



Thoughts on Integrating Evolutionary Analysis into Sociological Action Theory

Andreas Tutić 

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Abstract It is explored if and to what extent two approaches in behavioral sciences, which are promising with respect to an evolutionary grounded, integrative action theory, are actually compatible. These two approaches are, on the one hand, evolutionary psychology, which conceptualizes human nature as a collection of evolved psychological mechanisms, each being functionally specialized with respect to a specific problem of adaptation. And on the other hand, the dual-process perspective, which holds that human behavior is driven by the interplay of two qualitatively distinct types of cognitive processes: Autonomous, fast, and associative Type 1 processes, which operate outside of the consciousness of the actor, on the one hand, and controlled, slow, and rule-based Type 2 processes of which the actor is aware. Notably, both of these approaches have descendants in modern sociological action theory, i.e., goal-framing theory (Lindenberg 2008, 2009) and the model of frame-selection (Esser 2001; Kroneberg 2011). It is argued that evolutionary psychology and the dual-process perspective are largely compatible, thereby giving rise to an evolutionary grounded, integrative action theory. Accordingly, Type 1 processes can be traced back to evolutionary old cognitive modules, which humans share with other species and which are highly efficient at solving specific problems of adaptation in a stable environment. In contrast, Type 2 processes of higher cognition are distinctly developed in humans and highly effective at dealing with a rapidly changing life space.

Keywords Evolutionary psychology · Dual-process perspective · Evolved psychological mechanisms · Default interventionism · Evolutionary game theory

✉ A. Tutić
Department of Sociology, University of Bergen
Rosenbergsgaten 39, 5015 Bergen, Norway
E-Mail: andreas.tutic@uib.no

Zur Integration evolutionärer Analyse in die soziologische Handlungstheorie

Zusammenfassung Es wird untersucht, ob und inwieweit zwei Ansätze in den Verhaltenswissenschaften, die vielversprechend für eine evolutionär fundierte, integrative Handlungstheorie sind, tatsächlich miteinander vereinbar sind. Diese beiden Ansätze sind zum einen die evolutionäre Psychologie, die die menschliche Natur als Menge von evolvierten psychologischen Mechanismen konzeptualisiert, von denen jeder funktional spezialisiert ist, um ein bestimmtes Anpassungsproblem zu lösen. Zum anderen handelt es sich um die Dual-Process-Perspektive, die besagt, dass menschliches Verhalten durch das Zusammenspiel von zwei qualitativ unterschiedlichen Arten kognitiver Prozesse bestimmt wird: Einerseits autonome, schnelle und assoziative Typ-1-Prozesse, die außerhalb des Bewusstseins des Handelnden ablaufen, und andererseits kontrollierte, langsame und regelbasierte Typ-2-Prozesse, die sich im Bewusstsein des Akteurs abspielen. Interessanterweise haben beide Ansätze Ableger in der modernen soziologischen Handlungstheorie, nämlich die Goal-Framing-Theorie (Lindenberg 2008, 2009) und das Modell der Frame-Selektion (Esser 2001; Kroneberg 2011). Es wird argumentiert, dass die evolutionäre Psychologie und die Dual-Process-Perspektive weitgehend miteinander vereinbar sind und die Grundlage einer evolutionär fundierten und integrativen Handlungstheorie bilden. Demnach können Typ-1-Prozesse auf evolutionär alte kognitive Module zurückgeführt werden, die der Mensch mit anderen Spezies teilt und die in einer stabilen Umwelt zur Lösung spezifischer Anpassungsprobleme äußerst effizient sind. Im Gegensatz dazu sind Typ-2-Prozesse höherer kognitiver Funktionen beim Menschen einzigartig weit entwickelt und äußerst effektiv im Umgang mit einer sich schnell verändernden Lebensumgebung.

Schlüsselwörter Evolutionäre Psychologie · Dual-Process-Perspektive · Evolvierter psychologischer Mechanismus · Default-Interventionismus · Evolutionäre Spieltheorie

1 Introduction

Sociology has a rather tense, even conflictual outlook on evolutionary reasoning (Turner and Machalek 2018). On the one hand, it cannot be questioned that highly influential and dominant macro-sociological accounts such as functionalism, differentiation theory, and stage theories took considerable inspiration from biology in having organicism, i.e., the analogy between a biological organism and a society, as their intellectual and historical root. On the other hand, generations of scholars working in the fields of micro-sociology and in particular sociological action theory for the greatest part have effectively denied that biological and evolutionary reasoning could be of any use in understanding and explaining human behavior as well as interaction. More specifically, sociological action theory has embraced a set of premises that have been coined the standard social science model (Tooby and Cosmides 1992). Accordingly, human social behavior is not the product of innate

biological characteristics but stems from learned, cultural practices. The standard social science model holds that above and beyond the evolved capacity for culture, biological properties of humans can safely be ignored in doing sociological research.

It has been convincingly argued elsewhere that the well-cultivated and widespread aversion among sociologists toward explaining human behavior in terms of Darwinian principles is based on profound misconceptions regarding these very principles (Machalek and Martin 2004). In particular, the standard social science model draws its appeal among sociologists because evolutionary thinking is erroneously equated with some sort of biological reductionism and genetic determinism according to which human behavior is the immediate output of genetically hard-wired instincts. Needless to say, this take on evolutionary thinking ignores central cornerstones of this approach, in particular the notions of gene-culture co-evolution (Wilson 1998; Boyd and Richerson 1985) and prepared learning (Lumsden and Wilson 1981; Cosmides 1989; Cosmides and Tooby 1989), which effectively sidestep the untenable dichotomies between genes and culture or nature and nurture (Machalek and Martin 2004). In brief, modern evolutionary thinking does not deny that the great bulk of human social behavior is driven by cultural orientations; instead, Darwinian principles help to explain the emergence of a uniquely developed capacity for culture among humans (Baumeister 2005). In addition, the biological nature of humans is key to explaining the conditions under which certain cultural ideas and practices are learned and exert a profound impact on overt behavior.

In exploring the question of how evolutionary analysis can be integrated into sociological action theory, this paper will not focus on the standard social science model or prevalent misconceptions regarding evolutionary reasoning among sociologists. Instead, I shall take recent conceptual advancements in evolutionary psychology and the dual-process perspective as a springboard and explore in what way and to what extent these promising theoretical approaches are actually compatible. The focus on these two approaches is justified for several reasons. Although evolutionary psychology is one of several evolutionary perspectives in social science, in addition to sociobiology, behavioral ecology, and the literature on gene-culture evolution, it is particularly appealing from an action-theoretical standpoint because of its attempt to explain the human mind in terms of its constituting psychological mechanisms (Laland and Brown 2002, pp. 300ff.). The dual-process perspective has received a lot of attention in the sociological literature owing to its ability to effectively integrate a wealth of ideas in classical sociological action theory into a more integrative model of social action, as well as its fruitfulness in cultural sociology (DiMaggio 1997; Vaisey 2009; Brett 2022), particularly with regard to the question under what conditions cultural orientations actually have a significant impact on overt behavior (Tutić 2022a, b). The remarkable suitability of these two approaches in terms of founding a proper action-theoretical foundation for sociology is also demonstrated by the fact that both approaches have inspired two of the most promising modern attempts in sociological action theory, i.e., the goal-framing theory by Lindenberg (2008) and the frame-selection model (Esser and Kroneberg 2020) as introduced by Esser (1996, 2001) and Kroneberg (2005, 2011).

Against this background, the question of whether evolutionary psychology and the dual-process perspective are actually compatible deserves considerable attention.

