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Impulsive action and motivation

Nico H. Frijda

Amsterdam University, Seranggracht 1, 1019PM Amsterdam, Netherlands

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ABSTRACT

This paper explores the way in which emotions are causal determinants of action. It argues that emotional events, as appraised by the individual, elicit changes in motive states (called states of action readiness), which in turn may (or may not) cause action. Actions can be elicited automatically, without prior intention (called impulsive actions), or intentionally. Impulsive actions reflect the simplest and biologically most general form in which emotions can cause action, since they require no reflection, no foresight, and no planning. Impulsive actions are determined conjointly by the nature of action readiness, the affordances perceived in the eliciting event as appraised, and the individual's action repertoire. Those actions from one's repertoire are performed that both match the perceived affordances and the aim of the state of action readiness.

1. Emotions and action

Emotions are intimately related to action. They are among the main direct causes of action. They are integral to action control (Reis and Gray, 2009). Interestingly, action is hardly mentioned in the contributions that compose this issue. It may therefore be useful to take emotional action as the starting point for the reflections to which this issue of *Biological Psychology* gave rise.

An intimate relationship between emotions and action may appear obvious. Murders are committed out of hatred, in the political as well as the marital domains. Affections and sexual desires, one would say, often cause intimate actions. There also are simple, common, and frequent sequences of events and actions elicited by affective causes. When humans and non-human animals are hurt, they may shriek, whimper, or cry.

Yet, the notion that emotions cause action is being contested. One reason is that emotions often are just feelings. People may confess to them while not doing a thing. One may suffer great grief in silence. To many researchers and laymen, the word "emotion" therefore just refers to feelings. It did so to Darwin (1872), it did so to James (1890), and still does so to Kagan (2006). This leaves explaining actions like running away from a bear in the woods, as well as feelings, to other processes, such as stimulus–response connections (James, 1890). This entails making a sharp distinction between emotional feelings and those other processes, which then together form emotion proper. Wundt (1900) did so, using the word "*Affekte*". Damasio (2000) also did so, using "emotion". So did Scherer (2005), and so do I (Frijda, 1986). Emotions are the processes that cause actions, autonomic changes, feelings, and perhaps further phenomena.

There is another reason for questioning the causal nature of the emotion–action relationship. Actions occurring with a given emotion are usually highly variable, so much so that the conception of "a given emotion" (fear, say, or anger) may come to be viewed as erroneous (Barrett, 2006; Baumeister et al., 2007; Kagan, 2006). Fear, for instance, may lead to fleeing, but also to racing one's car to the hospital after hearing that one's child had an accident (the example is from Baumeister et al., I think). Anger may set off a bout of rage, but also make one silently turn away, or apologize for having given offense (Mesquita, 2003). Guilt may lead to wringing one's hands or scratching one's face, but also to a decision to be more circumspect at a next occasion. Situational specifics, rather than a specific emotion, seem to determine the action (Barrett, 2006).

There is a confusion at play here, however, due to forgetting about the differences between impulsive and reflective processing (Strack and Deutsch, 2004). Reflective processing of emotions may drastically modify or overrule impulsive processing. Focusing on the vicissitudes of reflective processing of emotional events may mistakenly lead to assigning impulsive processing a merely trivial role in action control (Baumeister et al., 2007), whereas any emotion originates in impulsive processing.

I will approach the emotion–action relationship by first examining impulsive action. Impulsive emotional actions suggest a rather direct, non-arbitrary causal relationship to emotions. They manifest elementary processes of remote evolutionary origin, since impulsive actions are observed from birds and squirrels to humans, if not even from oysters and squid onward. They point to what it is in what we call "emotions" that does directly cause action.

E-mail address: n.h.frijda@uva.nl.

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2. Impulsive action

Psychology distinguishes different sorts of action: habits and deliberate actions. Older psychology, in addition recognized a different sort: impulsive actions (Frijda, 2010; Pacherie, 2001). Wundt (1900) labeled them "drive actions" (*Triebhandlungen*); McDougall (1923) called them *instincts*. Both notions included not only species-specific action sequences, like modes of hostile attack and courting, but also simpler actions. I first borrow my examples from Pacherie (2001), and extend them from everyday observation. They include punching someone in a bar brawl, running away upon perceiving threat, following an attractive person with one's eyes, or kissing that person without ascertaining that it is welcome; taking one more drink after deciding that the previous one was the last. They include biting during a fight (children do it, and so may drunken adults), and smashing objects that resist being properly used or that one hurt oneself by (Hall, 1899), throwing objects at threatening individuals. They further include crying and most laughter, and threat and power displays, condescending as well as humble and submissive ways of interacting. They include freezing in fear and timidity and in black-outs during an examination. They include verbal actions like uttering insults and violent reproaches. They include emotional expressions, as in some of these examples.

