbol{h}$ and effort, inhibits identification of traits using measures of actions, productivities, or outcomes. Let $\boldsymbol{T} \in \boldsymbol{\mathcal{T}}$ be the vector of traits $(\boldsymbol{\theta}, \boldsymbol{\psi}, \bar{\boldsymbol{e}})$. The solution to the general decision problem of maximizing well-being is to pick outcomes $\boldsymbol{X}$, situation $\boldsymbol{h}$, action $\boldsymbol{a_{i,j}}$, and effort $\boldsymbol{e_j}$, $j \in \{1, \ldots, J\}$ subject to the constraints. Under some interpretations information sets are selected through exploratory activity. $\boldsymbol{h}$ is fixed if the situation is forced on the agent.

Equating output on a task $P_{j,h}$ conceived of as an **"enduring behavior"**, with a trait runs into three problems: (1) It fails to control for the $a_{i,j,h}$; (2) It does not control for

situations $\boldsymbol{h}$; and (3) $\boldsymbol{\theta}$ is a vector. As a consequence of (5), no single component of $\boldsymbol{\theta}$ can be attributed to the outcomes they determine. Similar issues arise in using any action $a_{i,j,h}$ or outcome $\boldsymbol{X}$ to identify $\boldsymbol{\theta}$. $\boldsymbol{\theta}$ is a vector; $\boldsymbol{e}$ may vary across people and situations may affect actions taken. People may express different behaviors and take different actions depending on their trait endowments, constraints, information and situations. In philosophy, only the actions undertaken with reflection and deliberation in pursuit of worthy goals are the data of virtue ethics (Callard, 2022). Some actions may be moral actions, but other actions may not be.

4 Integrating Virtue into the Economists' Model of Choice

We now elaborate on the ideas developed in the preceding section starting with the basic choice model of economics. We focus on self-control as an essential aspect of Aristotelian virtue ethics.[3]

4.1 Basic Choice Model

This subsection reviews the basic ideas in the standard model of choice in economics and to examine its suitability for the study of virtue ethics. It is a framework that can be used to discuss self-control and virtue more generally. Much current work in economics involves relaxing the assumptions used in this model. We start by considering choices made at a point in time under perfect certainty, which we later relax. We consider issues of intertemporal decisions and decisions under uncertainty in an appendix. The language we develop applies to these contexts, but for simplicity, we start with the basic model.

Agents are assumed to have preferences over a set of vectors of possible choices of outcomes $\boldsymbol{X} \in \boldsymbol{\mathcal{X}}$. We could also analyze preferences over $\boldsymbol{P}$ and $\boldsymbol{a}$, but its clear from what follows how to proceed in those cases.

A numerical value of $\boldsymbol{X}$ describes the set of choices an individual makes. The feasible choices that persons can make depend on $\boldsymbol{\theta}$, actions, and efforts of agents. $\boldsymbol{X}$ is K-dimensional, $\boldsymbol{X} = (X_1, \ldots, X_K)$, where the subscripts refer to a particular type of choice (e.g., X_1 is the performance of a public service). Economists conceptualize goals in terms of "utility" maximization. This idea means that each choice is associated with a "utility" function of the form of Equation (2) formally:

$$U(X) : R^K \rightarrow \boldsymbol{X} \in \boldsymbol{\mathcal{X}}.^4 \tag{6}$$

Utility can be internal satisfaction with ethical behavior or eudaimonic happiness.

Not all choices in a possible set may be feasible for an individual. An obvious example involves consumption; one's wealth delimits one's possible bundles of goods to consume. Hence one needs to couple (2) with a constraint set

$$\boldsymbol{\Omega} \subseteq \boldsymbol{\mathcal{X}}. \tag{7}$$

Different virtuous acts may be mutually exclusive given constraints, faced by agents. The utility function, coupled with the constraint set, play central roles in economic analyses of decision making. If the utility of a vector of choices has maximal utility among those that are feasible, it is chosen.

A longstanding literature, crystallized in Debreu (1959), gives conditions on how to construct a utility function from preferences over possible choices. In interpreting the utility function, it is important to remember that comparisons of different outcomes are the primitives from which the function is derived. The idea is that (under certain conditions), an agent's rankings of their possible choices can be represented as if they assigned a level of utility, i.e., a number, to each choice if one choice has a higher number than another that is equivalent to its being preferred.

In neoclassical economics, utility functions are derived on assumptions that are sometimes

interpreted as requirements of rationality. Examples include transitivity, i.e., if a is preferred to b and b is preferred to c, then a is preferred to c. Another example is independence of irrelevant alternatives (IIA), if a is preferred to b, this preference is not changed by the feasibility or infeasibility of choice c. It is by no means clear that these preference restrictions are in fact sensible requirements of definitions of rationality.

IIA, for example, rules out context-dependent preferences. Efforts to axiomatize the prospect theory of Kahneman and Tversky (1979) or other behavior alternatives to classical utility theory also follow the strategy of deriving functions from assumptions on preferences. Some of this work attempts to axiomatize different types of altruistic or ethical preferences. An example of the latter is Cherepanov et al. (2013), who axiomatize warm glow preferences, which refers to the idea that a person derives utility from an action such as giving to charity, in a way that the level of giving does not affect the utility as opposed to the act of giving itself. For our purposes, axiomatization is not a main interest since the axioms typically assume the ethical behavior that one is interested in.

As a numerical representation of an underlying preference ordering, the utility function does not directly speak to *why* an agent prefers one set of choices to another. If a person spends much time on parenting and little on teaching, it may be because the person enjoys parenting relative to teaching or because they feel morally obliged to do so.

In thinking about virtue, one special case of interest is that of lexical preferences, where an agent prefers, say, X_1 above everything else. In other words, an agent always chooses X_1 without regard for the other elements of $\mathcal{X}$. This class of preferences does not produce the standard utility function representations commonly used in economics but is accommodated within the general theory. Lexical preferences describe preference hierarchies. Thus, suppose that $\tilde{\geq}$ denotes preference ordering. The hierarchy is $1\tilde{>}2\tilde{>}...\tilde{>}K$, meaning activity "1" is preferred to "2" and "2" to "3," etc. Lexicality means that there is no tradeoff between "1" and "2." No amount of "2" compensates the utility loss from surrendering any or all of "1." Aristotelian scholars define virtue without reference to physical pleasures alone. Moral

preferences take this form. No person has a price. We could also have a mixed preference system:

$$U(\cdot) = U(\underbrace{X_1, \ldots, X_J}_{\text{Lexical}}, \underbrace{X_{J+1}, \ldots, X_K}_{\text{Usual Outcomes}}). \tag{8}$$

Bundles constructed from $X_1, \ldots, X_J$ may be valued lexically, i.e., a bundle of traits is required with no tradeoff against the bundle being valued.

Outcomes "1" through "J" are lexically ordered, but outcomes with subscripts $J+1$ or higher can be traded off against each other but not against the lexically ordered outcomes. This point justifies deontological beliefs about outcomes $1, \ldots, J$. One could also imagine as another case that the moral outcomes $(X_1, \ldots, X_J)$ can be traded off among each other but not with the usual goods. As a group, moral outcomes are lexical compared to the usual outcomes. This formulation would allow for the existence of a set of moral values that trump pleasure considerations associated with the other outcomes while acknowledging that choices may involve tradeoffs among themselves. Again, the agent prefers more of each argument, i.e., U is increasing in each argument.

Lexical preferences impose a constraint on the way a person orders the world. Thus "thou shalt not kill" is a constraint on behavior that may govern all choices. At no price will I kill ("life" is thus a lexical argument of utility).[5,6] Although outcomes (or bundles of outcomes) may be lexically ordered, actions may not be. Callard (2022) argues that Aristotle would rule out lexical preferences on actions, even though he may admit lexical preferences on outcomes. Agents may value outcomes so highly that they might take actions they abhor. Murdering an intruder to protect your family is an example.

In economics, some define self-control by comparing the utility of actual choices with utility maximizing choices. In a two-choice example, the "temptation" for outcome X^1 is the alternative X^2. The self-controlled person resists temptation. This may be a component of virtuous practice, but such struggles do not characterize a virtuous man in Aristotelian

ethics. Virtue does not arise from any effort of resistance, but instead from a practice of pursuing a worthy goal. Standard economics accommodates the notion of tradeoffs. Indeed, it assumes that the agent resists the temptation unless it produces the same level of utility. This is a trivial case of self-control, but we would still call it self-control because it attains the highest end against other alternatives (temptations). Each possible alternative choice is a temptation that is feasible.

Notice that $U(\boldsymbol{X})$ allows for *multiple outcomes*. A person may want more of each argument of $\boldsymbol{X}$, but resources may be finite or the choices may be exclusive. Suppose that $\boldsymbol{X} = (X_1, X_2)$ where X_1 denotes time devoted to parenting and X_2 denotes time devoting to teaching. Total time available is T. The constraint set is

$$X_1 + X_2 = T, X_1 \geq 0, X_2 \geq 0 \tag{9}$$

if time is divisible. If time is indivisible, then the feasible set (X_1, X_2) has two elements:

$$\{(T, 0), (0, T)\}. \tag{10}$$

A person can do one or the other but cannot do both. For either constraint set, we have a tradeoff between being a good teacher or a good parent. Being a good parent may be a component of the lexical system.

A conventional way of formulating the constraint set is to consider the cost $C(\boldsymbol{X})$ of each vector of choices.

$$C(\boldsymbol{X}) = \boldsymbol{Q}'\boldsymbol{X} \tag{11}$$

where $\boldsymbol{Q}$ is the unit price: how much a unit of each $\boldsymbol{X}$ costs. If outcomes (goods) are divisible, then the constraint set takes the form

$$\boldsymbol{Q}'\boldsymbol{X} = Y \tag{12}$$

where Y can be income, wealth, time, etc., depending on the context. Indivisibilities can mean that tradeoffs are no longer linear between the elements of $\boldsymbol{X}$. If $Y = 1$ and $C(\boldsymbol{X}) = X_1 + X_2$ then X_1 and X_2 can each be 0 or 1 but not both.

The agent can want each argument of $\boldsymbol{X}$ but cannot have all of them in indefinite amounts because of (12). The price vector $\boldsymbol{Q}$ characterizes the budgeting tradeoff: how much more of one goal causes the agent to have less of the other goal. In our example, the "price" is 1 (since time is being allocated between the two activities), and the X_1 and X_2 have binary values (0 or 1).

There is also a *utility tradeoff*. While prices describe tradeoffs with respect to the overall budget set, $U(\boldsymbol{X})$ characterizes how changes in the elements of $\boldsymbol{X}$ differentially affect utility. The standard problem in economics is

$$\max U(\boldsymbol{X}) \text{ subject to } C(\boldsymbol{X}) \leq Y. \tag{13}$$

These considerations might be applied to ethical choices, but the notion of tradeoffs is not to be found in Nicomachean ethics (Callard, 2022).

4.2 Extending the Standard Choice Model to Consider Self-Control

One class of self-control failures can be understood as occurring when an agent makes a feasible choice other than the solution to (13). We use the standard economic model to extend Aristotle's analysis to consider tradeoffs among realized goals. We consider only outcomes $\boldsymbol{X} \in \mathcal{X}$. Analysis of other components of the models discussed $(\boldsymbol{a}, \boldsymbol{e}, \boldsymbol{P}, \boldsymbol{\psi})$ could be patterned after this analysis. Failure of self-control can lead to a deviation of a choice from the optimum; but a deviation of a choice from the optimum can arise from reasons other than lack of self-control. An obvious example is nonoptimal choices made because of chance events or mistakes, e.g., my hand trembles and I push the wrong button or I err in multiplying some numbers in comparing monetary payoffs. A key question is how to

distinguish between temptation and mistakes. This situation is where salience can come into play. Identification of the reasons for deviations from the solution to (13) may differ if caused by salience rather than by various types of cognitive errors.

A special form of preferences is useful for our discussion. Consider outcome space. Persons may have "ideal points" $\bar{\boldsymbol{X}}$. These are goals in the sense of Aristotle. They are desired values that may be determined by ethical precepts. The ideal points may also depend on context $\boldsymbol{h}$ (social networks) and the same factors that influence $\boldsymbol{X}$ as previously described. Below we describe how $\bar{\boldsymbol{X}}$ can be the limit state of a virtue accumulation/habit formation process.