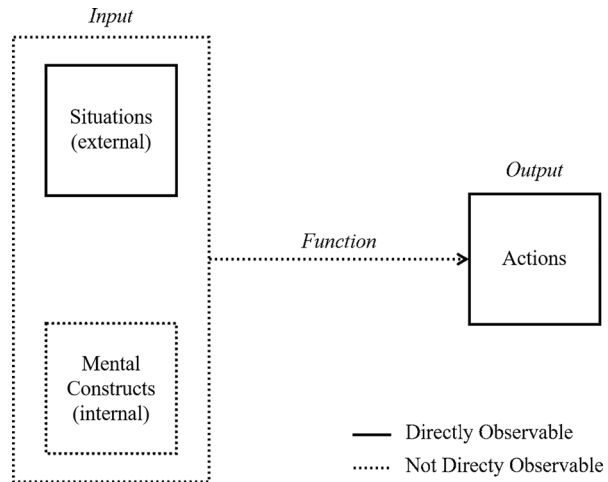
Before addressing this question directly, I first introduce a model of action theories that figures as a yardstick to discuss the methodological advantages and disadvantages of both evolutionary psychology and the dual-process perspective (Sect. 2). Then I describe key notions of evolutionary psychology (Buss 2019; Shackelford 2021), such as human nature and evolved psychological mechanisms (Sect. 3), and fundamental ideas of the dual-process perspective (Kahneman 2011; Evans 2010; Stanovich 2011), i.e., the distinction between two types of qualitatively distinct cognitive processes and the default-interventionist conception regarding their interaction (Sect. 4). Of course, the main task addressed in this paper then is to dwell on the questions if and to what extent these two approaches are in contradiction to or complement each other (Sect. 5). Here, I decidedly take the position that evolutionary psychology and more generally the Darwinian approach in the behavioral sciences and the dual-process perspective do in fact complement each other in that the latter conceptualizes the basic architecture of the human mind, whereas the former puts some content in the evolutionary old part of the human mind as well as providing the tools to explain its emergence. Section 6 concludes with a summary of the main argument and provides directions for future research.

2 Action Theory

To discuss the question of what evolutionary analysis can contribute toward sociological action theory, first and foremost it is necessary to clarify what the notion of “action theory” actually entails. In this metatheoretical section, I introduce a model of action theories that serves as a yardstick to discuss the pros and cons of recent advances in the Darwinian approach and interdisciplinary action theory. A more detailed account of this model is provided in Tutić (2022a; see also Kroneberg and Tutić 2021).

Most social scientists implicitly or explicitly agree to some form of methodological individualism (Udehn 2002; Albert 2005). Accordingly, explaining individual behavior is a necessary (but not sufficient) prerequisite to explaining social phenomena (Raub and Voss 2016). Figure 1 depicts schematically the action-theoretical approach to explaining individual behavior. As social scientists, we can directly observe that an actor is taking some action against the background of a certain objective situation.¹ Aspects of this objective situation are located outside of the actor’s organism and hence can also be called external factors. Our task as social scientists would be very much simplified if there was a simple empirical relationship between objective situations and overt behavior, so that whenever the objective situation is identical, the same course of behavior is chosen. However, human behavior is way too complex to follow such a function. Hence, action theorists generally posit the

¹ In this paper, the words “action” and “behavior” are used synonymously. This deviation from terminological conventions within sociological action theory is motivated against the background that concepts such as “intentions” and “subjective meaning,” on which the distinction between action and behavior is based, need to be endogenized within the frameworks under consideration, i.e., evolutionary psychology and the dual-process perspective.

Fig. 1 A Model of Action Theories

existence of certain mental constructs, which are located inside the actor's organism (i.e., internal factors), and let overt behavior depend on both the objective situation and the postulated mental constructs. Put differently, an action theory posits a function between inputs and outputs, $f : I \rightarrow O$, which is defined on the set of objective situations S and the set of mental constructs M as the set of inputs, $I = S \times M$, and maps each configuration of internal and external inputs onto the domain of observable behavior O . Note the extreme demands that the formulation of a function f entails: For every theoretical conceivable objective choice situation and for every theoretical conceivable internal state of the agent, function f has to describe exactly what behavior is to be observed.

Standard rational choice theory can be used to illustrate this model of action theories. In its simplest version, rational choice models objective choice situations as a subset of a grand set of options X . Hence, our set S is the set of all (non-empty) subsets of X , i.e., $S = 2^X \setminus \{\emptyset\}$. The internal state of decision maker is described by a (strict) preference relation \succ on X ; consequently, M is the set of all strict preference relations on X . The decision rule of rational choice, i.e., constrained maximization, now induces a function f by specifying that each decision maker (characterized by a specific \succ) picks in each choice situation (a particular $s \in S$) from the set of available options the one option that maximizes her preference, i.e., $f(s, \succ)$ is implicitly defined by $f(s) \succ x$ for all $x \in s, x \neq f(s)$.

Several remarks regarding this model of action theories are in order. First, this model is an idealization, i.e., most actual action theories in the social sciences fall short of it (see Tutić 2022a for a more in-depth discussion).² The most common deficiency is that the nomological core of the model, i.e., the function f , often called

² However, there are in fact examples for action theories which follow this model closely. Rational choice is an obvious case in point (e.g., Tutić 2020), but there are also other examples such as decision procedures studies in the literature on bounded rationality (e.g., Rubinstein 1998), decision algorithms implemented in computational social science (e.g., Manzo 2014), and parametrized models in mathematical psychology (e.g., Batchelder and Riefer 1999).

decision rules or rule system (Diekmann and Voss 2004; Buss 2019), is missing. Sociological action theories are typically content with merely positing certain mental constructs (such as values, norms, identities etc.), accompanied by the (implicit) claim that these constructs have some influence on behavior. Although this practice might suffice to “understand” behavior in the sense of providing sensitizing concepts and guidelines on what factors and variables to look out for and measure, it generally falls short of actually explaining behavior. In stating this, I implicitly make recourse to the metatheoretical idea (Hempel and Oppenheim 1948) that explaining a certain phenomenon (P) means logically deriving it from a general, law-like rule ($C \rightarrow P$) and initial conditions that refer to the premise of the rule (C). In the context of action theories, the initial conditions consist of the statement that a certain objective situation ($s \in S$) and a certain mental state of the actor ($m \in M$) are given; the function f in turn serves as the general, law-like rule and hence the nomological core of the action theory. In this sense, an action-theoretical explanation presupposes the formulation of a at least partially defined function f . Note, however, that action-theoretical accounts that lack an explicit function f are far from uninteresting; by identifying a set of mental constructs they provide a necessary first step toward the formulation of a proper action theory and inform explorative as well as descriptive research regarding what to look out for and measure.

Second, the model highlights the fundamental challenge to action theory. This challenge lies in the fact that mental constructs are generally much harder to observe and measure than external aspects of the objective situation. As a consequence of this lack of direct observability, empirical observations that diverge from theoretical predictions can easily be attributed to errors or imprecisions in the measurement of mental constructs (see Watts 2014). Thus, the postulation of mental constructs constitutes a necessary evil, and special methodological care is required when working empirically with these concepts (Kroneberg and Tutić 2021).

The third and final remark is directed at the notion of situations. Clearly, each action takes place in an extremely rich environment in terms of both physical–chemical and social aspects. Any action theory has to isolate a small number of aspects of these situations that it considers relevant for the explanation of overt behavior, and describe an objective situation only according to these aspects. Implicit in this theory-immanent definition of an objective situation is the assumption that all other aspects of the external environment are to a large extent irrelevant. For example, the standard decision theory in rational choice describes an objective choice situation simply by the set of available actions (Tutić 2020). If it turns out empirically that the order of elements within choice sets impacts behavior significantly, we encounter an anomaly in standard theory (Rubinstein and Salant 2006). This follows from the fact that the notion of a choice situation in standard rational choice disregards the order of elements and only considers sets. In a nutshell: The formulation of an action theory implicates a specification of the set of conceivable objective situations S , and each objective situation $s \in S$ needs to take account of all aspects of the environment which are considered relevant by the action theory under consideration.