Use of the term "impulsive action" has three connotations. One is absence of prior deliberation: one does it before consciously having decided to. The second is use of only part of the available cues that might indicate the adequacy of action: one hits someone who is clearly stronger; one says things that while saying them one realizes one may regret later: "I have never loved you!", "where were you last night?", "I will leave my spouse for you!" The third is a sense of "urge" before or while performing the action, that is, both an expectation of gain after completing it, and haste to fulfill it (Wittmann and Paulus, 2008).

"Impulsive action" resonates with the notion of impulsive processing as used in dual processing conceptions (e.g., Strack and Deutsch, 2004, impulsive versus reflective processing). Impulsive responding in that sense, however, has a broader meaning than what is meant here by impulsive action, since it includes grasping for the car's gear shift when having come to drive one with automatic transmission. The third connotation is absent there.

My analysis of impulsive action is inspired by those of Pacherie (2001), of unreflective skillful action by Rietveld (2008a,b), by descriptions of actions performed during emotional excitement (e.g., Hall, 1899), and, not the least of relevant sources of inspiration, by analyses of species-specific animal behavior (e.g., Eibl-Eibesfeldt, 1989; Kortlandt, 1955; Tinbergen, 1951), that is non-reflective (and non-habitual) almost by definition.

Let me try to analyze the features of actions with the above connotations more closely, and the problems for understanding them that they raise.

The first and central feature of impulsive actions is their being automatic; this they share with impulsive processes in Strack and Deutsch's (2004) sense. They show a number of the properties that Moors and De Houwer (2006) list as properties of automatic responses. They are unintentional, in the sense that they are not initiated by a prior cognitive representation of some future state, as deliberate intentional actions are (Kruglanski, 1996). This feature is illustrated by the differences between reactive and proactive aggression, which extend into autonomic concomitants (Scarpa et al., 2010). They also possess further automaticity features. They emerge without effort. And they are stimulus-driven (or driven by an emerging thought), rapidly following advent of the stimulus event.

Second: "stimulus-driven" is a shorthand for the feature that impulsive actions are stirred and steered by the present. Impulsive actions are initiated by events or objects present here and now (Frijda, 1986, 2010; Pacherie, 2001). The eliciting event, for instance, influences the progress of an action and striving underway. One encounters an obstacle, or notices that an obstacle gives way. Or something is perceived here and now that affords a consummatory action like inhaling or kissing. Or, by contrast, something that should be within reach appears as out of reach; or there is something here that should not be here; or a void is sensed where something loved was expected. In impulsive action, the presence, not the future, stirs action. Flight is not towards safety but away from danger. Focusing one's glance is not towards seeing clearly but away from seeing indistinctly. Impulsive desire is not towards something not here but towards bridging the gap between oneself and a coveted object. Emotions may respond to sequences of this sort. What stirs an embrace is the urge to kiss, what stirs the urge to kiss is the perceived kissability of lips. The perceived affordance primes the afforded action. All this is effortless, as befits automatic processes. The prospect of safety in fear and of lovemaking when being attracted are added by reflection or imagination, if they emerge at all before doing one's thing. Seeing and smelling fresh-baked bread make one's mouth water and reach out before realizing what one wants it for, or that one wants it at all. All this amounts to the generalization: what stirs and steers impulsive actions is "directed discontent" (Rietveld, 2008a,b), which need not include foresight of contentment. And all this, in turn, implies: impulsive actions are driven by stimulus events *as appraised*. "Appraisal" itself primarily refers to automatic, nonconscious processes due to innate representations, previous experience, or acute interactions (Frijda, 2007) that only on occasion are reflected in conscious experience.

The third feature of impulsive actions is that they indeed are *actions*. They are *I*ntentional in the broad sense of having bearing upon some object (Searle, 1983). They are not reflexes or mere movements. One hits and embraces someone; one runs away from something; one loses interest in everything, as when in grief one shuts out the world, goes to bed, and draws the blanket over one's head.