An explicit form is useful. Write utility in terms of departures from ideal points $\bar{\boldsymbol{X}}$:

$$U(\boldsymbol{X}, \bar{\boldsymbol{X}}) = \boldsymbol{a}'(\boldsymbol{X} - \bar{\boldsymbol{X}}) + \frac{1}{2}(\boldsymbol{X} - \bar{\boldsymbol{X}})'\boldsymbol{B}(\boldsymbol{X} - \bar{\boldsymbol{X}}), \tag{14}$$

where $\boldsymbol{B}$ is a symmetric negative definite matrix.[7] In Aristotelian ethics, $\bar{\boldsymbol{X}}$ is the ethical goal of an agent specified by his/her reflective preferences. In economics, $\bar{\boldsymbol{X}}$ is usually taken as given externally. In a two-outcome world ($\boldsymbol{X} = (X_1, X_2)$), $\boldsymbol{a}$ and $\boldsymbol{B}$ are generated by preferences and traits of agents and might also depend on $\mathcal{I}$ in (2).

$$\begin{aligned} U(\boldsymbol{X}, \bar{\boldsymbol{X}}) = a_1(X_1 - \bar{X}_1) + a_2(X_2 - \bar{X}_2) + \frac{1}{2}b_{11}(X_1 - \bar{X}_1)^2 \\ + \frac{1}{2}b_{22}(X_2 - \bar{X}_2)^2 + b_{12}(X_1 - \bar{X}_1)(X_2 - \bar{X}_2), \end{aligned}$$

where, to guarantee unique best decisions, $b_{11} < 0, b_{22} < 0$, $b_{11}b_{22} - b_{12}^2 > 0$ are required.[8] The marginal benefit of X_1 (the effect on utility of a small change in X_1) is

$$\frac{\partial U(\boldsymbol{X}, \bar{\boldsymbol{X}})}{\partial X_1} = a_1 + b_{11}(X_1 - \bar{X}_1) + b_{12}(X_2 - \bar{X}_2), \tag{15}$$

where "∂" denotes a partial derivative. ∂ considers small increments in X_1 holding everything

else constant.

Larger values of a_1 and b_{11} generate greater marginal benefit if $X_1 < \bar{X}_1$. As agents get beyond their ideal points, more X_1 has lower marginal value. $b_{12} > 0$ arises from complementarity. If $b_{12} > 0$, more of good X_2 above the ideal point raises the marginal valuation of goal 1, if $b_{12} < 0$, more of X_2 reduces the marginal benefit of X_1. The $\boldsymbol{a}$ and $\boldsymbol{B}$ coefficients characterize tradeoffs in preferences. The farther the agent is from the goal $\bar{\boldsymbol{X}}$ (on either side), the more negative the term $\frac{1}{2}(\boldsymbol{X} - \bar{\boldsymbol{X}})'\boldsymbol{B}(\boldsymbol{X} - \bar{\boldsymbol{X}})$.

The coefficients of the model give directionality to different departures from the ideal point. The model gives a vector version of Aristotle's principle of the golden mean: excess in either direction is disfavored. In our understanding, Aristotle does not consider vectors of goals or tradeoffs among them. Thus, (14) and (15) represent a generalization of Aristotle. If $a_1 > 0$ and $a_2 > 0$, more of each outcome is preferred, even above the value of the ideal point. A pure ideal point model sets $a_1 = 0$ and $a_2 = 0$. Then departures from the ideal point on either side cause a loss of well-being. Utility does not have to be monotonically increasing in the choices.

The ideal point model provides a metric (14) to compare the costs of self-control and virtue failures along different dimensions. Notice that there are multiple "self-control" problems depending on which argument of $\boldsymbol{X}$ we are looking at. Agents often choose values of $\boldsymbol{X}$ less than the ideal point values because resources are limited and agents cannot have it all. There are two tradeoffs: in the constraints and in the preferences. Because of limited resources, goals may need to be traded off.

Focusing on $\boldsymbol{X}$ obscures a more complex choice process in which agents choose $\boldsymbol{e}$, $\boldsymbol{h}$ and $\boldsymbol{a}$ that generate $\boldsymbol{X}$. They may also cultivate $\boldsymbol{a}$ and $\boldsymbol{B}$. For the sake of simplicity, we only work with $\boldsymbol{X}$ in this chapter.

4.3 Choice and self-control

This section[9] provides some interpretations of self-control failures from the vantage point of the baseline choice model. We interpret self-control failure as a departure from virtue.

4.3.1 Self-Control Failures as Optimization Failures

One class of self-control failures can be understood as occurring when an agent makes a choice other than the solution to (13). This is a situation can occur because of temptation. As previously noted, failure of self-control can lead to a deviation of a choice from the ideal point; but a deviation of a choice from the ideal point can arise from reasons other than lack of self-control. A key question is how to distinguish between temptation and simple mistakes. This is a situation where the idea of salience comes into play. Identification of the reasons for deviations from the solution to (13) may differ if caused by salience than by various types of cognitive errors.

The choice problem described by (13) treats all choices as equally salient. Some argue that one reason why choices can deviate from those that maximize utility is that inferior choices are more salient than optimal ones. We are not aware of a standard definition of salience in economics, although the term is used often in the behavioral economics literature. What seems key (and corresponds to our intuitive definition) is that some choices come more readily to mind than others and so it is evident that the choice problem we have described does not have a role for salience, which of course leads to the question of how one might extend the framework to account for salience. One possibility is to contrast "true" preferences $U(\boldsymbol{X})$ with salient preferences $S(U(\boldsymbol{X}))$. To say agent choices are influenced by salience means that they act on the basis of $S(U(\boldsymbol{X})) = S(\boldsymbol{X})$. If there are choices that are feasible but fail to come to mind, this is equivalent to the restriction that S zeros out components of $\boldsymbol{X}$ for those choices. Alternatively, one could imagine an individual-specific salience function, $S(\boldsymbol{X}, \boldsymbol{Z_i})$ where $\boldsymbol{Z_i}$ denotes some set of characteristics of agent i. This function can, for example, generate status quo bias. The idea would be that past choices are elements of $\boldsymbol{Z_i}$

and the function $S(\boldsymbol{X}, \boldsymbol{Z_i})$ is smaller for values of $\boldsymbol{X}$ that have yet to be tried.

With reference to the model that has been sketched, one can imagine different ways of embedding salience in a positive theory of choice. For example, it could be that one introduces an additional constraint set $\boldsymbol{\Omega'}$ such that $\boldsymbol{\Omega'} \subset \boldsymbol{\Omega}$ (i.e. $\boldsymbol{\Omega'}$ is a strict subset of the original constraint set) that identifies choices that are sufficiently salient to represent candidates for actual choices. This case may be too artificial because it treats salience as a 0-1 variable. Salience can also be incorporated as arising from uncertainty. What one knows, one values. As one departs from what one knows, the valuation is less because the utility is down-weighted. (This view is a version of expected utility theory where expectations are formed over the goods that one knows, say through experience.)

4.3.2 Self-Control and Virtue Failures and Reflective Preferences

A second type of self-control and virtue failure involves the choice of function that is used in (13). Reflective preferences may be thought of as inducing a utility function $R(\boldsymbol{X})$ which may or may not coincide with $U(\boldsymbol{X})$ that an agent in fact uses. Reflective preferences are those that arise from an agent's consideration of choices. The moral self may operate on $R(\boldsymbol{X})$. This captures the process of deliberation central to Aristotle's virtue ethics. This consideration leads to empirical identification issues as well. If $R(X)$ leaves no trace in behavior, how can we determine it? We can write down an $R(\boldsymbol{X})$ without identifying it from data. One could in principle ask whether behaviors are consistent with an a priori $R(\boldsymbol{X})$. But many utility functions may be consistent with the data; in particular, there may exist utility functions that do not embody reflective preferences that are observationally equivalent to $R(\boldsymbol{X})$. We could ask people questions, such as "what do you think of your decision/life choices?" to determine $R(\boldsymbol{X})$. But observing only the actual choice adds no information about $R(\boldsymbol{X})$ or $S(\boldsymbol{X})$. So, asking people about their preferences may be a good source of information. It seems to be the only way to pin down regret. Other models of regret compare expected outcomes with actual outcomes (Cunha and Heckman, 2016) but

implicitly assume agents have common preferences over both types of outcomes.

Philosophers raise the issue of *akrasia*, or weakness, as a type of self-control failure (see Kraut, 2022). Focusing on what is called synchronic akrasia: an agent voluntarily chooses the less desirable option even when a more desirable option exists (Marshall, 2010). Synchronic akrasia in the context of self-control failure could be interpreted as a situation where an agent might conclude that option A offers short-term benefits while choice B provides more utility (valued by either set of preferences) in the long run. Despite this, they may still opt for choice A. The conflict concerns whether to follow one's expectation of long-term good or in accordance with ones judgment of short-term good. If this type of failure occurs, it suggests the possibility that an agent is aware of his/her reflective preferences at all times, but sometimes fails to act according to them. If this situation is so, then the agent takes an action knowing, at the time he acts, that it is not optimal for him, from the dimension of his reflective choices. He therefore makes a choice that he regrets at the time he makes the choice, if regret is measured using $R(\boldsymbol{X})$. To be concrete, one can imagine a person who is on a diet thinking, while eating a jelly donut, that he should not be doing it. In other words, a person can believe that he should act in conjunction with $R(\boldsymbol{X})$ and be aware that he is not doing so. Relative to our formulation of preferences, one possibility is that akrasia involves maximizing over a utility function that shuts off some of terms that appear under reflective preferences or distorts the reflective utility function in such a way that the influence of certain terms is minimized. This idea adds something new to a discussion of why individuals fail to choose what is best for them, because the reflective preferences continue to be in the agent's mind at the time of choice.

To flesh this point out, suppose that an agent has two sets of preferences, $NR(\boldsymbol{X})$ and $R(\boldsymbol{X})$, one set is nonreflective (i.e., constitutes preferences that are a consequence of akrasia) and the other reflective. Following our earlier discussion, let $U(\boldsymbol{X})$ denote the preferences on which the agent in fact acts. A self-controlled person is one where $U(\boldsymbol{X})$ always equals $R(\boldsymbol{X})$. Periodic failures of self-control mean choices sometimes come from maximizing $R(\boldsymbol{X})$ subject

to constraints and sometimes come from maximizing $U(\boldsymbol{X})$ subject to constraints, that is, the operational set of preferences $U(\boldsymbol{X})$ fluctuates between the reflective and nonreflective utility functions. And of course, there is the third possibility that an individual always makes choices based on $NR(\boldsymbol{X})$, nonreflective preferences. Obviously, if an agent always follows the reflective or the nonreflective preferences, then the issues of observational equivalence we have discussed arise; how can one tell if an agent follows one or the other? However, if there is shifting between the two, this situation might provide additional information. This case also says something about the meaning of regret. If agents always follow their nonreflective preferences, they do not experience regret in the way they would if, they currently follow reflective preferences but have followed nonreflective preferences in the past.

As mentioned above, it would seem that survey evidence is key in thinking about akrasia and regret. We end this discussion with a concern about survey evidence and regret. It is known that 90% of smokers regret having started. What do we do with that? It is possible that these smokers would make the same choice over and over again because there is *ex post* and *ex ante* regret.[10] The interpretation of survey data on regret requires hard thinking about identification, something so far not seen in the economics literature. It is also possible that we will want to think about the sorts of questions that would be most useful for uncovering self-control failures.[11] Additional discussion of consistency in dynamic choice is in Appendix A.[12]

5 Measures of Economic Preferences

We define preferences in equation (2), and personality traits as $\boldsymbol{\theta}$ in our framework. We now consider how economists and psychologists define different preferences and traits and how they measure them.

Economists study how preferences and constraints affect choices made by economic actors. Economists interpret personality traits as determinants of actions taken to be a type of

preference; in the same way that an individual has a preference between eating apples or oranges, they also possess preferences regarding what gambles they deem acceptable, what decisions they perceive as fair, and how much they are willing to trust others. Economists measure the traits of interest in a number of manners. These traits can be captured using direct assessment through economic "games" and tasks or through survey measures that can be either self-reported or reported by others based on observation. The correlation of different measures to lifetime outcomes is also of particular interest. The following subsections review some of the main preferences and traits of interest to economists.

5.1 Risk Preference

Risk preference deals with the ability to make choices when the outcomes are probabilistic in nature. That is, what decisions do individuals make when the outcome of the choice is uncertain at the time of the decision? Since uncertainty is present in many facets of life, analyzing the many different ways that individuals approach risky decisions can lead to a better understanding of the way that they interact with the world.

In the laboratory, risk preference is typically assessed by asking individuals to make choices over gambles such as choosing between a coin flip and a certain payment or choosing between gambles over different stakes. Empirically, these studies often find that many participants will elect to pay a premium in order to minimize their exposure to risk. Choices made in these laboratory experiments are taken to be a manifestation of a general tolerance for taking risks. Risk preferences have also been consistently measured using qualitative self-assessments of general risk tolerance. They are typically measured by asking how much individuals agree with a statement such as "In general I am willing to take risks" (Falk et al., 2018). It has been suggested that this qualitative assessment may actually be more predictive of other behaviors outside the lab.

5.2 Loss Aversion

Loss preference addresses similar questions to risk preference, but focuses specifically on gambles that include the possibility of suffering a loss. In practice, loss preference is typically referred to as loss aversion, as it has been consistently shown that many individuals will go to greater lengths to avoid the possibility of loss when compared to making choices over equally sized gains. As many risky choices outside of the laboratory involve the possibility for both loss and gain, assessing choices when the potential for loss is present is important and distinct from assessing tolerance for risk when only gains are possible.

Loss aversion is usually measured in a similar fashion to risk preference with individuals making choices between a number of gambles but, in the case of measuring loss preference, each choice involves some chance for loss.