3 Evolutionary Psychology

Evolutionary psychology is primarily concerned with identifying so-called evolved psychological mechanisms. Human nature is thought to comprise many distinct such mechanisms, each of which being an adaptation to an adaptive problem faced in the environment of evolutionary adaptedness. Although these statements may seem innocuous, the involved terms are actually technical in nature and need to be handled with considerable care. Unpacking these terms is key to interpreting these statements correctly and hence to understand the action-theoretical substance as well as the explanatory strategy of evolutionary psychology. Before actually engaging in this, a word of clarification is in order: My depiction of evolutionary psychology largely follows the modular and adaptationist school of thought, as founded by Leda Cosmides and John Tooby. Although their approach can still be considered dominant within evolutionary psychology, it is not without its critics and not all scholars who consider themselves evolutionary psychologists subscribe to it (Laland and Brown 2002, p. 157).

The term psychological mechanism can be defined as an information processor that is located inside an organism (Lewis et al. 2021; Buss 2019). An information processor in turn consists of three components:

- A set of inputs on which the processor operates,
- a set of outputs that the processor generates,
- a function that is defined on the set of inputs and takes values in the set of outputs.

It is instructive to compare the concept of a psychological mechanism with our model of action theories. Both concepts are similar in having at their very heart a function that maps inputs onto outputs. However, there are crucial differences when it comes to the specification of inputs and outputs. As indicated in Sect. 2, the decision rule of an action theory is defined on the product of both the totality of external factors (i.e., the “choice situations”) and the totality of internal factors (i.e., the “mental constructs”). In contrast to this, scholars of evolutionary psychology underline that their notion of inputs does not refer to the totality of factors. Instead, each particular psychological mechanism takes only a thin slice of aspects of the totality as input. It is argued that the human organism, in terms of its physical–chemical environment, is in every millisecond confronted with an unimaginable plethora of pieces of information on which it could potentially operate. A particular psychological mechanism does not take into account all of these available information pieces, but only operates on a very small subset. The type of input on which the mechanism operates is instructive in identifying the type of adaptive problem the mechanism evolved to deal with. So, this is a first and major difference between the notions of an action theory and a psychological mechanism.

Regarding inputs, at first glance there seems to be a second important difference. Whereas the model of action theory makes it very clear that the outputs depend on both external and internal factors, the notion of inputs regarding psychological mechanisms does not explicitly differentiate between internal and external factors. In addition, the literature in evolutionary psychology sometimes leaves the impression of downplaying the importance of internal factors. For instance, it is often high-

lighted that behavioral differences among humans do not stem from differences in the equipment with psychological mechanisms but from differences in the external factors (Lewis et al. 2021, p. 98): “These information-processing systems require environmental inputs in order to work, and because that environmental information can vary widely—both between and within individuals across time and space—these information-processing mechanisms, even if identical across all individuals, can produce a great deal of variation in behaviour across individuals.” Statements like these somewhat obscure the important nuance that individuals at a current point in time and space differ not only in their “environmental input” but also in their “internal inputs,” and that these differences in “internal inputs” are an additional source of behavioral variance, whilst keeping the functions at the heart of psychological mechanisms fixed across individuals.

However, aside from some inconvenient wording here and there, the action-theoretical idea that functions take both external and internal factors as inputs is conceptually acknowledged in evolutionary psychology. This becomes clear when we turn to the notion of outputs. In our model of action theory, the outputs were restricted to overt behavior. This contrasts with the notion of output regarding psychological mechanisms, which is considerable broader. It includes overt behavior, but also mere physiological reactions. Importantly, the output of a psychological mechanism also comprises information that can be used as input by other psychological mechanisms (see Buss 2019, p. 45). The latter implies unambiguously that the input of a particular psychological mechanism is not necessarily restricted to information originating from outside of the organism (external factors) but also includes information stemming from other parts of the inside (internal factors; see also Burke 2021, p. 457).

The term human nature can be defined as the species-typical characteristics of humans (Lewis et al. 2021, p. 98). These characteristics can be morphological, physiological, as well as psychological in nature and are thought of as resulting from natural selection. Regarding the domain of psychological characteristics, human nature consists of a collection of evolved psychological mechanisms. This description of human nature as a mere collection of psychological mechanisms marks an important deficiency of evolutionary psychology in terms of our model of an action theory. Whereas in our model a decision maker is characterized by one function mapping from the cartesian product of choice situations and mental constructs onto actions, a human decision maker in evolutionary psychology is characterized by a set of psychological mechanisms, each having at its core its own function mapping inputs onto outputs. In fact, in the literature on evolutionary psychology a great many sociologically relevant psychological mechanisms are under consideration. This encompasses, for example, a mechanism for the detection of cheaters in situations of social exchange (Cosmides et al. 2010), a mechanism to detect coalitional alliances (Kurzban et al. 2001) as well as several mechanisms regulating mate preferences and mating behavior (Buss 1989). Although the study of mechanisms like these is without doubt a productive research program, it does, nevertheless, raise the action-theoretical question of how these diverse mechanisms can be integrated into a coherent model of human behavior, i.e., into a full-blown action theory in the sense of Sect. 2. Put differently, describing human nature as a collection of functions, each of

which is defined on certain inputs, is not the same as establishing a function that is defined on the totality of inputs. In this sense, the characterization of human nature by evolutionary psychology falls short of a proper action theory.

Some scholars in evolutionary psychology attempt to go beyond conceptualizing human nature as a mere collection of evolved psychological mechanisms by grouping these mechanisms into a small set of classes. The classification is usually based on differentiating between certain types of adaptive problems so that each class of mechanisms is functional with respect to the underlying type of adaptive problem. Important types of adaptive problems under consideration in these attempts relate to problems of survival, problems of mating, problems of parenting, as well as problems of cooperation and competition (Buss 2019, p. 48; Brase 2021, p. 36). The number of types of adaptive problems, and hence the number of classes of evolved psychological mechanisms, as well as the terminology, vary widely in the literature. For instance, Kenrick and Griskevicius (2013) use the term *subelves* with respect to classes of mechanisms and differentiate between seven *subelves*: The night watchman (evading physical harm), the compulsive hypochondriac (avoiding disease), the team player (making friends), the go-getter (gaining status), the swinging single (attracting a mate), the good spouse (keeping the mate), and the nurturing parent (caring for family). In a similar manner, Roy F. Baumeister (2005) argues that evolution has endowed us with a set of basic motivations, which are functional with respect to fundamental adaptive problems. These motivations encompass many of the *subelves* covered by Kenrick and Griskevicius (2013), which directly relate to the physical and social environment of humans, such as a desire for food or belongingness. Reminiscent of the idea of a gene-culture co-evolution, Baumeister also stresses that adaptive problems of the cultural environment of humans induce basic motivations of their own, such as a desire to learn and use language (Baumeister 2005, p. 138). That is to say, the cultural environment of humans not only channels and refines the manner by which basic motivations stemming from the physical and social environment play out under “culturalized” (Baumeister 2005, p. 6) conditions, but induce their own basic motivations as well.