Fourth, impulsive actions are directed. Their being non-intentional (small letter) notwithstanding, they are purposive. They have an intent, an inherent end point at which they terminate. They implement an *aim*. Impulsive actions seek to establish, modify, or abandon a relationship with their Intentional object. Looking at something, looking away, smashing an object: they all do modify a relationship. Purposiveness or the presence of an aim is evidenced by the variability of impulsive actions, in adapting to situational variations, with a constant relational outcome. Their course of execution is guided by that aim. Running away increases spatial distance from the frightening event, while zigzagging when needing to; it may utilize obstacles to obstruct being sighted by a pursuer.

That impulsive action implements some aim is not a coincidence. Impulsive action is triggered by events as appraised as having affective valence. They are pleasant or unpleasant, or at least intriguing. They raise the discomforts of discrepancy between a current and a desired state, or between potentiation of some action schema and its enablement, execution, or completion. Those are what stir action, and what stir that action onward. The aims triggered by appraisal of one's present state thus include affective dynamics.

The aims underlying impulsive action thereby not only have direction but also have some degree of urgency. This action readiness contains no planning and no implementation intentions that both are central in voluntary behavior (Gollwitzer, 1999).

"Get it!", "away from here" is all that is needed, and generates being set for finding some action schema that may achieve the aim. "Get it, *now!*" also sets a time for it: *now*. "Get it now, *dammit*!" also sets an urgency.

Aims and dynamics: do they apply to all impulsive action? Do they apply to expressive behavior, for instance?

I think they do, at least to most of it. As Wundt (1900) already pointed out, the designation "expressive behavior" is confusing. It is not why the behaviors are there; they just happen to be cues to feeling states, just as smoke happens to signal fire. The idea that facial and other expressions developed to communicate feeling states served Darwin's (1872) purpose to explain the evolutionary survival of behaviors that otherwise "are of no use". But the idea is incorrect. The so-called "expressive behaviors" are of direct use in emotional interaction. Darwin's interpretation of expressions as communications is being followed in most current literature, but has for long been seriously contested. Prominent investigators such as Wundt (1900), Bühler (1934), Kafka (1937), and Dumas (1948) all held that such behavior mainly consists of actions that establish or modify subject–object relationships, or that influence the actions of others to modify such relationships, by helping, stopping aggression, or coming closer. They do not communicate inner states but implement behavioral intents, or invitations to collaborate or comply. A facial expression of fear does not express fear but implements attending, withdrawing, and self-protection, for instance. Hess and Bourgeois (2010) provided theoretical support and experimental evidence for this position. "Expressive behavior", in other words, fully qualifies as impulsive action that participates in implementing aims regarding person–environment interaction. It serves to modify subject–object relationships by partaking in increasing or decreasing interaction, tuning or not tuning to other individuals, and coping with actions by others. I have elaborated on this view elsewhere (Frijda, 1953, 1969, 1982, 1986, 2007).

3. Aims and goals

"Aim" and "goal" may seem rather similar. They both refer to intents. But they distinguish two kinds of intent that differ importantly.

The term "goal" is here reserved for intents involving cognitive structures established prior to action, and pertaining to some future event. These cognitive structures have to be maintained with some effort over the time from instigation to action completion (Miller and Cohen, 2001). Aims of states of action readiness, by contrast, are established and maintained by the perceived, recalled, or imagined events as appraised. They are maintained effortlessly for as long as event affordances and appraisal maintain them, with an urgency that comes from those same affordances and appraisals. In impulsive actions, they need not involve such cognitive structures at all. As argued earlier, the orientation towards a future state can be restricted to the present. It can merely involve *change from the present, – change from now*: disappearance of pain, disappearance of the desired object being out of reach. This is why action can be purposive without involving a goal, as for instance Frankfurt (1988) has emphasized. In fact, Pacherie (2008) describes a conceptual framework for distinguishing "intentions", that differ in degrees of specification of intent content. "Aim" is the least specified one.

This underlines the importance of distinguishing between goals (in the present sense) and what I call aims. Animals other than humans do not posses the cognitive capacities enabling representations of future states (with the possible exception of scrub jays; Clayton et al., 2003). At least all vertebrates, however, do show impulsive purposive action.

At the subpersonal level of analysis, "aims" can be understood, not as articulate and reportable representations of states of the world to be, but as "sets[1]": as pre-motor or motor representations of being set for action, often with their to-be parameters of direction, force, and timing, and as being set for receiving sensory representations ("efferent copies") of particular action outcomes and relational changes, at some level of abstraction. The states of being set are nonconceptional, non-propositional "executive representations," as posited by Pacherie (2001). Their content is reflected, I assume, by action readiness awareness: sketchy images of aims, with their parameters of force, direction, and timing (Jeannerod, 2006).