5.3 Ambiguity Aversion

Ambiguity preference is also associated with risk preference. Whereas risk preference assess decisions made over known probabilities, ambiguity preference analyzes decisions made when the stakes of each choice are unknown. This distinction is the difference between betting on a coin flip versus betting on a random draw from an opaque container holding an unknown distribution of balls. In the former case, the chance of a given outcome occurring is known to be 50%, whereas in the latter case the probability of a given outcome is unknown. As in the loss case, most individuals empirically appear to dislike ambiguous outcomes, paying a premium to receive a less ambiguous outcome. Thus, this preference is often termed ambiguity aversion.

Ambiguity aversion is typically assessed using similar tasks to those used to measure risk preference. In these cases, the probability of each outcome is unknown to the decision maker.

5.4 Time Preference

Time preference asks questions about the ability to delay gratification. It involves investigation as to what circumstances will lead individuals to forgo benefits at an earlier date to receive greater benefit at a later date. A related concept is that of present bias, which is the observation that for many individuals the effective difference between the present and a later date is larger than the difference between two future dates with the same time delay.

Time preference is measured in the laboratory by asking participants to make choices between receiving a smaller benefit at an earlier date versus receiving a larger benefit at a later date. To disentangle present bias from other time preference, participants are usually asked to make choices between the present and a later date as well as choices between two different later dates. Time preferences are also commonly assessed with self-reported qualitative measures including asking how much individuals agree with statements such as "I tend to postpone tasks even if I know it would be better to do them right away" and "I am willing to give up something that is beneficial for me today in order to benefit more from it in the future."

5.5 Altruism

Certain economic preferences relate to interpersonal behaviors. The trait of altruism looks at how willing individuals are to give up their own benefits in order to provide benefits to others. Altruism specifically looks at the choices that are made when the participant receives nothing in return for helping someone else. This relates to understanding why individuals participate in volunteer work or give to charity.

In the laboratory, altruism is often measured using the **Dictator Game**. The subject is provided with the opportunity to take either a large benefit for themselves or take a smaller benefit to themselves in order to give a benefit to someone else. Altruism can also be assessed qualitatively. It may be assessed by asking how much individuals agree with a statement such as "If I get nothing in return, I am willing to share with others."

5.6 Trust

Another interpersonal trait is that of trust. The economic conception of trust assesses how willing individuals are to let someone else determine how much of a benefit they will receive in a given situation.

Trust is usually measured with the **Trust Game**. In this task a subject is given a certain endowment and then is given the opportunity to transfer any amount of that endowment to a second person. The second person receives a payment that is determined by the amount sent by the first person multiplied by some factor. The second person may then send any amount back to the first person. The amount of the endowment sent by the first person is taken to be a measure of how trusting they are. Trust is also measured qualitatively. Individuals may answer how much they agree with a statement such as "I assume that people have only the best intentions."

5.7 Positive and Negative Reciprocity

Positive and negative reciprocity refer (respectively) to how willing individuals are to reward someone who has previously treated them kindly or to punish someone who has previously treated them unkindly. These traits involve revenge taking behaviors as well as prosocial behaviors.

Positive reciprocity is usually measured in the laboratory by assessing the decisions of the second player in the **Trust Game**. In particular, how much is the second mover willing to send back when they receive a large payment from the first mover? Negative reciprocity is often measured in the laboratory using results from the **Ultimatum Game**. In this game, one player is given an endowment and they are allowed to share as much or as little of that endowment with the second player as they choose. The second player can either ACCEPT or REJECT the offer. If they accept, both players receive payment based on the agreed upon split. If they reject, neither player receives any payment. Decisions by the second player, particularly when the endowment is not split equally, are taken to be measures of

negative reciprocity. Qualitatively, positive and negative reciprocity may be assessed asking how much individuals agree with statements such as "When someone does me a favor, I am willing to return it" and "I remember when others treaty me unfairly, and will treat them similarly."

5.8 Cooperation

Cooperation is a measure of how well individuals are able to work with each other to produce mutual benefit. Maximizing a joint payoff may involve reducing one's own individual payout. Coordinating actions with others and weighing the good of oneself with the good of the group are valuable interpersonal skills.

Cooperative abilities are measured in the laboratory with coordination games such as the **Prisoner's Dilemma** or a **Public Goods Game**. These games ask players to make private choices that can either prioritize their own payment or benefit the group. Although there are benefits to coordination, players are privately incentivized to deviate from the collective optimum. Behaviors in these games are taken to be representative of how individuals value working with others toward mutual gain.

6 Other Aspects of Human Differences Studied by Economists and Psychologists

In addition to preferences that are derived from the economics literature, economists are also interested in a number of traits measured by other disciplines. The focus of measuring these traits is to understand how they are correlated with the other preferences and to see how their levels and development affect the lifecycle outcomes that economists study.

6.1 Personality

Personality traits as measured by psychologists have received particular interest as these traits have been consistently shown to highly correlate with the other measures and their predictive power for other outcomes suggests they can play an important role in impacting individual economic trends.

The way personality is measured has been debated among psychologists and consequently among economists. The Big Five traits of Openness to Experience, Conscientiousness, Extraversion, Agreeableness, and Negative Emotionality form a taxonomy that is commonly employed by economists. Other taxonomies such as HEXACO (Honesty-Humility, Emotionality, Extraversion, Agreeableness, Conscientiousness, and Openness to Experience) and the Big Three (Neuroticism, Psychotism, Extraversion) have also been utilized by economists to describe human behavior.

Personality traits are typically assessed using questionnaire measures. These traits can either be reported by the participants about themselves or reported by other knowledgeable peers, family members, coworkers, teachers, or supervisors. Short form measures of personality may be as short as 30 questions whereas longer and more in-depth measurement devices (that may also collect information on subdomains in addition to broad top-level domains) can include over 100 questions.

6.2 Executive Function

Another trait economists have begun to study from another discipline is Executive Function (EF) which originated in the study of child psychology. EF refers to the ability to control thoughts, actions and emotions. EF plays an important role in helping to sustain attention, set and reach goals, maintain impulse control, resist distraction, manage frustration, manage consequences, and make plans for the future. EF skills are key for effective task completion and handling change. EF is most often described as having three components: working memory/updating, shifting/cognitive flexibility, and inhibition.

EF skills are measured using task-based assessments. Each assessment is typically focused on measuring one of the three components, so multiple tasks are administered to get a full view of one's EF skills. Common tasks include card sorting games where subjects must remember a set of (changing) rules by which to sort cards; Go-Nogo tasks where participants must inhibit responses to stimuli; and memory tasks with increasing information to remember. In children, EF skills may also be measured by asking teachers or caregivers to answer questions about child behavior.

6.3 Cognitive Skills

All of the traits discussed previously are deemed "noncognitive" by economists. This is in contrast to traits related to cognition, which can include both "fluid" and "crystallized" intelligence. Fluid intelligence refers to reasoning skills and problem solving abilities, while crystallized intelligence is learned knowledge.

Cognitive skills are typically measured with problem-solving assessments. Fluid intelligence may be measured with tasks such as **Raven's Matrices** or other reasoning tasks. In these games, individuals are asked to complete patterns or sequences – reconciling sometimes incomplete information to form a judgement. Crystallized intelligence is measured using assessments such as IQ tests or other standardized tests including the Scholastic Aptitude Test (SAT) and Armed Forces Qualification Test (AFQT). In these assessments the main focus is on recalling learned information.

6.4 Complexity and Adaptation to Change

The ability to break down complex tasks and to find novel solutions is important for effective problem solving. Being able to adapt to changing conditions can be beneficial for managing stressful situations and make choices under pressure.

Complexity is typically measured in the laboratory by presenting participants with multi-part problem-solving tasks and assessing how they find solutions to the problems they are

assessed with. These tasks present participants with changing conditions that present opportunities to update strategies in order to come to an optimal solution.

6.5 Locus of Control

Locus of control is a measure of how much individuals feel their own actions affect the events in their life. It focuses specifically on whether they think their life circumstances are based more on their own individual actions or external forces. Locus of control can affect how and under what circumstances individuals view the efficacy of their actions for making change.

Locus of control is typically assessed using qualitative questionnaires asking subjects to self-report on how they feel about the effects of their actions and others on their life circumstances. Participants may score their agreement with statements such as "Many of the unhappy things in people's lives are partly due to bad luck" and "Peoples misfortunes result from the mistakes they make" (Rosenberg, 1965).

6.6 Self Esteem

Self esteem is a measure of how individuals regard their own worth (Almlund et al., 2011). This attribute relates to how participants feel about their own value and place in society as well as how they relate to others.

Because self esteem is a measure of one's own self-conception, it is measured using self-reported survey measures. Individuals are asked to rate their agreement with questions such as "I feel that I am a person of worth, at least on an equal plane with others" (Rosenberg, 1965).

6.7 Self-control

Self-control refers to the ability to resist temptation, whereas economists typically assume that individuals will always make choices in line with maximizing their utility, it is commonly

observed that individuals do not actually always display this pattern and sometimes make choices that do not line up with maximizing this utility. Sometimes this deviation can be caused by issues with self-control.

7 Processes of Development of Traits

How do preferences, virtue, and character traits evolve? In Aristotelian ethics, these traits can be acquired. We discuss three possible channels of their development.

1. **Ontogeny** (programmed developmental processes common to all persons, including genetic sources (see, e.g, Lee et al., 2018) and **sociogeny** (shared socialization processes).

2. Personality changes through external forces above and beyond common ontogenic and sociogenic processes that operate through alterations in normal biology, such as brain lesions and chemical interventions.

3. Investment, educational interventions, parental investment and peer effects can affect personality throughout the lifecycle.

Economics contributes to a deeper understanding of (14). We first discuss the issues previously discussed in a dynamic setting to set the stage for the study of the evolution of preferences and traits as virtues.

Aristotle writes extensively about the formation of virtue through practice and guidance. As previously noted, this contradicts the interpretation of Plato in Meno that virtue is a gift of God in the sense that no one is able to teach it. Callard (2022) notes that the formation of virtue is an essential aspect of Aristotle's notion of partial virtue which can be perfected through learning by education, mentoring, and practice. This experience-dependent approach is consistent with models of learning of skills in economics. Eventually traits can become perfected and virtuous behavior can become virtually automatic. In the same way

preference $\boldsymbol{\psi}$ can be shaped by habituation and guidance. $\boldsymbol{\theta}$ and $\boldsymbol{\psi}$ can become such powerful determinants of actions that they dominate the influence of effort and situations in shaping actions.

7.1 Dynamics of self-control

We focus on the formation of self-control as an example of a more general model. Take a simple case to illustrate the approach. Consider an outcome X which may be perceived as virtuous. Recall that X depends on $\boldsymbol{P}$, $\boldsymbol{\psi}$, $\boldsymbol{e}$ and $\boldsymbol{\mathcal{I}}$. Let $\bar{X}$ be an ideal self (e.g., an ideal weight, health, ranking in world scholarship). This can be produced by $\boldsymbol{\psi}$ or by non-reflective preferences. It might also depends on context $\boldsymbol{h}$ including social networks to which agents belong. $\bar{X}$ is a scalar (The vector case is straightforward). The current level is X_a. Let $X_a < \bar{X}$, so that agent a falls short of the goal. There is a cost of falling short of the goal.

Suppose that the cost of falling short can be written in deviation form ideal point form:

$$C_U(\bar{\boldsymbol{X}} - \boldsymbol{X}_a)^2, \;\; C_U > 0. \tag{16}$$

Costs may be derived from $R(X)$ or $U(X)$. This ideal point form says, for example, in the case of ideal body weight, being too thin or too fat is not valued as much as being right on target. C_U is a measure of the per unit cost of departure from the ideal in the appropriate evaluation metrics. One can easily relax the symmetry of (16) by making the cost function asymmetric. $\bar{\boldsymbol{X}}$ is the Aristotelian golden mean, now defined for a vector.

Advancing toward a goal in the next period is costly. It takes effort or may cause some other goal to be compromised, or both, consider a scalar case. If one starts at a with X_a it will be costly to move from it. Adjustment is associated with education and intervention. Write the cost of adjustment of a move from X_a to X_{a+1} as

$$C_A(X_{a+1} - X_a)^2. \tag{17}$$

Consider a model of perfect certainty and ignore discounting. If $A = 2$ (a two-period world), the agent in period 0 has initial value X_0. He seeks to maximize his well-being. The total level of well-being over the whole life cycle is

$$\underbrace{C_U(\bar{X} - X_1)^2}_{\text{period 1 well-being}} + \underbrace{C_A(X_1 - X_0)^2}_{\text{cost of adjustment}}. \tag{18}$$

Initial condition X_0 can reflect the accident of birth, genetics, and a variety of family influences.

What is his best course of action? Straightforward calculations show the optimal outcome in period 1 (X_1) is

$$X_1 = \left(\frac{C_U}{C_U + C_A}\right)\bar{X} + \left(\frac{C_A}{C_U + C_A}\right)X_0. \tag{19}$$

The two terms in parentheses sum to 1. The higher C_U relative to C_A the closer is the agent to ideal point $\bar{X}$. The greater the cost of adjustment (C_A) relative to the shortfall (C_U), the greater the shortfall. Constraints in costs affect C_A. This situation may be due to personality traits (e.g., lethargy, etc.). Goals and motivations enter through C_U and $\bar{X}$. With sufficient practice, C_A the cost of attaining virtue may be zero. A truly virtuous person in Period 1 with God-given virtue (effortless attainment) would have $X_0 = \bar{X}$ unless he developed effortlessly in $a = 1$ (after X_0 was determined).