One action-theoretical approach in particular, which draws heavily from evolutionary psychology, has gained traction within sociology: The goal-framing theory, as proposed by Siegwart Lindenberg (2008, 2009), states at its theoretical core that three goal-frames have to be differentiated; these goal-frames can be thought of as bundles of evolved psychological mechanisms that tackle three fundamental types of adaptive problems.³ First, the hedonic goal-frame emphasizes sensory pleasure and the satisfaction of individual needs in a short-term time horizon. Second, the gain goal-frame is concerned with the accumulation and effective usage of resources in a medium- to long-term time horizon. And finally, the normative goal-frame focuses on the social demands that the actor is facing, i.e., the appropriateness of behavior and group outcomes. It must be stressed that the concept of a goal-frame is very

³ Lindenberg in fact uses the term *module* (Fodor 1983) to refer to evolved psychological mechanisms. In the more recent literature, the term *module* is often avoided because it carries certain connotations such as “informational encapsulation” which do not necessarily apply to evolved psychological mechanisms (Brase 2021, p. 44).

broad and encompasses various dimensions of perception, judgment, and behavior (Lindenberg 2008, p. 670): “When they are focal, they create modularity by affecting what we attend to, what information we are sensitive to, what information we neglect, what chunks of knowledge and what concepts are being activated at a given moment, what we like and dislike, what criteria for goal achievement are being applied, etc.” Hence, understanding and explaining concrete behavior can only be achieved by identifying which of the three goal-frames is focal in the choice situation under consideration. Importantly, Lindenberg (2008) stresses that the other two goal-frames linger in the background and either support or undermine the primarily active goal-frame. Whereas aspects of the choice situation that are relevant for the focal goal-frame are expected to have a sizeable effect on overt behavior, aspects of the choice situation that are only relevant to a background goal-frame should only have a small effect. For instance, the relative prices of choice alternatives should exert a strong effect on behavior if the gain goal-frame is focal, but be considerably weaker if the normative goal-frame is focal (Lindenberg 2008, p. 675). According to goal-framing theory, the selection of the focal goal-frame is not under the voluntary control of the actor, but subject to situational contingencies and framing effects. Lindenberg (2008, 2009) adds two further ideas regarding the selection of goal-frames: First, goal-frames differ in their a priori strength such that, *ceteris paribus*, the hedonic goal-frame has a greater chance of being focal than the other two frames. Second, although the selection of goal-frames is not under the voluntary control of the actors, they can nevertheless have some influence by seeking or avoiding stimuli and in particular social environments that support the salience of certain goal-frames.

If we compare goal-framing theory with our metatheoretical model of action theories, we find significant deficiencies. The theory is content with postulating the existence of certain mental constructs (i.e., goal-frames), but abstains from formulating any decision rule that describes in sufficient detail how these goal-frames interact with aspects of the objective situation in generating overt behavior. In addition, the notion of goal-frames is so broad that it has to be deconstructed considerably to allow for the formulation of such decision rules. Comparing the list of goal-frames with the aforementioned list of subselves by Kenrick and Griskevicius (2013), it also becomes obvious that theorists face a trade-off between parsimony and preciseness: The smaller the number of classes of psychological mechanisms, the more abstract and, in a sense, vague the types of adaptive problems under consideration.

The terms evolved psychological mechanisms and human nature constitute the action-theoretical substance of evolutionary psychology. However, the contribution of evolutionary psychology toward our scientific inquiry of human behavior does not stop at positing the nuts and bolts of a model of human behavior. Instead, evolutionary psychology, and more generally, the Darwinian approach in behavioral science, is aimed at actually explaining human nature and the emergence of evolved psychological mechanisms in humans. The key to the explanatory strategy lies in the term adaptation. An adaptation is defined as a characteristic of an organism that results from natural selection because it helps to solve an adaptive problem (Tooby and Cosmides 1992). In turn, an adaptive problem can be broadly defined as a recurrent aspect of the organism’s environment of evolutionary adaptedness that influences its chances for survival and reproduction (Brase 2021, p. 35). For each

adaptation, the environment of evolutionary adaptedness is defined as the “statistical composite of selection pressures” (Buss 2019, p. 35), which are present during its evolution (Tooby and Cosmides 1992). For many of the evolved psychological adaptations in humans, the environment of evolutionary adaptedness is located in the Pleistocene, where humans lived in small hunter-gatherer societies (Brase 2021, p. 42).

Evolved psychological mechanisms are those psychological mechanisms that qualify as adaptations (Lewis et al. 2021, p. 98). As such, an evolved psychological mechanism needs to be functional with respect to a specific, well-defined adaptive problem. Put differently, an evolved psychological mechanism is considered to be domain specific, i.e., functionally specialized with respect to a specific adaptive problem and only operates on inputs that are relevant to this function. Explaining the evolution of an evolved psychological mechanism thus necessarily involves identifying its underlying adaptive problem and to argue convincingly how and in what ways the mechanism under consideration is functional in solving this problem. Theoretical arguments for the functionality of a psychological mechanism in this regard primarily stem from features of its special design, which ensure that the adaptive problem is dealt with efficiently, economically, precisely, and reliably (Williams 1966). Put differently, the psychological mechanism that is to be explained must be described in terms of its inputs, outputs, and the functional relationship between them in sufficient detail such that it becomes apparent in what precise manner the mechanism overcomes its hypothesized underlying adaptive problem. Formal model-building as well as computer simulations are invaluable tools in achieving the required level of precision and help to prevent explanatory accounts in evolutionary psychology from degenerating into “just-so-stories” (Burke 2021, p. 460) about our distant past. Of course, it is impossible to directly test the hypothesis that a specific psychological mechanism evolved in response to a particular adaptive problem (Burke 2021, p. 454). However, provided that the mechanism under consideration is sufficiently well described in theoretical terms, its empirical validity can be tested rigorously among present humans. In addition, indirect evidence for its evolutionary origin can come from a variety of sources, such as studies that show that a mechanism is universal among humans or studies indicating that variations in adaptive problems between sexes or species correlate with variations in psychological mechanisms (Buss 2019, pp. 52 ff.).

4 Dual-Process Perspective

The dual-process perspective in interdisciplinary action theory arises from apparent convergences in the psychological (Kahneman 2011; Evans 2010; Stanovich 2011), economic (Rubinstein 1998), and sociological (Esser 2001; Kroneberg 2011) literature and rests upon the notions of dual processes and default interventionism (see Tutić 2022a, b for more extensive accounts).

The notion of dual processes refers to the most fundamental and commonly accepted assumption in the dual-process perspective. Accordingly, two qualitative distinct types of cognitive processes have to be differentiated to understand and

explain human behavior (Evans and Stanovich 2013). Type 1 processes are defined as occurring without support of working memory and tend toward being automatic, fast, unconscious, associative, and capable of working in parallel. In contrast, Type 2 processes operate, by definition, with the help of working memory and typically are controlled, slow, conscious, and processed only one at a time. Canonical examples of Type 1 processes are the recognition of familiar faces and the inferences from facial expressions to underlying emotional states. Solving a nontrivial algebraic problem provides a good example of a Type 2 process (Kahneman 2011).

The idea of two distinct types of cognitive processes can be motivated against the background of a plethora of stylized empirical findings regarding human reasoning and decision-making that document systematic deviations from normative calculi such as logic, stochastics, and standard decision theory. To illustrate this, consider the canonical Wason selection task (Wason 1968). Here, subjects are confronted with four cards and told that each card has a letter on one side and an integer on the other side. Suppose the cards are presented such that the subjects see only one side of each card and these look as follows: R J 5 2. The task given to the subjects is to identify the minimal set of these cards that they need to turn around to check whether the following rule applies: If there is an R on one side of the card, then there is a 5 on the other side of the card. Empirically, many subjects exhibit the so-called matching bias and turn around those cards that are explicitly mentioned in the rule, i.e., they turn around the card showing R and the card showing 5. Only a small minority of subjects give the logically correct response which is to check the cards showing R and 2 (e.g., Rubinstein 2013). Proponents of the dual-process perspective make sense of these findings by arguing that the matching bias is driven by Type 1 processes, whereas explicit logical reasoning can only occur via a Type 2 process. That is, as 5 is explicitly mentioned in the rule, it is intuitive to turn the card showing 5 around. It takes some reflection (and the appropriate mindware, see below) to see and understand that the validity of the rule does not hinge upon what the other side of this card shows. This interpretation is backed by studies showing that subjects who give the logically correct response have a higher median response time than subjects adhering to the matching bias (Rubinstein 2013). This example showcases the very thrust of the dual-process perspective and its explanatory strategy regarding “anomalies” in judgment and decision making: The application of normative calculi such as logic, stochastics, and decision theory generally occur via Type 2 processes. Deviations from prescriptions of these calculi often take place because Type 1 processes suggest intuitive responses that typically are based on mere associations and subjects act as cognitive misers (Stanovich 2011), avoiding engaging in effortful and fully fledged Type 2 processing.