This adjustment model is of distinct interest because it links self-control to the ability to change behaviors and move towards ideal ones as circumstances change. It suggests a link between self-control and the ability to deal with changes in one's environment. Extending the model over multiple periods, for bounded C_A, the model converges to $\bar{X}$ the ideal point.

This simple model conveys the essence of economic models of skill and preference formation. The cost of adjustment C_A is influenced by emotion, the stocks of preferences and skills and many other factors, including those in the environment (cost of schooling, parental warmth), etc.

A more fully developed framework helps to understand the origins of C_A and the link between outcomes $\boldsymbol{X}$ and traits $\boldsymbol{\theta}$.[13] Equation (20) shows how an outcome at ge $\boldsymbol{X_a}$, which may be the performance on a task, depends on cognition $\boldsymbol{Q_a}$, personality $\boldsymbol{\Omega_a}$, other acquired skills such as education and job training $\boldsymbol{K_a}$, and the effort allocated to the task $\boldsymbol{e_{X_a}}$:

$$\underbrace{X_a}_{\substack{\text{Outcome on a}\\ \text{task at age } a}} = \phi_a(\overbrace{\underbrace{Q_a}_{\text{Cognition}}, \underbrace{\Omega_a}_{\text{Personality}}}^{\boldsymbol{\theta}}, \underbrace{K_a}_{\substack{\text{Other}\\ \text{acquired}\\ \text{skills}}}, \underbrace{e_{X_a}}_{\substack{\text{Effort}\\ \text{devoted to}\\ \text{task}}}) \quad a = 1, \ldots, A. \tag{20}$$

Equation (21) shows how the effort allocated to outcome X_a depends on cognition $\boldsymbol{Q_a}$, personality $\boldsymbol{\Omega_a}$, other acquired skills K_a, incentives T_a, and preferences $\boldsymbol{\Psi_a}$:

$$e_{X_a} = \psi_{X_a}(\overbrace{\boldsymbol{Q_a}, \boldsymbol{\Omega_a}}^{\boldsymbol{\theta}}, \boldsymbol{K_a}, \underbrace{\boldsymbol{\mu_a}}_{\substack{\text{Incentives}\\ \text{to perform}\\ \text{on task}}}, \underbrace{\boldsymbol{\Psi_a}}_{\text{Preferences}}). \tag{21}$$

This representation distinguishes preferences from skills, although as previously noted, the two are likely closely related. Both emotion $(\boldsymbol{\Omega_a})$ and reason can affect behavior (Phelps et al., 2022). Their relationship is an ongoing topic of research. $\boldsymbol{\Psi_a}$ is a determinant of the ideal point. It affects *aspirations* in the sense of Callard (2018).

The effort applied to a task is the outcome of a choice problem that depends on skills, preferences, and incentives, much like a supply equation in the standard economic theory of consumer choice. Preferences are additional skills. Some psychological theories posit that people have limited effort that they can divide among different tasks (see, e.g., Baumeister and Tierney, 2011).

Equations (20) and (21) formalize the difficulty in establishing causal relationships between outcomes and skills. Multiple skills and effort generate performance on a given task or outcome. Many studies in psychology and economics do not control for these inputs and equate measurement of a set of outcomes with the skill the analyst is trying to measure.[14]

This practice can lead to a substantial bias in inference about any particular skill.

In addition, most studies assume a linear or at least monotonic relationship between outcomes and skills. This practice is particularly problematic for measuring personality skills, where the effect of a skill on an outcome is not always linear or monotonic. Too much of a good thing can be bad. For example, extreme levels of skills are associated with psychopathologies. High levels of conscientiousness are associated with obsessive-compulsive disorder, which hinders task performance (Samuel and Widiger, 2008). Nonlinearities can also arise when skills and incentives interact, as in the analyses of Borghans et al. (2008) and Segal (2012) who show that people with different personality skills respond differently to incentives on tests.

Skills evolve over time through investment and habituation.[15] Equation (22) shows that skills at age $a+1$ are age-dependent functions of cognitive ability, personality skills, other acquired skills, and investment $\boldsymbol{I}_a$ at age a. In this way, previous levels of skills and acquired skill affect current levels of skills and acquired skill. Equation (22) formalizes the notion that skills governing performance at a point in time are themselves the outcome of investment and habituation:

$$(\boldsymbol{Q_{a+1}}, \boldsymbol{\Omega_{a+1}}, \boldsymbol{K_{a+1}}) = \eta_a(\boldsymbol{Q_a}, \boldsymbol{\Omega_a}, \boldsymbol{K_a}, \underbrace{\boldsymbol{I_a}}_{\substack{\text{Investment} \\ \text{and} \\ \text{Experience}}}), \qquad a = 1, \ldots, A. \tag{22}$$

In conjunction with resource constraints, a "deeper" set of preference parameters at age a may govern investment decisions and effort allocated to tasks. Both emotion and reason cooperate to produce skills and preferences. Investment includes parenting, schooling, on-the-job training, practice, role modelling and mentoring – all factors that promote growth of skills. See Figure 12.1.

In addition, investment today increases the stock of future skills, which in turn increases the return to future investments. Economists call this phenomenon *dynamic complementarity*. This channel increases the returns to early investments because it makes future invest-

ments more productive. For this reason, Cunha et al. (2010) show that it is economically efficient to invest in the most disadvantaged young children because it raises their payoffs from future investments. Heckman and Mosso (2014) present a more complete discussion of static and dynamic complementarity and a formal proof of when early investment is more effective compared to later investment.

An important extension of this modelling approach is that performance on current tasks themselves can depend directly on performance of past tasks independently of a person's skills or effort. This embodies the idea of habituation that was discussed by Aristotle (Ross, 1956; Callard, 2022, 2020; Kraut, 2022): constant practice of moral behavior can make persons moral habitually. Formally, Equation (20) can be modified as:

$$\boldsymbol{X_a} = \phi_a^{'}(\boldsymbol{Q_a}, \boldsymbol{\Omega_a}, \boldsymbol{P_a}, \boldsymbol{K_a}, \boldsymbol{e_{X_a}}, \boldsymbol{X_{a-1}}) \tag{23}$$

where $\boldsymbol{X_{a-1}}$ is the previous outcome (see Pollak, 1970, 1976). For example, $\boldsymbol{X_{a-1}}$ could represent the outcomes of moral acts by a person at $a-1$.

Econometric methods can be used to separate the direct effect of past measures from the effect of skills (Athans and Falb, 2013; Granger, 1969; Heckman, 1981a,c,b; Harvey, 1989; Torgovitsky, 2019; Williams, 2020). Models of this type are also common in the economics literature and are beneficial, because they capture learning (Becker and Murphy, 1988; Hai and Heckman, 2019; Pollak, 1970, 1976).

This framework recognizes that different skills might be relatively easy to shape at different stages of the life cycle. *Sensitive periods* for a given skill are periods when investments are relatively more productive. *Critical periods* for a particular skill are periods when investment during any other period is not productive (see Cunha and Heckman, 2007).

Figure 12.1 illustrates why understanding the effects attributable to specific interventions is a challenging task. Most empirical studies only investigate the interventions aimed at one slice of the life cycle. They do not connect the links across the life cycle or correct for the effects of later investment in producing the outcomes attributed to early investments. An

important area for future research on virtue, preference, and skill formation is to better document how early interventions influence the efficacy of later interventions.

8 Evidence on the Power of Interventions to Shape Traits

Reference `http://cehd.uchicago.edu/Kautz_Heckman_Diris_etal_Extract` presents an extensive summary of interventions from early childhood to adulthood. This section updates that research with a focus on personality and cognitive skills.

8.1 Evidence from Interventions

Evidence from the randomized evaluation of the Perry Preschool Program shows how skills can be changed in ways that produce beneficial lifetime outcomes. The Perry Preschool Program enriched the lives of three- and four-year-old low-income Black children with initial IQs below 85 at Age 3.[16]

Participants were taught skills in a "plan-do-review" sequence where students planned a task, executed it, and then reviewed it with teachers and fellow students. They learned to work with others when problems arose.[17] In addition, home visits promoted parent-child relationships. The program ended after two years of enrollment and both treatments and controls entered the same school. The program was evaluated by the method of random assignment.

The program improved outcomes for both boys and girls, resulting in a statistically significant rate of return of around 6-10% per annum for both boys and girls (see Heckman et al., 2010). These returns are above the post-World War II, pre-2008 meltdown in stock market returns to equity estimated to be 5.8% per annum (see DeLong and Magin, 2009). Later work shows that this fadeout was transitory. García and Heckman (2022) show that by Age 54 many cognitive and noncognitive skills improve.

The Perry Preschool Program improved personality skills. Participants had better direct measures of personal behavior (a weighted average of "absences and truancies," "lying and cheating," "stealing," and "swears or uses obscene words" measured by teachers in the elementary school years). Both boys and girls improved their "externalizing behavior," a psychological construct related to agreeableness and conscientiousness. For girls, the program improved openness to experience (proxied by academic motivation). The program also improved scores on the California Achievement Test (CAT). This evidence supports the evidence previously presented that shows that performance on achievement tests depends in part on personality skills. Arthur Jensen's lifetime campaign against early intervention program was based on using faulty measures of relevant lifetime skills.

Using data for participants when they were 54 years old, García et al. (2021) found that the Perry Preschool Program reduced participation in special education and K-12 grade retention and increased high school graduation rates, especially for female participants. Furthermore, the intervention was shown to reduce criminality. Additionally, García et al. (2022) show that the intervention improved Executive Functioning, Positive Personality, Grit, and Openness to Experience. They analyzed data from the children of original participants and show that this second generation also had better educational and employment outcomes, less criminal activity, and improved health.

The Jamaica early child stimulation intervention provided a home visiting program and a nutritional supplement to mothers of children with stunted growth, and aimed at increasing the mothers' ability to enhance child development outcomes by encouraging play and mother-child interaction (Grantham-McGregor et al., 1997, 1991). Children in the treatment group were compared to other children who were randomly assigned to receive just the nutritional supplement and a pure control, as well as a comparison group of non-stunted children. Recent work assessing impacts of the intervention when the participants are 31 years-old shows lasting long-term effects of the stimulation. In contrast to other studies of early childhood interventions, whereas the Jamaica study initially observed no changes to IQ at

Age 7, follow-up assessments at Ages 11-31 have shown sustained IQ score benefits (Walker et al., 2022).

Additionally, the program led to improvements in contentiousness and grit, and reduced depressive symptoms, alcohol use, and risk taking. Studies of the effects of the intervention in the teens and twenties also showed some impact on criminality and violent behavior, though these differences do not persist into the thirties. Findings in Gertler et al. (2022) also show that the Jamaica program led to improved labor market outcomes including 43% higher hourly wages and 37% higher earnings than the control group. The sustained results of this intervention suggest that a low-cost home visiting program can improve character skills and traits with a meaningful impact on other behavioral outcomes.

Zhou et al. (2022) studied a replication of the widely emulated Jamaican program, China REACH, that has the same curriculum with adjustments to the Chinese culture and was delivered by local women with similar level of education as the mothers in the treatment group. The home visiting intervention has significant and positive impacts to the treated children's cognitive and noncognitive skills. Home visits improved children's home environment and promoted the interactions between the children and caregivers (see Heckman and Zhou, 2022; Zhou et al., 2022; Gertler et al., 2022; and Walker et al., 2022).

The Carolina Abecedarian Project (ABC) and the Carolina Approach to Responsive Education (CARE) provided enriched childcare programs to disadvantaged (predominantly Black) children. The children were randomized into receiving high quality childcare that focused on language, motor, and cognitive development as well as social and emotional competencies.[18] The children were compared to a control group that was randomized to not enroll in the high-quality childcare, although some control families may have enrolled in alternative preschool programs. The intervention was shown to improve academic outcomes (including attaining more years of education and improvement in IQ and achievement test scores) and reduce specific behaviors such as teen pregnancy and reported marijuana usage (Campbell et al., 2002). Analyzing data from a long-term follow-up of the ABC/CARE

intervention, García et al. (2018) show that the program improved IQ and Social emotional skills as well as leading to better educational and employment outcomes. The effects of the treatment were stronger for girls than for boys. This difference appears to be driven by differences in the baseline family characteristics for boys and girls. García et al. (2018) show that these gender differences are also present in the effects on criminality, though the intervention decreases criminal behavior for both boys and girls.

Tables 1–11 introduce the curriculum and targeted population, and summarize the latest empirical evidence from a variety of interventions ranging from the general programs to the programs that are focused on specific personality traits. Most of the programs show strong and persistent positive effects on the treated groups' personality and social and life outcomes. These programs also provide unique insights for researchers and policy makers.

We find five striking patterns among the latest findings on personality interventions. First, generalized intervention programs are shown to have positive impacts on specific personality traits that were not targeted initially. The Balu und Du Mentoring program in Germany (Table 1) is a generalized mentoring program where volunteer mentors (usually college students) spend one afternoon per week with the children on a one-on-one basis, participating in casual activities, such as visiting a zoo or cooking. The goal of the program is to enrich children's social environment by providing access to a positive role model. The program's curriculum was not specifically designed to augment particular personalities. Yet, four years after the intervention, Abeler et al. (2021) find that treated children were much more honest than the control group. This finding is consistent with the proposed mechanism of virtue development, wherein children practice virtues based on imitating prosocial mentors (see Callard, 2022). Other generalized intervention programs such as Jamaica Reach Up and Learn (see, e.g., Gertler et al., 2022; Walker et al., 2022), Perry Preschool Program (see, e.g., Heckman et al., 2008), and ABC (see, e.g., Heckman et al., 2008) have shown similar gains.

Second, personality interventions have stronger and more persistent positive effects on

personality and social outcomes than cash transfer programs. Table 5 and Table 6 show the empirical evidence from the Sustainable Transformation of Youth in Liberia (STYL) program aimed at reducing anti-social behaviors. Both a treatment providing just cognitive behavioral therapy (CBT) and a second treatment that pairs therapy with cash transfers show strong and persistent positive effects on reducing anti-social behaviors, even 10 years after the intervention. However, the cash-only treatment did not have any effect on reducing anti-social behaviors even after the treatment.

Third, interventions are most effective for participants who are at the highest risk at baseline. Kosse et al. (2020) and Abeler et al. (2021) found that children who experience cold parenting and have mothers with low prosociality scores benefited the most from the mentoring program. Blattman et al. (2022) also show the therapy was most effective for the highest-risk men in Liberia.

Fourth, successful interventions can replicate to another environment but not always. Table 10 shows a successful replication of the Jamaican Reach Up and Learn, the China REACH program. Zhou et al. (2022) show comparable gains to children's cognitive and noncognitive skills to the original Jamaican pilot (see García and Heckman, 2022 for detailed discussion on comparing numbers of replicated programs to the pilot programs). They also find home visits improved treated children's home environment. However, as we compare the STYL program (Table 5) to the READI Chicago (Table 7), a similar large-scale program in Chicago that used CBT with the aim of reducing gun violence, Bhatt et al. (2023) do not find significant positive impact on the treated men when compared to the similar group in Liberia. Even the READI Chicago program provides more supports to the treated men (supported and subsidized work, outreach support, and referral services) and has better trained staff (trained counselors vs. trained nonspecialists). Therefore, identifying and analyzing the key components in the interventions is the crucial question for the literature.

Finally, treatment effects vary through different channels. Table 2 shows an intervention program in high-risk Chicago communities (Chicago Heights Early Childhood Center) that

has two individual treatment groups, preschool and parent academy. Treated children in the preschool group receive the intervention directly, whereas children in the parent academy group do not receive any direct intervention but instead their parents learn parenting through classroom and homework. Cappelen et al. (2020) show that treated children in these two groups have distinctive personalities. A recent study by Cunha et al. (2023) shows that teaching and coaching parents how to incorporate empathy into parenting practice could reduce bullying in middle school students which provides another piece of evidence on indirect treatments.

The curriculum of Promoting Alternative Thinking Strategies (PATHS) teaches self-control, emotional awareness, and social problem-solving skills and is aimed at elementary school children (see Bierman et al., 2010). A recent random-assignment, longitudinal study demonstrates that the PATHS curriculum reduces teacher and peer ratings of aggression, improves teacher and peer ratings of prosocial behavior, and improves teacher ratings of academic engagement. PATHS is an exemplar of school-based social and emotional learning (SEL) programs. A recent meta-analysis shows that the program improved grades by 0.33 standard deviations and achievement test scores by 0.27 standard deviations.(Durlak et al., 2011).[19] Likewise, several random assignment evaluations of *Tools of the Mind*, a preschool and early primary school curriculum targeting development of self-control, show that it improves classroom behavior as well as executive function, defined as higher-level cognitive skills including inhibitory control, working memory, and cognitive flexibility (Barnett et al., 2008, 2006; Bodrova and Leong, 2001, 2007; Diamond et al., 2007; Lillard and Else-Quest, 2006). Positive findings are reported for the Montessori preschool curriculum (Lillard and Else-Quest, 2006). Unlike the Perry study, these studies do not have long-term follow-ups.

There is evidence that targeted intervention efforts can improve preferences and skills. In contrast to the multi-faceted curricula described above, studies targeting improvement in aspects of conscientiousness are designed to isolate a particular mechanism producing behavioral change. In early work, Rueda et al. (2005) designed a set of computer exercises

to train attention in children between four and six years of age. Children in the intervention group improved in performance on computer tasks of attention relative to children who instead watched interactive videos for a comparable amount of time. Similarly, Stevens et al. (2008) designed a 6-week computerized intervention and showed that it can improve selective auditory attention (i.e., the ability to attend to a target auditory signal in the face of an irrelevant, distracting auditory signal). Although yielding interesting preliminary results, these programs had only short-term follow-ups and involved very small samples.

A recent strand of research has focused on testing and implementing interventions on a larger scale and directly in school. Alan and Ertac (2018) show that an intervention in Turkey designed to encourage forward-looking behavior by increasing the salience of future selves improves patience as measured on experimental tasks. The effect is persistent three years later and associated with an improved "behavior grade" for girls and high achieving students. For a different sample, Alan et al. (2021) find that the treated children are more patient than the control children in that they choose to wait to eat chocolate at a later date. They also exhibit more self-control, in that treated children consumed less chocolate than they had planned to. Finally, the intervention has greater impact on girls.

A companion intervention implemented in Turkish elementary schools focused on grit and children's willingness to compete. Treated children were taught by their own teachers at schools with materials that aimed to foster grit. Alan and Ertac (2019) find that treated children were more willing to compete in a math competition task, and the gender gap on willingness to compete was eliminated. In the two-year follow-up study, Alan et al. (2019) show that the treatment effect on grit persisted and treated children had higher scores on the math standardized test.

Kosse et al. (2020) show that social skills can also be impacted. They study a mentoring intervention program in Germany which randomly paired children from low income families with college student mentors. Before the intervention, children from low income families scored lower on measures of prosociality. The mentoring program has a significant and

persistent positive impact on treated children's prosociality; the gap on prosociality across income groups disappeared and persisted two years after the intervention. In addition, the treated children who experienced cold parenting style and who had mothers who with lower prosociality scores benefited the most from the program, suggesting mentoring as the substitution for parenting. After four years of the intervention, Abeler et al. (2021) found that children in the treated group were much more honest than the controlled children, offering evidence that generalized intervention could have positive and persistent effect on nontargeted personalities. This result is a recurrent finding of the intervention literature. Programs that do not target specific skills have impacts across multiple skills.

The Montreal Longitudinal Experimental Study (MLES) randomly assigned disruptive boys from low-income neighborhoods to participate in a two-year social-skill and self-control training program implemented at the time of entry into primary school. Algan et al. (2022) studied the treatment effect up to age 39; they found that the intervention had a significant impact on noncognitive skills from late childhood and throughout adolescence. They showed that it increased aggression/self-control, attention control, and trust. In early adolescence they did not see any academic differences, but school performance differences appeared in later adolescence and boys in the treatment group were more likely to belong to a group (cultural or recreational). During the same age period, Castellanos-Ryan et al. (2013) showed treated boys had reduced alcohol and drug use. Starting from early adulthood, participants had improved labor market participation, required lower social transfers, and had better social outcomes. Boisjoli et al. (2007) and Vitaro et al. (2013) showed the treated boys had higher high-school graduation rates and reduced criminal behavior throughout adolescence and early adulthood.

Several studies suggest that noncognitive skills can be remediated in adolescence. A recent study by Cunha et al. (2023) focuses on the issue of bullying in middle schools and adolescence. They conducted a parental involvement program on empathy education in China that teaches parents how to incorporate empathy into their parenting practices through

online parent-child reading activities and empathy-oriented movies for four months. They found that the intervention on parents decreases the likelihood of their children being bullies or victims, and students in the treatment group had higher empathy index, prosociality scores, positive traits index, and mental health index. Martins (2010) analyzed data from EPSIS, a program developed to improve student achievement of 13-15 year-olds in Portugal by increasing motivation, self-esteem, and study skills. The program consists of one-on-one meetings with a trained staff member or meetings in small groups. The intervention was tailored to each participant's individual skill deficit. Overall, the program was successful and cost-effective, decreasing grade retention by 10%. Kautz and Zanoni (2019) found similar effects for a mentoring program in high schools in disadvantaged neighborhoods.

Heckman et al. (2006) estimated a version of Equation (22) to analyze the effects of increases in education on measured cognition and noncognitive measures.[20] Controlling for the problem of reverse causality that schooling may be caused by noncognitive skills, they found that schooling improves both personality and cognitive skills and that these skills, in turn, boosted outcomes.[21] Heckman et al. (2018) estimated a sequential model of education to study the effects of education on a variety of outcomes. Correcting for selection into education, they found that early cognitive and personality skills affect schooling choices, labor market outcomes, adult health, and social outcomes, and that increasing education promotes beneficial labor market, health, and social outcomes.

Todd and Zhang (2019) confirmed that returns to schooling are in part a consequence of positive changes to personality through education. They found that these changes are concentrated predominantly among individuals from poorer families and tend to stabilize by Age 30. Furthermore, some authors claim that cognitive and noncognitive skills are associated with sorting into different job types and individuals who score high on both tend to choose more schooling and subsequent employment in white collar occupations. Kassenboehmer et al. (2018) contributed to this literature and provided estimates of the effect of university education on the Big Five personality skills. Controlling for selection into

college, they showed that it increased the extraversion skill by 0.3 standard deviations and seems to have some impact on agreeableness, although the latter is quite heterogeneous and depends on family background.

Cunha et al. (2010) estimated a model of the technology of skill formation using longitudinal data on the development of children with rich measures of parental investment and child skills. They controlled for the endogeneity of investment using shocks to family income along with other instruments. Their model was a version of Equation (22). Skills were self-productive and exhibited dynamic complementarity – current values of skills affect the evolution of future skills through direct and cross effects. A leading example of a cross effect is that more motivated children are more likely to learn.[22] They estimated parameters that summarize how past personality skills affect future cognitive skills.

They found that self-productivity becomes stronger as children become older, for both cognitive and personality skills.[23] It is more difficult to compensate for the effects of adverse environments on cognitive endowments at later ages than it is at earlier ages. This finding is consistent with the high rank stability of cognition over ages past 10-12 years reported in the literature. It also helps to explain the evidence on the ineffectiveness of cognitive remediation strategies for disadvantaged adolescents documented in Cunha et al. (2006); Knudsen et al. (2006) and Cunha and Heckman (2007).

Personality skills foster the development of cognition but not vice versa (see Cunha and Heckman, 2008; Cunha et al., 2010). It is relatively easier at all stages of life to compensate for early disadvantage in endowments by boosting personality skills.[24] However, personality seems to stabilize around the age of 30 (see Todd and Zhang, 2019 and Terracciano et al., 2010). Thus, the most effective adolescent interventions target personality skills.[25]

Some life experiences, such as employment, can also improve personality. Gottschalk (2005) analyzed evidence from a randomized control trial that working at a job can improve locus of control, a trait related to neuroticism that measures the extent to which individuals believe that they have control over their lives through self-motivation or self-determination

as compared to the extent that the environment controls their lives (Rotter, 1966).[26] He uses data from the Self-Sufficiency Project (SSP) in which some welfare recipients were randomly offered substantial subsidies to work. The subsidy more than doubled the earnings of a minimum wage worker. People in the experimental group worked about 30% more hours than those in the control group. After 36 months, those who received the subsidy were more likely to have an improved locus of control.

Negative life experiences can have lasting effects on preferences and personality as well. Americans who experienced sexual abuse and parental neglect in childhood appear to have increased levels of neuroticism and lower conscientiousness and openness to experience at ge 30 (Fletcher and Schurer, 2017). Afghanis who experienced violence exhibited more risk tolerance but also a higher preference for certainty when asked to recall fearful events (Callen et al., 2014). Furthermore, Malmendier and Nagel (2011) documented that individuals who experienced negative financial events, such as the Great Depression exhibited a lower willingness to take financial risks.[27] Anger et al. (2017) showed that trauma can sometimes also result in positive changes in personality. Studying German data, they found that job loss due to factory closings increases openness to experience for highly educated workers while leaving other dimensions of personality unchanged.

Economic preferences have also been shown to have a causal impact on outcomes.[28] Montizaan et al. (2015) exploited a change in the Dutch public pension system in 2006 which affected workers born after 1950. By comparing the reaction of public sector workers born just after the reform took effect to those born just before, they were able to show that affected individuals who score higher on negative reciprocity reduced their work effort (measured by self-reported on the job motivation). Furthermore, this decline seemed proportional to the degree of perceived unfairness – it is larger for workers born very close to the cutoff date and among those who work with many colleagues who were unaffected – and also to the closeness to the "perpetrator" of the injustice (workers working directly for the central government shirk more).