In the dual-process perspective, human behavior is understood to result from the outcome of the interaction between the two types of cognitive processes. Importantly, there is no universal agreement regarding the question of how to conceptualize this interaction. However, leading proponents of the dual-process perspective in psychology (Kahneman 2011; Evans 2018) as well as sociology (Esser and Kroneberg 2020) favor what is called default interventionism. According to this position, in each choice situation there is a Type 1 process suggesting a certain course of behavior, which acts as a default. Only if Type 2 processing kicks in, identifies a more

suitable course of action, and is successful in overriding the default provided by Type 1 processes will the actor emit a course of behavior that deviates from it. The level of Type 2 processing in turn depends on both motivational factors and cognitive resources (Evans 2018). The motivation to engage in conscious and effortful reflection depends both on individual dispositions, such as cognitive styles (Kahneman and Frederick 2002), and on situational contingencies, such as the framing of the choice situation as one requiring intensive reasoning (Ferreira et al. 2006). Cognitive resources encompass dispositional as well as situational working memory capacity and also the mere availability of enough time to actually think about the task at hand. It is important to note that even if the actor engages in extensive Type 2 processing, the default provided by Type 1 processes need not be overridden. For one, the initial intuition about the problem at hand might simply be corroborated by reflection. Alternatively, the actor might attempt to explicitly reason about the problem, but lack the adequate mindware, i.e., knowledge, education, and raw computing power (Stanovich 2011; Evans 2018), to come up with an adequate solution.

In terms of our model for action theories depicted in Fig. 1, the dual-process perspective suffers from major shortcomings. Although concepts such as Type 1/Type 2 processes and working memory do hint at essential internal factors and also suggest a basic architecture of the human mind, the approach is far from providing specific enough decision rules such as to effectively describe a function that maps from the product of choice situations and mental constructs onto behavioral outputs. Note that the notion of process as used in the dual-process perspective essentially equals the aforementioned notion of an information processor. That is, given some inputs that are present in the choice situation, processes generate some output and this transformation of inputs into output can be described by rules (Gawronski et al. 2014). The scope and content of Type 2 processes are fairly straightforward to describe; these are for the most part information processors operating normative calculi such as logic, stochastics, and decision theory. However, the notion of Type 1 processes, or as Evans and Stanovich (2013) put it, the autonomous set of systems (TASS), appears to be both some kind of umbrella term and also a residual category. It figures as an umbrella term because for almost each type of judgment and decision-making problem studied in the literature, and for each specific application of the dual-process perspective, there is a separate Type 1 process upon which scholars rely to base the problem-specific notion of intuitive response. TASS also serves as a residual category in that all kinds of judgments and behaviors that deviate from established normative calculi are traced back to some Type 1 process. What these deficiencies regarding the scope and content of Type 1 processes imply is that the set of processes that have been theoretically integrated into an overarching mapping f in the sense of Subsect. 2 is not well defined. As the set of processes is not well defined, this criticism also applies to the set of external aspects of the choice situation and internal factors, i.e., mental constructs on which these processes operate.

A second problem in establishing a proper function f on the basis of the dual-process perspective is that the theoretical conceptualization of the interplay of Type 1 and Type 2 processes by means of default interventionism is still too vague. This can readily be seen from recent advancements in the psychological dual-process literature, in which scholars such as De Neys (2018) and Pennycook (2018) have

proposed models of the interaction that they consider alternatives, whereas Evans (2018) more or less takes the position that these models are compatible with his account of default interventionism. As a consequence of this theoretical blank space it remains an open question in what precise manner which external and internal factors determine whether overt behavior is mainly driven by Type 1 or by Type 2 processes.

Interestingly, the model of frame-selection as proposed by the sociologists Hartmut Esser (1996, 2001) and Clemens Kroneberg (2005, 2011) provides a clear-cut decision rule regarding the interaction of Type 1 and Type 2 processes. To explain this decision rule, it is necessary to introduce some background to this model. The model of frame-selection integrates two essential ideas of classical sociological action theories into a rational-choice style model of human decision making, i.e., the idea that actions happen against the background of a subjective definition of the situation (Thomas theorem; Thomas and Thomas 1928) and the idea that the degree of rationality and reflection varies between choice situations (Schütz 1972). According to the model of frame-selection, observable behavior is modeled by a series of three selections that thematize the definition of the situation (so-called frames), the orientation toward behavioral programs (so-called scripts), and finally the concrete selection of a behavioral output (see Kroneberg 2005 for details). Each selection can either take place in the automatic-spontaneous mode (as-mode), which corresponds to Type 1 processes, or in the reflective-calculating mode (rc-mode), which corresponds to Type 2 processes. Importantly, the model of frame-selection is explicit regarding the question under which conditions a selection comes about in the as- or rc-mode. According to the so-called *logic of mode selection*, a selection takes place in the as-mode if and only if the inequality $m_{a^*} \geq 1 - c/(\rho v)$ is satisfied, in which the alternative a^* is the alternative that would be selected in the as-mode, m_{a^*} its so-called match, c denotes the cost of reflection, ρ the probability that reflection is successful, and v the opportunity costs of an erroneous selection. The match of an alternative measures the extent to which the alternative subjectively fits to the situation at hand, i.e., it is a concept that is aimed at capturing the associative character of Type 1 processes. Tutić (2022b) argues that the logic of mode selection is compatible with default interventionism and moreover integrates traditional as well as more recent ideas regarding the importance of both motivational factors and cognitive resources as described in the psychological literature on the dual-process perspective.

Although the model of frame-selection is a step in the right direction against the background of our model of action theories, the model of frame-selection can be described to suffer from considerable drawbacks. First of all, the model appears overly complex and as a consequence also overparametrized, mainly because it explains each particular piece of behavioral output by a series of six selections (frame, script, behavior each of which can come about either in the as- or in the rc-mode). A second point of criticism arises from this theoretical richness of the model; in applications of the model of frame-selection it can be challenging to relate empirical phenomena to the plethora of theoretical entities of the model. For instance, cultural orientations such as values and attitudes can plausibly have a bearing on frames, scripts, their matches, and activation weights respectively, as well as probabilities

and utilities that play a role in the model's conception of selections in the rc-mode (Tutić 2022b). Owing to this "theoretical ambiguity" (Kroneberg and Kalter 2012, p. 77), it might be difficult to trace the overall behavioral effect of changes in such factors. Finally, the model lacks an axiomatic foundation. As a consequence, it is hard to tell what all of its foundational concepts such as frames and scripts actually mean in terms of observable behavior, i.e., how to measure these concepts. In addition, it remains unclear what kinds of observable behavior would actually contradict the model (Tutić 2015a). Against this background, it seems worthwhile to simplify the model and subject it to decision-theoretic analysis using the techniques exemplified in the literature on bounded rationality (Tutić 2015b, 2022a). In this way, core ideas of the dual-process perspective can be developed in the direction of a proper action theory.⁴

Empirical research on the dual-process perspective primarily focuses on testing hypotheses on the influence of motivational factors and cognitive resources regarding the occurrence of Type 1 or Type 2 processes in various types of thinking and decision problems (e.g., Evans 2018). The dual-process perspective has also been fruitfully applied in cultural sociology (DiMaggio 1997; Vaisey 2009; Brett 2022; Tutić et al. 2022); here, the central idea is that cultural orientations, especially when stored or internalized in an associative, nondeclarative manner, should exert a greater impact on observable behavior when this behavior occurs in a Type 1 process rather than in a Type 2 process (see Tutić 2022b).