9 The Development of Economic Preferences: Evidence from Experimental Economics

Sutter et al. (2019) provide an extensive review on the experimental economics results on the development of economics preferences among children and adolescents.[29] Their findings are as follows:

- *Rationality of choices*: Young children show evolving rationality by making correct inferences and applying strategic thinking in lab tasks. Rationality develops with age from childhood to adolescence (Table C.1).

- *Time preferences*: Older children are more forward-looking in terms of willing to wait for a larger reward than getting a smaller reward sooner. Time preferences are correlated with participants' socio-economic status, children and adolescents with low SES-background are less patient. Time preferences are correlated with future health and educational outcomes. Furthermore, interventions have positive effects on forward-looking behavior (Table C.2).

- *Risk preferences*: Risk aversion decreases with age especially in childhood. Girls are more risk averse than boys across childhood, adolescence, and adulthood. Parents' risk preferences are correlated with their children's risk preferences. Parents with low SES-background are more risk tolerant (Table C.3).

- *Altruism and Egalitarianism*: Egalitarianism becomes more predominant within childhood. Adolescents become more meritocratic in that they value individuals' efforts, efficiency, and social welfare concerns when making allocation decisions. Boys value efficiency while girls are more generous and egalitarian. Children coming from low SES-backgrounds are less pro-social and less generous. Parents' and children's social preferences are correlated. In-group favoritism and self-control also affect social preferences (Table C.4 and Table C.5).

- *Trust and Reciprocity*: Children and adolescents value fairness and efficiency in bargaining games. They accept equal splits and rejection rates increase with less equal splits. Reciprocity increases with age in trust games (Table C.6).

- *Cooperation*: Cooperation develops with age. Older children display less free-riding behavior, and more prosocial and reciprocal decisions in public goods and prisoner's dilemma games. In-group favoritism and possible punishments from third parties increase cooperation (Table C.7).

- *Competitiveness*: Boys are more willing to compete across childhood and adolescence. Children with low SES-background have lower level of competitiveness. Interventions can close a large portion of gender gap in competitiveness (Table C.8).

10 Personality Development in Longitudinal and Cross-sectional Studies

Appendix D and Appendix E provide overviews of the evidence on personality development. This section summarizes the common trends in development across studies.

10.1 Personality Development in Longitudinal Studies

Tables 12–14 present the latest longitudinal studies on personality development from early childhood to early-middle adulthood. There are three general trends of development across these studies. First, Agreeableness and Conscientiousness domains increase with age while Extraversion, Emotional Stability, and Openness to Experience domains decrease with age across almost all of the studies. Second, there are gender differences in the development of Big Five domains and facets within the domains. Third, personality development becomes more stable with age.

10.2 Personality Development in Cross-sectional Studies

Roberts et al. (2006) and Soto et al. (2011) study personality development with large samples and across much of the life cycle. Figure E.1 demonstrates the maturity principle discussed in the review by Soto and Tackett (2015), that Conscientiousness, Emotional Stability, and Agreeableness domains generally increase with age. Activity generally decreases with age, and Openness to experience domain has an inverted U relationship with age. Another general finding in the personality development literature is that personality becomes more stable with age (the cumulative continuity principle; see Roberts and DelVecchio, 2000). A longitudinal study by Wängqvist et al. (2015) (see Figure D.7) also shown stability in personality development starting in the early adulthood. Lastly, Figures E.2–E.6 show the adolescence disruption period consistent with the research of Steinberg (2014). The multi-dimensional transitions from childhood to adolescence correlate with a hiatus in personality development in early adolescence. Similar results can be found in the previous section, that both longitudinal and cross-sectional studies suggest the existence of this conclusion.

11 Summary and Conclusion

This chapter uses simple economic models to clarify the concepts of virtue ethics developed by Aristotle and place them into a well-defined economic framework. We give empirical content to Aristotelian notions about virtue and its development. The study of virtue involves considerations that are not standard in economics or psychology. We link the study of virtue to the emerging body of work that joins economics and psychology. We report recent evidence in economics. We discuss measurement problems and present models of the development of personality and character. Economic models sharpen distinctions that appear in philosophy and psychology and suggest new approaches giving empirical content to philosophy and psychology in the study of virtue.

Much remains to be done. We have shown the promise of what has been done and is

presently being done. Aristotle's notion that habituation, mentorship, and parenting produce valuable cognitive and socio-emotional skills is documented for a variety of intervention studies. The notion of virtue as an action influenced by acquired traits, agent preferences, and situations confronting individuals is captured by the economic models. Economic models traditionally associated with pursuit of material gain are sufficiently flexible to accommodate pursuit of higher values and the good. Virtue is not God-given or automatic but can be acquired. Deliberation (choice) is an essential aspect of the pursuit of virtue. Consistent practice of virtue builds traits that make it more likely to be virtuous in the future in the face of competing claims to human activity.

Notes

[1]Callard (2022).

[2]Equations (1)-(5) capture the "if-then" notion of Mischel and Shoda (1995) used to resolve the person-situation debate in psychology.

[3]An analysis of Aristotelian virtue from the viewpoint of psychology is presented in Ryff and Singer (2008). An application to epidemiology and the operational definition of health appears in Ryff and Singer (1998).

[4]These are the same utilities as in Thurstone's (1927) pioneering model of choice.

[5]Some utilitarian/welfarist philosophers (the difference is whether the social welfare function is additive over utilities or is a more general function of utilities) have argued in favor of deontological side constraints to avoid implications such as the desirability of organ harvesting to trade 7 lives for 1, etc. Constraints of this type can be built into the utility function. Also, note that Mill believed in the higher versus lower pleasures, so the idea of treating some outcomes as lexically better than others is not too far from some strains of classical utilitarianism.

[6]Lexical preferences are a limiting case of a preference structure in which the utility of one good always has larger utility compared to another good. These more general preferences allow one to relax rules such as "thou shalt not kill" to account for unusual contexts and thus avoids the sorts of counterexamples utilitarians use against deontologists (e.g., refuse to torture someone who knows the location of an atomic bomb in Manhattan).

[7]Notice that the presence of the term $\boldsymbol{a}'\bar{\boldsymbol{X}}$ has no effect on behavior. It acts as a constant term in the utility function.

[8]Thus b_{12} cannot be too big.

[9]This section benefited from comments by Angela Duckworth and Gabriel Lear

[10]Models of apparent dynamic inconsistency can arise from arrival of information over time and from the dynamic evolution of preferences. Hai and Heckman (2022) is a recent empirical model of regret.

[11]One use of the notion of akrasia is that it helps in thinking about the relationship between self-control and moral conduct. One can be immoral and self-controlled. One example is Stalin, who exhibited great self-control, we would argue, both in moving up the Soviet hierarchy to achieve dictatorial power. We would say his reflective preferences were immoral. Immoral actions that are taken because of akrasia are fundamentally different because the agent is aware he should not be doing what is in fact doing. In other words, akrasia links self-control and moral behavior if the morals are judged relative to the agents own reflective preferences. But if the reflective preferences are immoral, then the link is broken

[12]The "rational addiction" model of Becker and Murphy (1988) and Hai and Heckman (2022) produces consistent decision making, but there can still be regret moment by moment when people compare instantaneous utility states. Appendix B discusses choice under uncertainty.

[13]This framework draws on Almlund et al. (2011).

[14]Selecting measures and verifying them is part of the sometimes mysterious and inherently subjective process of "construct validity" in psychology. For a discussion, see Borghans et al. (2008).

[15]Habituation is an integral part of Aristotle's theory of the formation of virtue.

[16]We draw on the analysis of Heckman et al., 2013 and García and Heckman, 2022.

[17]Sylva (1997) describes the Perry program as a Vygotskian program fostering personality skills. Vygotsky developed a psychology of child development in structured social settings that emphasized development of social and personality skills.

[18]There was also a second wave of randomization. This intervention provided school-aged supports in the form of a home -school resource teacher who worked as a liaison between families and schools. This intervention is not the focus of the continued research cited here.

[19]Note however that the largest federal study to date on character education programs, including PATHS, failed to find evidence for improvements in behavior or academic performance (see Social and Character Development Research Consortium, 2010).

[20]They estimate the effect of schooling on self-esteem and locus of control, personality skills related to neuroticism. The Rosenberg Self-Esteem Scale attempts to assess the degree of approval or disapproval of oneself (Rosenberg, 1965). The relationship between these measures and the Big Five skills of neuroticism is discussed in Almlund et al. (2011).

[21]Both Heckman et al. (2018) and Heckman et al. (2006) use an identification strategy based on matching on proxies for unobserved skills that corrects for measurement error and the endogeneity of schooling.

[22]There is preliminary evidence that the personality of one's peers may also have an impact on the individual's outcomes. Golsteyn et al. (2017) exploit random variation in assignment of students to university tutorial sections to estimate a positive effect on performance from having more persistent and more risk averse peers. This effect is limited to students who themselves have a low degree of persistence and is twice as large in magnitude than that of having peers with higher GPA. As the hours spent studying are unaffected, the authors conclude that the presence of persistent and risk averse peers directly enhances the productivity of low-persistence students in their company.

[23]In the language of economics, the elasticity of substitution for cognitive inputs is *smaller* later in life.

[24]Elasticities of substitution are essentially the same at different stages of the life cycle.

[25]Cunha et al. (2006) report that 16% of the variation in educational attainment is explained by adolescent

cognitive skills, 12% is due to adolescent personality (socioemotional skills), and 15% is due to measured parental investments.

[26]The relationship between locus of control and the Big Five trait of neuroticism is discussed in Almlund et al. (2011).

[27]However, it is unclear what part of these changes can be attributed to changes in risk preferences as opposed to altered beliefs about returns to investing.

[28]As discussed before, recent research suggests that they may be strongly related to noncognitive personality skills traditionally measured by psychologists.

[29]See Appendix C and Sutter et al. (2019) for their summary tables of results.

12 Tables and Figures

Table 1 The Effect of Interventions on Personality: Balu und Du

Interventions	**Program Focuses**	**Sample and Criteria**	**Initial Outcomes**	**Follow-up Outcomes**
Curriculum: Mentors and children engage in joint activities (e.g., visiting a zoo, museum; cooking; or just talking; etc.) that are adapted at the individual level, to provide children with an additional attachment figure and role model, new experiences, and feelings of being valued. *Duration and intensity*: Treated children met their mentors once per week for an afternoon for one year. *Settings*: Almost all mentors are university students (from 18 to 30 years old) voluntarily participating in the program. They met one to one to their children mentees.	*Goals*: The mentoring program focuses on "informal learning" that integrating and reinforcing learning processes into children's daily life through enriching the children's social environment by mentors' role modeling and being benevolent friends (Kosse et al. (2020)).	*Sample*: 590 children aged 7 to 9 from Bonn and Cologne, Germany, were randomly assigned to the treatment group ($N = 212$) or the control group ($N = 378$). *Criteria*: the children's families must meet with at least one of the following low-SES criteria: low income, low education, or single-parent.	*Post Treatment*: Kosse et al. (2020) showed that treated children had higher prosociality measure score (0.273 standard deviations, $p < 0.01$), altruism ($p < 0.05$), trust ($p = 0.05$), and other-regarding behavior ($p = 0.266$) than the control group, and the gap between control high SES children is closed ($p = 0.651$). They also found that children with low prosociality-promoting parental inputs gained more from the intervention (0.214 standard deviations of prosociality measure higher if the mother with 1 standard deviation lower on the prosociality measure, $p < 0.05$; 0.192 standard deviations higher if the child has 1 standard deviation less of home social interaction intensity).	*Two-year follow-up*: Kosse et al. (2020) found that the average increase in prosociality across all samples is more than 0.4 standard deviations, showing the development of prosociality among children. They also showed that treated children had higher scores on prosociality than the control group (0.217 standard deviations, $p < 0.05$) and the gap between control high SES children is closed ($p = 0.749$). *Four-year follow-up*: Abeler et al. (2021) showed that the mentoring program has significant positive effect on honesty, that treated children were more honest then the controlled children (11.2 percentage points, $p = 0.029$).

Table 2 The Effect of Interventions on Personality: Chicago Heights Early Childhood Center (CHECC)

Interventions	**Program Focuses**	**Sample and Criteria**	**Initial Outcomes**	**Follow-up Outcomes**
Preschool: a full-day, five days a week, 9 months preschool. *Parent Academy*: a 90 minutes, twice per month, 9 months incentivized parenting program that teaches parents how to teach their children at home. Parents could earn up to $7,000 per child per year based on the parents and children's performance.	*Goals*: Preschool: promoting social-emotional skills through group interactions and partnered activities. Parent Academy: general parenting program	*Sample*: 302 children aged 3 to 4 from Chicago Heights, Illinois, were randomly (at the household level) assigned to the preschool treatment group ($N = 84$), the Parent Academy treatment group ($N = 89$), and the control group ($N = 129$). *Criteria*: Chicago Heights has an almost 80% Black or Hispanic population and the average per capita pretax income is $17,546 (Cappelen et al. (2020)).	*Post Treatment*: Fryer et al. (2015) found that the Parent Academy has positive effect on children's standardized noncognitive score ($p < 0.05$). Furthermore, Hispanic and white children in the Parent Academy group had better standardized cognitive and noncognitive scores (all four $p < 0.01$) while there is no significant effect for black children.	*3.5-year follow-up*: Cappelen et al. (2020) found that children in the Parent Academy valued efficiency over fairness compared to the control group that they put 0.32 standard deviations more of inequality in the experiment ($p = 0.03$). Meanwhile, children in the preschool group were more likely to be egalitarian that they place 0.28 standard deviations less of inequality than the control group ($p = 0.046$).