5 Compatibility of Evolutionary Psychology and Dual-Process Perspective

Having described the foundations of both evolutionary psychology and the dual-process perspective, as well as having discussed their merits and deficiencies from a general action-theoretical point of view, we now turn to the question of to what extent these two promising approaches regarding the explanation of human behavior are compatible.

The first aspect to stress here is that many proponents of the dual-process perspective are open toward Darwinian reasoning and, to some extent, also are engaged in it. In particular, the claim that Type 1 processes are evolutionarily old and shared with other species, whereas Type 2 processes are evolutionarily more recent and distinctly developed in humans, has been repeatedly put forward in the literature

⁴ Although a full discussion of the pros and cons of the model of frame-selection is not within the scope of this contribution, please note that these points of criticism are relative to the background of the metatheoretical model of action theories. That is, although the model might be described as too complex and overly rich in parameters to meet the demands of full-blown action theory in the sense of Sect. 2, exactly these properties can also be described as desirable for an action theory that is primarily aimed at providing an overarching orienting scheme that is universally applicable and provides a springboard for the development of more parsimonious and formalized action theories of middle range (see the discussion of "modularity" (in German: *Modularität*) in Kroneberg 2011). In addition, it is important to note that the model of frame-selection is by no means the only action theory in sociology that can be criticized for theoretical ambiguity and a lack of axiomatization.

(Stanovich 1999; Evans 2010). It is based on the simple observation that human behavior and cognition have some commonalities with those of other species but also differ in important aspects. Type 1 processes are thought to be based on instincts and associative learning and considered to be the carriers of these commonalities, whereas Type 2 processes make the human species distinct in enabling it to use language and calculi extensively and to engage in hypothetical thinking (Evans and Stanovich 2013, p. 236).

On top of being open toward Darwinism, it seems fair to say that the dual-process perspective has been considerably influenced by recent advances in evolutionary psychology when it comes to the conception of Type 1 processes. Recall from the last subsection that the notion of process used in the literature on the dual-process perspective and the notion of an information processor, which lies at the very heart of the concept of an evolved psychological mechanism, are very similar, if not identical. Therefore, in our description of the dual-process perspective, we readily characterized Type 1 processes as a collection of such information processors, i.e., the autonomous set of systems (TASS). This is already a modern and informed way of putting it. In some of the older literature on the dual-process perspective (e.g., Stanovich 1999) both Type 1 and Type 2 processes were characterized as systems (i.e., System 1 and System 2; see also Kahneman 2011) respectively. Of course, the notion of a “system” suggests that the individual parts of the system are to some extent integrated above and beyond merely forming a set. Exactly this assumption by now seems untenable to leading advocates of the dual-process perspective (Evans and Stanovich 2013, pp. 225 f.): “Stanovich (2004, 2011), for example, noted the wide diversity of autonomous processes that were being lumped together under the heading of System 1, abandoning that term in favor of TASS—the autonomous set of systems—in order to indicate that they do not belong to a single system with a single set of attributes.” Hence, the theoretical conception of the autonomous part of the human mind within the dual-process perspective has gravitated toward the notion championed in evolutionary psychology, i.e., that of a mere set of information processors.

The last paragraph can also be put neatly along the line that the idea that “[...] the *old* mind is massively modular” (Evans 2010, p. 48) has gained considerable traction within the dual-process perspective. However, proponents of the dual-process perspective are generally reluctant to the notion that the human mind as a whole can be characterized as a mere set of functionally specialized information processors. Apparently, this reluctance stems from the fact that the dual-process perspective, with its differentiation between two qualitatively distinct types of cognitive processes and its conception of their interplay along the lines of default interventionism, puts some additional structure on the inner workings of the decision maker that goes beyond a mere set of information processors. In particular, Type 2 processes are thought to be much more integrated than Type 1 processes, thereby constituting a proper system of reflective thinking and higher cognition (Evans 2010; Evans and Stanovich 2013). Importantly, System 2 is not considered to be domain specific, i.e., specialized on certain types of inputs to serve some particular function, but to be domain general, i.e., functional with respect to a broader class of problems and able to process a huge variety of inputs. The claim that the human mind encompasses,

in addition to domain-specific information processors a domain-general system of higher cognition, marks the greatest point of contention between the dual-process perspective and evolutionary psychology (Evans 2010, p. 260).⁵

An interesting attempt at reconciling evolutionary psychology with the idea of the existence of a domain-general system of higher cognition comes from Satoshi Kanazawa.⁶ His point of departure is the observation that the well-established literature on general intelligence poses a difficulty for evolutionary psychology (Kanazawa 2010a, b): If the mind consists solely of domain-specific information processors, how can we explain the emergence of general intelligence, which apparently is domain-general in that it influences cognitive performance across a great variety of tasks? Following the explanatory logic of evolutionary psychology, Kanazawa searches for an adaptive problem to which general intelligence figures as an adaptation and finds the class of evolutionary novel problems. According to Kanazawa's exposition, the environment of evolutionary adaptedness consisted, on the one hand, of standard, routine problems that led to the emergence of a great variety of functionally specialized, i.e., domain-specific, evolved psychological mechanisms. On the other hand, the environment of evolutionary adaptedness also confronted humans with novel problems that threatened their survival and general intelligence evolved as an adaptation to deal with these kinds of nonstandard problems. Against this background, he formulates the so-called Savanna-IQ interaction hypothesis that states that more intelligent actors are more likely to exhibit evolutionary novel preferences and values, whereas less intelligent actors tend toward having "evolutionary old preferences and values" (e.g., Kanazawa 2010b, p. 285). In this formulation, evolutionarily old preferences and values are thought to stem from domain-specific evolved psychological mechanisms that evolved as adaptations to routine problems in the environment of evolutionary adaptedness, whereas evolutionary new preferences and values result from the application of general intelligence to recent contingencies

⁵ As indicated before, the account of evolutionary psychology provided in this paper largely follows the footsteps of Cosmides and Tooby (1989). Not all of their ideas receive universal acclaim among evolutionary psychologists. In particular, the massive modularity hypothesis, with its insistence on the claim that the mind does not encompass domain-general systems of higher cognition has also been criticized (e.g., Spelke 2010; Kanazawa 2010a; Chiappe and Gardner 2011). Speaking generally, schools of thought within evolutionary psychology that do not advocate the massive-modularity hypothesis are easier to reconcile with the dual-process perspective (Evans 2010). Within evolutionary sociology, Jonathan H. Turner and Alexandra Maryanski are among the most influential critics of the massive modularity hypothesis, mainly on the grounds that the notion of functionally specialized modules evolving in the Pleistocene does not do justice to the fact that selection regarding the human mind primarily works by rewiring existing neural structures (Turner and Maryanski 2015; Turner 2015). Regarding the critical question of the evolution of a domain-general system of higher cognition, they argue that the capacity to process abstract symbols (most importantly language) in the neocortex evolved against the background of an already enlarged subcortex (e.g., Turner 2015, p. 187), which provided hominins with the adaptation to process emotions, thereby promoting their social bonds in a savanna environment in which group orientation is key for survival.

⁶ I am aware that Kanazawa and part of his work is regarded as controversial by some, including colleagues working in evolutionary psychology. This also holds with respect to several aspects of his theory of general intelligence (Penke et al. 2011). In this paper, I make use of Kanazawa's theory of general intelligence because it helps to clarify the extent to which evolutionary psychology and the dual-process perspective are compatible. In doing so, I do not wish to express an explicit endorsement of all aspects and applications of this theory.

and conditions in modern societies. A sociologically interesting application of this hypothesis deals with nationalism (Kanazawa 2021). Nationalism can be thought of as the consequence of an evolutionarily old preference for the ingroup over the outgroup. That is, the ingroup bias is an evolved psychological mechanism to the routine adaptive problem of avoiding ostracism in hunter-gatherer societies. Using data from the USA and the UK, Kanazawa (2021) shows that, in line with the Savanna-IQ interaction hypothesis, intelligence correlates negatively with nationalism, even when controlling for standard variables in political science.

Although Kanazawa does not necessarily intend to reconcile the dual-process perspective and evolutionary psychology, I believe that his argumentation goes a long way in achieving this. That is, Kanazawa's reasoning regarding general intelligence and the Savanna-IQ interaction hypothesis can be reformulated and adapted to provide a blueprint for the explanation of the evolution of a domain-general System 2. First, instead of focusing on general intelligence, it seems conceptually more adequate to substitute the term System 2, understood as a domain-general, integrated set of information processors that is capable of processing normative calculi such as logic, stochastics, and decision theory. From the perspective of the dual-process perspective, general intelligence is not an information processor per se, but a cognitive resource that relates to one core aspect of the raw computing power of System 2. Second, in this reformulation we will not make recourse to the mentalist concepts of preferences and values that serve as proximate causes for behavior in Kanazawa's argument (although it is definitely desirable to localize these traditional concepts in a cognitively informed action theory; see Tutić 2022b). Instead, we can directly refer to the underlying evolved psychological mechanisms as ultimate causes. In this regard, recall that evolved psychological mechanisms for routine problems are considered to be domain specific by Kanazawa. Hence, in this reformulation I substitute Type 1 processes for what Kanazawa calls evolutionarily old preferences and values.

Against the background of these two conceptual adaptations, Kanazawa's thesis regarding the emergence of general intelligence can be turned into a thesis regarding the evolution of a System 2 of higher cognition. Accordingly, the domain-general system of higher cognition (i.e., System 2) may have emerged as an adaptation to evolutionary novel, nonroutine problems present in the environment of evolutionary adaptedness. Further, given these two conceptual adaptations, Kanazawa's Savanna-IQ interaction hypothesis turns out to express a central implication of the way in which the dual-process perspective conceptualizes the interplay of Type 1 and Type 2 processes. As indicated above, the dual-process perspective, with its concept of default interventionism, holds that Type 2 processes can suppress and override the responses provided by Type 1 processes. However, this warrants a sufficient degree of Type 2 processing that in turn depends on both motivational factors and cognitive resources. In the dual-process perspective literature, intelligence is well recognized as one of these cognitive resources that make a higher level of Type 2 processing and hence a suppression of Type 1 responses more likely (e.g.,

Stanovich 2011).⁷ Hence, keeping in mind our two conceptional adaptations above, the Savanna-IQ interaction hypothesis, which claims that intelligence comes with the increased ability to suppress evolutionarily old preferences and values, is well in line with a central implication of default interventionism. In this sense, the Savanna-IQ interaction hypothesis can also be derived from the logic of mode selection by simply letting intelligence influence the probability of successful reflection ϱ and noting that the probability that the inequality $m_{a^*} \geq 1 - c/(\rho\nu)$ is true, and hence that the selection comes about in the as-mode (i.e., governed by Type 1), decreases in ϱ . All in all, Kanazawa's theory of general intelligence contributes to our discussion of the compatibility of evolutionary psychology and the dual-process perspective two important points: First, evolutionary psychology, and in particular, its stance of explaining human nature in terms of evolutionary fitness, can be combined with notions of domain-general systems of higher cognition. Second, Kanazawa's theory, and in particular the Savanna-IQ interaction hypothesis, draws a picture of the evolved mental architecture of humans that by and large corresponds to default interventionism.

Kanazawa is by no means the only scholar who argues that domain-general systems of higher cognition promote evolutionary fitness in humans. For instance, Chiappe and Gardner (2011) essentially make the same point in claiming that Type 1 processes evolved to solve long-standing adaptive problems, whereas Type 2 processes serve to deal with novel problems and as a source to find more efficient solutions to routine problems. Accordingly, the Pleistocene, which forms a major part of our environment of evolutionary adaptedness, encompassed strong fluctuations in ecological conditions and hence selection pressure toward the emergence of cognitive processes that are capable of adapting to novel features of the environment (Potts 1998). Similarly, as Kanazawa implicitly does with his Savanna-IQ interaction hypothesis, Chiappe and Gardner (2011) highlight the idea of default interventionism by stressing that the cognitive processes evolving to grapple with novelty must have the capability to suppress and override innate Type 1 responses. A concrete example provided by Chiappe and Gardner (2011, p. 678) is food storage. Under the conditions of considerable variance in the supply of meat and fish, our ancestors living in hunter-gatherer societies needed to suppress the innate Type 1 response of directly consuming food, and instead find creative means of storing it. This is indicative of Type 2 behavior, because it involves "response inhibition, response preparation, and integration of action across time [...]" (Wynn and Coolidge 2003, p. 4).

⁷ Note that intelligence is but one factor among many influencing the degree to which Type 2 processing occurs and is likely to override default Type 1 responses. In particular, actors also differ in cognitive styles and thinking dispositions, i.e., the extent to which they rely on their first intuitions provided by Type 1 processes. Research on individual differences regarding anomalies in judgment and decision making has uncovered that cognitive styles moderate the relationship between fluid intelligence and the ability to give normatively correct responses to demanding problems (Stanovich 2011). In general, the dual-process perspective suggests fewer continuous individual differences in the evolutionarily old mind made up of Type 1 processes and more continuous individual differences, and in particular, a crucial role of raw computing power in the sense of fluid intelligence, in the evolutionary new mind (e.g., Stanovich 2012, p. 352).

Whereas Kanazawa (2010a, b) and Chiappe and Gardner (2011) point toward the adaptive problem of dealing with evolutionarily novel challenges in explaining domain-general higher cognition, an account of the evolutionary function of conscious thought provided by Baumeister and Masicampo (2010) highlights *prima facie* different types of adaptive problems as the primary source for this adaptation in humans. Although conscious thought is not considered to be necessarily identical to Type 2 processing within the dual-process perspective, consciousness is regarded as a typical correlate of higher cognition (Evans and Stanovich 2013). Hence, an explanation of the emergence of conscious thought within humans is also to a considerable extent informative regarding an explanation of a domain-general system of higher cognition. In line with Baumeister's general position developed in *The Cultural Animal* (Baumeister 2005), culture can be considered both an adaptation but also a source of additional adaptive problems, which in turn trigger further adaptations. Against this background, conscious thought, and by extension domain-general higher cognition, are considered to be functional with respect to problems located in the social and cultural environment (Baumeister and Masicampo 2010, p. 947). In particular, conscious thought allows for taking offline the direct stimuli-response chains that are characteristic of Type 1 processes, and instead collect, share, and integrate informational inputs from a plethora of such Type 1 processes before a behavioral response is emitted. Conscious thought also promotes language and communication, thereby providing all the benefits that come from social coordination and cooperation. Finally, conscious thought allows for different forms of serial (or sequential) reasoning that is needed to process normative calculi such as logic or statistics as well as for the mental simulation of alternative realities that are associated with different kinds of alternative behaviors (Baumeister and Masicampo 2010, p. 958; Evans and Stanovich 2013, p. 235).

Note that theoretical accounts such as that of Kanazawa (2010a, b), Chiappe and Gardner (2011), and Baumeister and Masicampo (2010) do conserve the explanatory strategy of evolutionary psychology, i.e., essential psychological features of humans are explained as adaptations to adaptive problems. The only aspect in which they deviate from standard arguments in evolutionary psychology is that they break with the assumption that only the emergence of domain-specific information processors can be explained in this way. In addition, the explanatory accounts of on the one hand Kanazawa (2010a, b) and Chiappe and Gardner (2011) and on the other hand Baumeister and Masicampo (2010) actually complement each other in that it might be argued that the bulk of evolutionarily novel problems do not so much stem from the physical but from the social and in particular the cultural environment.