Table 3 The Effect of Interventions on Personality: Montreal Longitudinal Experimental Study (MLES)

Interventions	**Program Focuses**	**Sample and Criteria**	**Initial Outcomes**	**Follow-up Outcomes**
Curriculum: For the first year, there were nine social skills training sessions to teach the boys how to behave more prosocially including how to invite others to play, how to compliment others, how to ask why, and how to provide help (Vitaro et al. (1999)). For the second year, there were ten sessions focused on self-control strategies including how to react to unpleasant situations, how to control anger, and how to solve problems analytically (Camp et al. (1977); Goldstein et al. (1980)). *Duration and intensity*: MLES lasted for two years, it started when the boys were 7 years old and ended when they were 9 years old. Treated boys received 45 minutes sessions once per week for two years. *Settings*: The sessions were delivered by two full-time trained childcare workers with university training, one psychologist, and one social worker. And they were hold at school but outside of the classrooms.	*Goals*: MLES foucused on the direct training on scoial skills and self-control.	*Sample*: 250 boys from low socioeconomic status (SES) areas of Montreal, Canada were randomly assigned to the treatment group (69 boys) and the control group (181 boys). *Criteria*: teachers from 53 kindergartens assessed their male children's behavior using the Social Behavior Questionnaire (Tremblay et al. (1987)). Boys scoring above the 70th percentile on the disruptiveness scale were include in the intervention program.	*Ages 10 to 13*: Algan et al. (2022) found that treated boys had positive impacts on noncognitive skills: Aggression Control (0.15 standard deviations higher than the control group, $p = 0.05$), Attention Control (0.16 standard deviations, $p = 0.06$), and Trust (0.16 standard deviations, $p = 0.02$). Tremblay et al. (1995) and McCord et al. (1994) found that more boys in the treatment group stayed in an age-appropriate class up to age 12 (pattern over time $p < 0.05$; Time X Group effect $p = 0.05$) and had less delinquent behaviors ($p < 0.05$). Vitaro and Tremblay (1994) showed that treated boys at 12 years old had lower aggressivity ratings ($p < 0.05$), lower proportion of ever been involved in three delinquent acts (vandalism, stealing objects less than \$10, and stealing bicycles; all $p < 0.05$), and their best friends were less disruptive than the controlled boys' best friends ($p < 0.05$).	*Ages 14 to 17*: Algan et al. (2022) found that treated boys had positive impacts on noncognitive skills and school performance: Aggression Control (0.19 standard deviations, $p = 0.04$), Trust (0.18 standard deviations, $p = 0.04$), grades (0.22 standard deviations, $p = 0.10$), ever repeated a grade (15 percentage points lower, $p = 0.03$), and years in special education (10 percentage points lower, $p = 0.11$). Castellanos-Ryan et al. (2013) showed that at 14 years old, the intervention was associated with lower alcohol use frequency (intercept $d = 0.48$) and from ages 14 to 17, the intervention was significantly associated with a reduced increase in number of drugs used ($d = 0.70$). *Ages 18 to 19*:Algan et al. (2022) found that treated boys were more likely to belong to a group (cultural or recreational; 16 percentage points, $p = 0.02$).

Continued

Table 4 The Effect of Interventions on Personality: Montreal Longitudinal Experimental Study (MLES)-Continued

Interventions	**Program Focuses**	**Sample and Criteria**	**Initial Outcomes**	**Follow-up Outcomes**
Same as above.	Same as above.	Same as above.	Same as above.	*Ages 20 to 39*: Algan et al. (2022) found that treatment has positive effect on labor market outcomes: 2.2 more years of nonzero income from employment ($p = 0.03$), almost 20 percent higher annual income from employment ($p = 0.08$). Treated boys had better insurance outcomes: yearly social transfers were almost 40 percent lower ($p = 0.06$) and better social outcomes: they paid C$106 more ($p = 0.04$) and two more years ($p = 0.04$) to a professional organization (e.g., union) and were 15 percentage points more likely to ever got married ($p = 0.01$). At age 24, Boisjoli et al. (2007) showed that the treatment group has higher high-school graduation rate (13%, $p < 0.05$) and lower rate of criminal record (11%, $p = 0.06$). *Ages 11 to 17, 23, and 28*: Vitaro et al. (2013) showed that treated boys had lower property violence across three developmental periods ($F = 0.76, p = 0.05$).

Table 5 The Effect of Interventions on Personality: Sustainable Transformation of Youth in Liberia (STYL)

Interventions	**Program Focuses**	**Sample and Criteria**	**Initial Outcomes**	**Follow-up Outcomes**
Therapy: cognitive behavioral therapy (CBT) led by trained nonspecialists for three to four hours sessions, three times a week, for 8 weeks. Facilitators and treated men met in groups for lectures, discussions, role playing, and homework. The curriculum also includes one-on-one home(work)-visiting counseling. The CBT taught the men skills of self-control in emotions and future planning, how to react to dangerous situtations, and how to behave and self-identify as a member of the society. *Cash grants*: Unconditional cash transfer that treated men immediately receive $200 in cash. Treated men receive 15 minutes of lecture on how to manage and use the money wisely. *Therapy + Cash*: Treated men receive both CBT and cash transfer.	*Goals*: Therapy: the program focuses on self-control in terms of controlling emotions and future planning; how to react to dangerous situations; and convinces men to adopt anticriminal and anti-violent values and lifestyle. Cash grants: general direct cash transfer with a brief session on how to managing the money.	*Sample*: 999 high-risk men in crime and violence from Liberia with average age of 25 years old were randomly assigned to the Threapy treatment group (28%), the Cash grant treatment group (25%), Threapy plus Cash grant treatment group (25%), or the control group (22%). *Criteria*: Recruiters targeted the locations and people identified with crime and violence activities.	*Post Treatment*: Blattman et al. (2017) showed that CBT has positive effect on reducing antisocial behaviors, therapy treatment group has 0.25 standard deviations of increase in reduction of antisocial behaviors (adjusted $p = 0.026$) while therapy plus cash grant treatment group has 0.21 standard deviations of increase (adj. $p = 0.004$); both groups of treated men had better self-control skills (0.159 and 0.244 standard deviations; $p = 0.08, p = 0.011$) (Blattman et al. (2022)). Also, the therapy plus cash treatment group has 0.32 standard deviations increase in more forward-looking time preferences (adj. $p < 0.01$). Furthermore, therapy plus cash treatment has poisitive effects on treated men's mental health (0.34 standard deviations, adj. $p < 0.01$) and on treated men's quality of social network (0.33 standard deviations, adj. $p < 0.01$).	*One-year follow-up*: Blattman et al. (2017) found that only the therapy plus with grant treatment group has 0.25 standard deviations of increase in the reduction of antisocial behaviors (adj. $p = 0.037$). *Ten-year follow-up*: Blattman et al. (2022) found that both therapy only and therapy plus cash interventions have persistent positive effect on reducing antisocial behaviors for treated men (therapy only: 0.20 standard deviations, $p = 0.058$; therapy plus cash: 0.25 standard deviations, $p = 0.019$). In addition to this founding, the treatment effects from threapy only and threapy plus cash are statistically equal ($p = 0.635$), showing that the main effect came from the CBT.

Continued

Table 6 The Effect of Interventions on Personality: Sustainable Transformation of Youth in Liberia (STYL)-Continued

Interventions	**Program Focuses**	**Sample and Criteria**	**Initial Outcomes**	**Follow-up Outcomes**
Same as above.	Same as above.	Same as above.	Same as above.	*Ten-year follow-up*: Furthermore, both therapy only and therapy plus cash treatment effects were only positive and significant for the top quartile group of the baseline antisocial measure (0.71 and 0.819 standard deviations; both $p < 0.01$) showing that the treatment was most effective for the highest-risk men (Blattman et al. (2022)). For other gains, treated men in the therapy plus cash group were more forward-looking and patience in time preferences (0.247 standard deviations, $p = 0.008$) and they had better mental health (0.207 standard deviations, $p = 0.041$).

Table 7 The Effect of Interventions on Personality: Rapid Employment and Development Initiative (READI Chicago)

Interventions	**Program Focuses**	**Sample and Criteria**	**Initial Outcomes**	**Follow-up Outcomes**
Curriculum: *Supported, subsidized work*: treated men could work at provided worksites on weekdays for 18 months. The intervention program provides safe transportation and subsidies to local employers who hire treated men. *CBT-informed curriculum*: treated men were taught to practice anti-violence thoughts that were led by counselors for 18 months. The CBT sessions were 3 times per week for 90 minutes each. *Outreach support and referrals to other services*: READI staff would help treated men to continue attending supported works and CBT sessions safely. They would also provide referrals to other services such as reducing drug use.	*Goals*: READI aims to reduce gun violence through disrupting four channels that lead to it: the instrumental use of violence in illegal markets; using violence to signal strength and to deter future dangerous; using violence to punish others; and decisions made by irrational behaviors (Bhatt et al. (2023)).	*Sample*: 2456 high-risk men from five high-risk communities in Chicago. *Criteria*: High-risk men with gun violence that are over 18 years old and living in Chicago high-risk communities. The intervention used algorithm pathway that predicts the risk score of being involved in gun violence over the next 18 months and men with the highest risk scores were referred for the intervention. Outreach workers also referred high-risk men to the program. Finally, men leaving jail or on parole were also referred to the program.	Bhatt et al. (2023) found no significant effects on the index combining three measures of serious violence for treated men.	N/A

Table 8 The Effect of Interventions on Personality: Becoming a Man (BAM) and Cook County Juvenile Temporary Detention Center (JTDC)

Interventions	**Program Focuses**	**Sample and Criteria**	**Initial Outcomes**	**Follow-up Outcomes**
Curriculum: *Becoming a Man (BAM)*: 27 to 45 one-hour, once per week group sessions during the school day over one to two school years (depending on the cohort) to help develop relationships, self-reflection, and skill building. The program was delivered by college-educated men without specialized training. *Cook County Juvenile Temporary Detention Center (JTDC)*: Twice-daily group cognitive-behavioral therapy (CBT) sessions focusing on reflective/introspective activities and skill-building with token rewards.	*Goals*: BAM: teachs participants how to practice and apply anti-violence thoughts and actions. JTDC: teachs juvenile arrestees good behavior inside the facility and how to practice and apply anti-violence thoughts and actions to lower readmission rates.	*Sample*: BAM study 1: 2,740 7th- to 10th-grade male students at highest risk of failure in schools. BAM study 2: 2,064 9th and 10th graders. JTDC: 2,693 arrested males.	BAM study 1: Heller et al. (2017) found treated students have improved schooling outcomes by 0.14 standard deviations ($p < 0.01$) in the intervention year. The total arrests were reduced by 0.19 standard deviations ($p < 0.10$) in the intervention year. JTDC: Heller et al. (2017) showed the probability of readmission for the treatment group reduced from 13 to 16 percentage points ($p < 0.05$) from the second to the 18th months after the release.	BAM study 1: Heller et al. (2017) found treated students have improved schooling outcomes by 0.19 standard deviations ($p < 0.01$) in the following year. The rate of graduated on time is increased by 7 percentage points ($p < 0.10$). BAM study 2: Heller et al. (2017) found treated students have improved schooling outcomes by 0.10 ($p < 0.05$) standard deviations in the second intervention year. The total arrests were reduced by 0.17 standard deviations ($p < 0.05$) in the second intervention year.