Accounts to explain central notions of the dual-process perspective via Darwinian means have also stretched to formal attempts, primarily on the basis of evolutionary game theory (e.g., Bear and Rand 2016; Toupo et al. 2015; Tomlin et al. 2015). These contributions shed light on the question under which conditions of central features of a cognitive and psychological architecture along the lines of the dual-process perspective emerge in an evolutionary dynamic. For illustrative purposes, I briefly sketch the essentials of the study by Bear and Rand (2016), which deals with the problem of the evolution of cooperation. In this model, agents face at each time step either a single-shot prisoner's dilemma, in which it pays to defect, or a repeated

prisoner's dilemma, in which cooperation is advantageous. What makes this study interesting is that the strategy space under consideration allows for, but does not by design enforce, a dual-process psychology. That is, a strategy of a player consists of four informational pieces: The probability of intuitive cooperation, the probability of cooperation if the actor reflects and identifies the (current) game as one-shot, the probability of cooperation if the actor reflects and identifies the game as repeated, and a threshold for the cost of reflection. The model is constructed such that an agent only engages in reflection if the costs of reflection, which are drawn from a uniform distribution, are below this threshold. Hence, a threshold of zero corresponds to an agent who effectively does not have a dual self because she always engages in intuitive behavior. Using standard techniques to model evolutionary dynamics (i.e., the Moran process), Bear and Rand (2016) find that, given that the probability of the occurrence of a repeated game is not too low, a dual-process psychology emerges in the long run: The threshold regarding the costs of reflection is strictly positive so that agents with some probability actually engage in either intuitive or reflective behavior, they always cooperate intuitively, and use reflection to defect in one-shot games and cooperate in repeated games. Note that the action-theoretical substance of this paper is problematic because it ties the dual-process perspective to the intuitive-prosociality hypothesis, i.e., the idea that humans tend toward cooperation on intuitive grounds (Rand et al. 2012), and this hypothesis has received fair criticism in empirical research (Grehl and Tutić 2022). However, the formal techniques employed, in particular the manner in which the switch from a single- to a dual-process logic is modeled via a threshold for reflection, provide a blueprint for how to formalize the endogenous emergence of a dual-process architecture of the human mind.

6 Conclusions

From my point of view, our discussion has shown that the behavioral sciences, all conceptual ambiguities and theoretical deficiencies notwithstanding, have already made considerable progress toward a general theory of action that itself is explained or principally explainable in Darwinian terms. This positive assessment comes from the fact that evolutionary psychology and the dual-process perspective have considerable commonalities and that their apparent discrepancies seem surmountable. The biggest commonality between these two approaches is the idea that the human mind encompasses a plethora of domain-specific information processors that to a large extent are explainable as adaptations to adaptive problems of the environment of evolutionary adaptedness (Stanovich 1999). From the perspective of the dual-process perspective, evolutionary psychology is thus extremely helpful and complementary in both providing the specific content of Type 1 processes and suggesting Darwinian explanations for them. The greatest point of contention lies in the assumption of the dual-process perspective that the human mind also encompasses a domain-general system of higher cognition. However, as approaches such as that of Kanazawa (2010a, b) demonstrate (see also Rand et al. 2012), evolutionary psychology does not necessarily involve the assumption that all evolved psychological mechanisms are domain specific and can also be used to explain the emergence of

a domain-general system of cognition. In this regard, evolutionary psychology benefits from insights of the dual-process perspective in making its research program consilient with other established bodies of literature such as intelligence research and differential psychology (see Kanazawa 2010b). Finally, as the contribution by Bear and Rand (2016) illustrates, evolutionary game theory can be used to study the conditions under which a dual-process architecture of the human mind endogenously emerges.

Besides formulating desiderata for a proper action theory in the social sciences, this contribution has been remarkably silent on specific ideas from classical and modern sociological action theories. However, classical sociological action theories anticipated several key ideas of the looming synthesis in interdisciplinary action theory, in particular, the multiplicity of the self, the unconditionality of certain forms of behavior (e.g., norm-following behavior), the definition of the situation, and the variability of rationality. These four ideas are to different degrees well represented within both goal-framing theory (Lindenberg 2008, 2009) and the model of frame-selection (Esser 2001; Kroneberg 2011), which are considerably closer to the idea of a proper action theory than many of the classical attempts. As I have argued in some detail in this paper, goal-framing theory should be interpreted as a sociological version of evolutionary psychology, which also contributes toward this approach by organizing the plethora of evolved psychological mechanisms into sociologically meaningful categories that are also manageable in applied research. In turn, the model of frame-selection can be considered as a sociological descendant of the dual-process perspective, which has its strong-suit in providing a neat and encompassing formulation regarding the interplay of the two types of cognitive processes. Against this background, it seems fair to say that in principle, both evolutionary psychology and the dual-process perspective have proven to be frameworks that allow central insights from classical sociological action theories to be captured.

Moreover, the argument that evolutionary psychology and the dual-process perspective are in principle compatible suggests that a decisive step toward an integrative action theory in sociology could be made by combining goal-framing theory (Lindenberg 2008, 2009) and the model of frame-selection (Esser 2001; Kroneberg 2011). As indicated in Sect. 3, Lindenberg differentiates between three broad classes of evolved psychological mechanisms, i.e., the hedonic goal-frame, the gain goal-frame, and the normative goal-frame. This differentiation between three types of goal-frames can be used to put more substance on the under-theorized notion of frames in the model of frame-selection, which in its current form works with a purely formal set of frames and leaves it to the sociological practitioner to fill this formal notion with content in concrete applications. Lindenberg's theory, with its focus on modularity, in turn neglects the existence of a domain-general system of higher cognition that can take evolved psychological mechanisms offline and override the direct imprint of goal-frames on behavior. This differentiation between domain-specific modules and a domain-general system of higher cognition nicely captured the differentiation between the *as*- and the *rc*-mode in the logic of model selection. Putting the concepts of goal-framing and modes of decision making together, we arrive at the idea that each concrete choice takes place under one of six conditions that arise from the combination of goal-frame (hedonic, gain, normative) and mode

(as, rc). Following the model of frame-selection, decisions within the rc-model could be modeled by a standard subjective expected utility calculus in which subjective probability and utilities should be made dependent on the type of preselected goal-frame. In contrast, choices in the as-mode should follow a logic of adequacy (in German: *Angemessenheit*; Kroneberg 2005), as modeled by the match of frames and activation weights of scripts and behaviors in the logic of mode selection. Regarding the question of how to theorize on the selection of one of these six conditions, both theories have considerable insights to contribute. Lindenberg (2008) argues that in the absence of situational cues to the contrary, the hedonic goal-frame should have a stronger grip on the mind than the gain and the normative goal-frame. The logic of mode selection describes how motivational factors and cognitive resources determine whether the as- or the rc-model gets selected (Kroneberg 2011; Tutić 2022b). Both goal-framing theory and the model of frame-selection highlight the importance of situational conditions in the selection of goal-frame or mode, and this idea is nicely captured by the definition of match and activation weights in the model of frame-selection (Kroneberg 2005). Combining the model of frame-selection and goal-framing theory along these lines provides a promising next step for the development of a sociological action theory that systematically integrates insights from evolutionary analysis.

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Andreas Tutić 1982, Dr. phil. habil., associate professor at the University of Bergen, Norway. Fields of research: Sociological theory, action theory, cognitive sociology, mathematical sociology, experimental social science. Publications: Triage in Times of COVID-19: A Moral Dilemma. *Journal of Health and Social Behavior* 63, 2022 (with I. Krumpal and F. Haiser); Status Characteristics and the Provision of Public Goods—Experimental Evidence. *Sociological Science* 5, 2018 (with S. Grehl).