Table 9 The Effect of Interventions on Personality: Parental Involvement Program on Empathy Education in China

Interventions	**Program Focuses**	**Sample and Criteria**	**Initial Outcomes**	**Follow-up Outcomes**
Curriculum: Parents learn how to incorporate empathy into their parenting practices through online parent-child reading activities and empathy-oriented movies. *Duration and intensity*: Four-month intervention with two biweekly readings and one movie per month. *Settings*: This online intervention is delivered through a Chinese social media: Wechat.	*Goals*: This parental involvement program aims to foster empathy in middle school students through educating and coaching their parents to reduce bullying activities.	*Sample*: 2,246 seventh and eighth grade students (14.5 years old on average) from Yongkang county, China. Randomization is conducted at the classroom level.	*Post Treatment*: Cunha et al. (2023) find that treated parents had higher empathy score (0.10 SD; $p < 0.05$), were more likely to change to democratic parenting (3.9 percentage points; $p < 0.05$), and were more willing to invest in empathy education (5 percentage points; $p < 0.10$) then the controled parents. Students with treated parents had higher empathy index (9.4 percentage points; $p < 0.05$), higher prosociality scores (0.16 SD; $p < 0.05$), higher positive traits index (0.14 SD; $p < 0.01$), and better mental health index (0.11 SD; $p < 0.05$) than the students in the control group. Students in the treatment group were less likely to identify themselves as bullies (5.3 percentage points; $p < 0.05$) and bully-victims (6.5 percentage points; $p < 0.05$); they were less likely to witness bullying incidents (6.1 percentage points; $p < 0.10$), but were more likely to stand up for the victims (5.2 percentage points; $p < 0.05$). For cumulative measures, treatment group students scored less on bullying perpetration (0.15 SD; $p < 0.10$) and bullying victimization (0.19 SD; $p < 0.05$).	N/A

Table 10 The Effect of Interventions on Personality: Jamaica Reach Up and Learn and China REACH

Interventions	**Program Focuses**	**Sample and Criteria**	**Initial Outcomes**	**Follow-up Outcomes**
Curriculum for Jamaica Reach Up and Learn: Home Visiting: Child and mother participants received home visiting focused on child stimulation as well as a nutritional supplement. *Duration and intensity*: Weekly home visits provided by community health workers for 2 years. The sessions consisted of the home visitor conducting a play session with the mother and child. Dietary supplements were also delivered weekly and consisted of 1 kg of milk-based formula.	*Goals*: The intervention was aimed at increasing the mothers ability to promote children's development through play and mother-child interaction.	*Sample*:127 9- to 24-month-old children in Kingston, Jamaica were randomly assigned to receive just the stimulation intervention ($N = 30$), the stimulation and supplement ($N = 32$), just the supplement ($N = 32$), or a pure control ($N = 33$). *Criteria*: Stunted (height-for age < -2 SD of the NCHS references) children were identified from poor neighborhoods.	*Post Treatment*: Both the stimulation and supplementation interventions had impacts on development. Within 4 years of the intervention, small improvements were reported in cognitive, motor, and memory domains.	*Age 31*: Walker et al. (2022) report sustained improvements in IQ. The intervention also led to improvements in contentiousness and grit, and reduced depressive symptoms, alcohol use, and risk taking.
Curriculum: Based on the Jamaican curriculum with adoptions to the Chinese settings. *Duration and intensity*: Same duration and intensity as the Jamaican pilot, and nutrition supplements were provided to both treatment and control groups. *Settings*: Home visits were delivered by local women with similar education level compared with the treated group's mothers.	*Goals*: The program aims to improve the health and cognition of children by promoting their engagement with caregivers and the larger community.	*Sample*: More than 1,500 children (6 to 24 months old) from Huachi county, Gansu Province, China. The randomization was conducted at the village level. *Criteria*: Different than the Jamaican study, China REACH does not focus on the stunted children.	*Post Treatment*: Zhou et al. (2022) find significant and positive effects on treated children's language and cognitive score (1.04 SD; $p < 0.01$), and fine motor score (0.68 SD; $p < 0.01$). Moreover, the intervention benefits the treatment group's home environment that the HOME score increased by 0.87 SD ($p < 0.01$).	N/A

Table 11 The Effect of Interventions on Personality: Perry Preschool Program and Carolina Abecedarian Project (ABC)

Interventions	**Program Focuses**	**Sample and Criteria**	**Initial Outcomes**	**Follow-up Outcomes**
Curriculum for Perry Preschool Program: Participants were taught social skills in a plan-do-review sequence where students planned a task, executed it, and then reviewed it with teachers and fellow students. They learned to work with others when problems arose. Additional home visits to promote parent-child interactions. *Duration and intensity*: Participants were taught social skills in a plan-do-review sequence where students planned a task, executed it, and then reviewed it with teachers and fellow students. They learned to work with others when problems arose. Additional home visits to promote parent-child interactions.	*Goals*: The Perry Preschool Program focused on reflective decision-making and deliberate problem solving. The curriculum was designed to foster development of cognitive and socio-emotional skills.	*Sample*: 123 disadvantaged children from Ypsilanti, MI were randomly assigned to receive access to a preschool program and home visits ($N = 65$). *Criteria*: Low Socio-Economic Status and IQ scores (below 85 at baseline).	*Post Treatment*: The intervention did not initially lead to improvements in IQ, but it did improve measures of personal behavior and decreased externalizing behavior.	*Age 54*: García et al. (2022) show that the intervention improved Executive Functioning, Positive Personality, Grit, and Openness to Experience.
Curriculum for ABC: Children were randomized to receive a high-quality preschool program focused on a curriculum of educational games that were age-appropriate interactions between the child and an adult. *Duration and intensity*: For the first 5 years of life treated participants received year-round full day preschool.	*Goals*: The preschool intervention was focused on language, motor, and cognitive development as well as social and emotional competencies.	*Sample*: Four cohorts were recruited between 1972 and 1977. 109 families of infants were matched on their sociodemographic characteristics and randomized into treatment ($N = 57$) or control ($N = 54$) groups. *Criteria*: Local clinics helped to identify children based on 13 sociodemographic factors that were weighted to create a high-risk index.	*Post Treatment*: N/A	*Mid-30s*: The program was shown to improve IQ and social emotional skills as well as leading to better educational and employment outcomes. The effects were stronger for girls than for boys.

Table 12 Overview of Personality Development from Longitudinal Studies

Authors	**Data**	**Measures**	**Results: Age**	**Results: Gender**
Brandes et al. (2021)	*Age*: 10 (middle childhood) to 13 (early adolescence) *Sample Size*: 440 *Data Collection*: Mother-reported *Timeline of Measurements*: Longitudinal annual report over 4 years	Inventory of Children's Individual Differences (ICID-S; Deal et al., 2007) *Domains and facets*: Neuroticism (Fear, Negative Affect, Shy), Extraversion (Positive Emotions, Sociable, Considerate, Activity Level), Conscientiousness (Organized, Achievement Orientation, Distractible-reverse-coded), Agreeablenss (Antagonism and Strong Willed-both reverse-coded), and Openness to Experience (Intellect and Openness).	*Under Neuroticism domain*: Fear and Negative Affect decrease with age. *Under Extraversion domain*: Extraversion, Activity Level, Sociability, and Positive Emotions decrease with age. *Under Agreeableness domain*: Agreeableness, Gentleness, Unassertiveness, and Compliant increase with age. *Under Openness to Experience domain*: Openness to Experience and Openness (facet) decrease with age.	*Boys*: Neuroticism decreases with age only among boys. Considerate, Gentleness, and Unassertiveness increase with age only among boys. Negative Affect and Activity Level decrease more than girls with age. *Girls*: Conscientiousness, Organized, Achievement Orientation, Attentiveness, and Agreeableness, increases with age only among girls. Compliant increases more than boys with age. Extraversion, Sociability, and Openness decrease more than boys with age.

Continued

Table 13 Overview of Personality Development from Longitudinal Studies-Continued

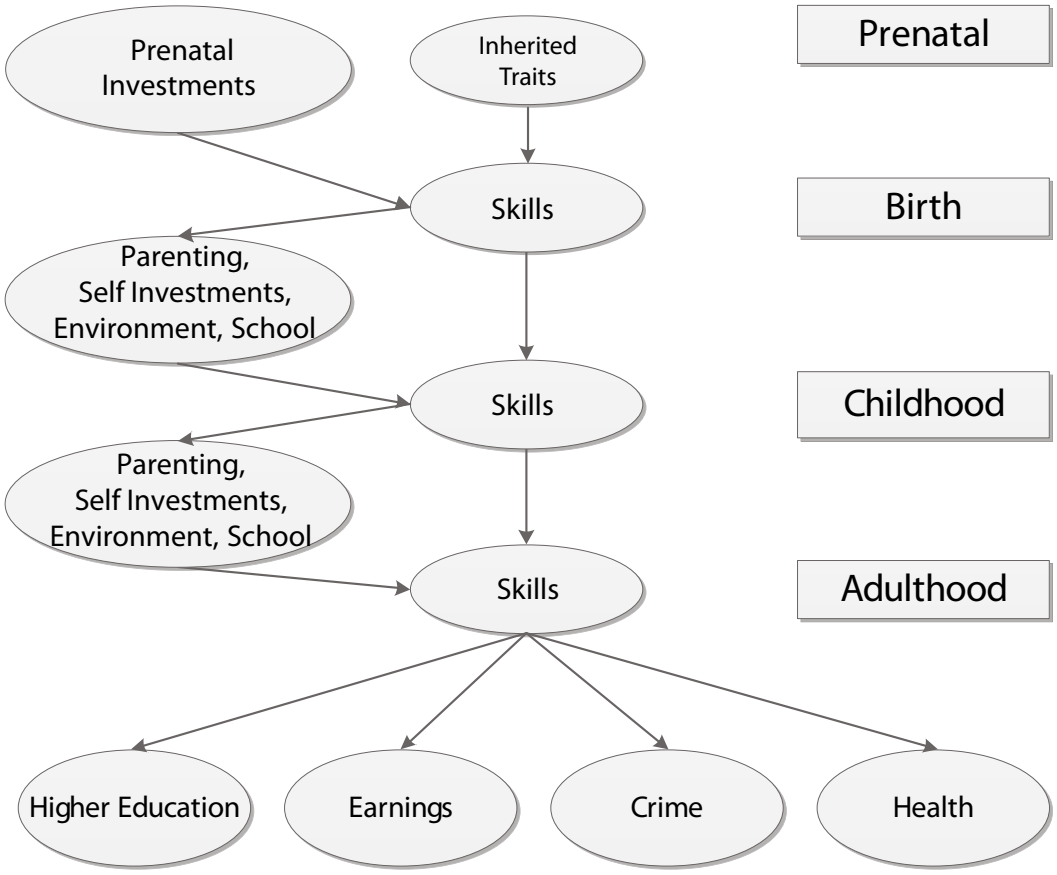
Authors	Data	Measures	Results: Age	Results: Gender
de Haan et al. (2017)	*Sample 1*: *Name*: the longitudinal Flemish Study on Temperament and Personality in Childhood (FSTPC; De Pauw, 2010) *Age*: 2 to 4.5 *Sample Size*: 365 *Data Collection*: Mother-reported *Timeline of Measurements*: measured 4 times for every 6 months across 18 months *Sample 2*: *Name*:the longitudinal Flemish Study on Parenting, Personality, and Development (FSPPD; Prinzie et al., 2003) *Age*: 6 to 17 *Sample Size*: 579 *Data Collection*: Mother-reported *Timeline of Measurements*: measured 4 times across 8 years	Both samples use Hierarchical Personality Inventory for Children (HiPIC; Mervielde and De Fruyt, 1999) for the Big Five facets.	*Under Extraversion domain*: During the early childhood energetic decreases with age. Extraversion decreases with age during the middle childhood and the end of middle adolescence. *Under Benevolence (Agreeableness) domain*: During the early childhood altruism and compliance increase with age, and egocentrism decreases with age. Compliance decreases with age from childhood to adolescence. *Under Conscientiousness domain*: During the early childhood, Achievement striving and Concentration increase with age, and Perseverance decreases with age. *Under Emotional Stability domain*: During the early childhood, Anxious increases with age, and Self-confident decreases with age. *Under Imagination domain*: During the early childhood, Intellect increases with age. Imagination decreases with age from childhood to adolescence.	Gender differences found in the development of Extraversion, Agreeableness, Conscientiousness (only from the childhood to the adolescence), and Emotional Stability (only from the childhood to the adolescence). There was no gender difference in the development of Conscientiousness and Emotional during the early childhood, and in the development of Imagination.

Continued

Table 14 Overview of Personality Development from Longitudinal Studies-Continued

Authors	**Data**	**Measures**	**Results: Age**	**Results: Gender**
Syed et al. (2020)	*Name*: Gothenburg Longitudinal study of Development (GoLD) *Age*: 2 to 33 *Sample Size*: 139 *Data Collection*: Mother-reported (from ages 2 to 15) or self-reported (from ages 21 to 33) *Timeline of Measurements*: Measured 9 times when the participants were at ages 2, 3, 7, 8, 15, 21, 25, 29, and 33	The California Child Q set (CCQ; Block, Block): *Ego resiliency*: the tendency to change responses depending on situations *Ego control*: the tendency to control impulses	*Ego resiliency*: Gradually decreasing with age from 2 to 33 that best fit with linear model. The change is small that showing the minimal mean level change over time but varies with individuals with different starting levels. *Ego control*: The data was fit by a quadratic growth model that a significant growth starting from age 2 to adolescence then decreasing to the early adulthood and getting back to the previous high level during the adulthood. The starting level of ego control would vary the development over time.	No difference found between genders.
Wängqvist et al. (2015)	Same dataset as above but only from *ages 2 to 29*.	Swedish version of the Big Five Inventory (Zakrisson, 2010; John et al., 2008) and the California Child Q-set (CCQ, Block, Block).	*From ages 21 to 29*: Agreeableness and conscientiousness increase with age. Neuroticism decreases with age. *From ages 2 to 21*: Extraversion decreases with age. Agreeableness and Conscientiousness increase with age. Neuroticism and Openness to experience increase then decrease with age.	*From ages 21 to 29*: Women are more extraverted and neurotic. Agreeable increases with age only among women. Men are more open to experiences.

Figure 12.1 Framework for Understanding Skill Development



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