The main outcome of the preceding exploration of impulsive action, I think, has been what I undertook this exploration for: to clarify how emotions can directly cause action. Impulsive actions suggest what it is in emotions that do so. It indeed is an "impulse": a state of action readiness, a motive state.

4. Motivation

Motive states form the central process in several analyses of emotion. They did in several earlier emotion theories (e.g., McDougall, 1923; Bindra, 1959). It is the conception of Lang and Bradley (2010), Harmon-Jones et al. (in press), and myself (Frijda, 1986, 2007). Lang and Bradley (2010) provide an excellent framework for situating this central process. External events engage motive circuits that, on the one hand, "engage sensory systems that increase attention and facilitate perceptual processing, and on the other [...] initiate reflex responses that mobilize the organism and prompt motor action" (p. 3). To accommodate emotions in general, the description has to be widened somewhat, since some emotions involve decreased attention and prompting of inaction, as do bliss and beatific serenity.

Motivation is not being given this central place in all emotion analyses. It was not in those of James (1890) and Damasio (1994), for instance, who both described emotions as behavioral reflexes to "emotionally exciting facts". Interposition of motive states between event perception and motor action, however, explicitly accommodates the multiple mental and motor actions that given events may engage or initiate. It explicitly provides for the considerable flexibility in emotional responding that reflex systems would not predict.

Stressing this role of motivation in emotions needs a caveat. The word "motivation" has two quite different denotations in psychology. One of these refers to an individual's more or less stable dispositions such as sensitivities, needs, and attachments that cause certain events to appear of interest to him or her. For instance, sexual motivation renders individuals of one's preferred sex interesting and worth interacting with, and an attachment renders actions and the fate of its object of interest. I refer to dispositional motives as "concerns". The other meaning refers to occurrent states, that is, event-induced states of relatively short duration. It refers to actually being interested and inclined to act or not to act. Occurrent motivation is at stake here. I will refer to it as "motive states," as "states of action readiness", or as "action tendencies", depending on the connotation to be emphasized in the context.

The word "motivation" may evoke the hydraulic metaphor of reservoirs of motivation-specific energy that accumulates over time, and is then released in motivation-specific – sexual, aggressive, affiliative, etc., – action (Lorenz, 1963). That model is implausible, if only because the evidence for release-like

[1] The word "set" is used in psychology to denote "a predisposition to a response" (Concise Oxford Dictionary, 1982, p. 964, meaning 4), translating the German term "*Einstellung*".

spontaneous emotional actions is scant. Emotional action is usually elicited by encountering stimulus events or thoughts. This basic fact has led to the conception of *incentive motivation* (Bindra, 1959; Toates, 1986). Motive states consist of being set to achieve particular aims, or of potentiated action dispositions and support processes to in fact achieve such aims (Gallistel, 1980). States of action readiness are in general aroused by encountering concern-relevant events (Ellsworth and Scherer, 2003; Frijda, 2007) which, however, include internal events such as stomach contractions and the restlessness of young mammals in spring that stem from the activation of concerns.

States of action readiness are states of being set to achieve their aims, and if possible to produce some action that can do something about those aims. The aims serve as cues to find and potentiate relevant action schemas. Any aversive stimulus prepares the individual to do something defensive towards it, for instance, which "anything defensive" may get more specific by including more information in the cue, until readiness settles on one selected action schema. In impulsive action, this process is inclined to select the first or most directly available schema that matches the cue, exemplifying the second of the mentioned properties of impulsive actions.

In deliberate action, representation of properties of the goal (e.g., its direction or location) precedes specification into potentiating some action schema proper (Gazzaniga et al., 2002; Georgopoulos, 1995), and can be present in the absence of activation of motor activity, as evident from movement imagery (Jeannerod, 2006). The same probably occurs with the aim of impulsive action. One usually is aware of what one wants or does not want before having shaped an image of what to do about it. In fact, states of action readiness may remain at that stage. Response may be held in abeyance, as action readiness proper, without any appreciable motor consequences, and give rise to a feeling of urge or desire or of some specific emotion like anger or fear. Activation of action schemas after neural potentiation is inhibited anyway until criteria for acting are met, and inhibition during preparation is lifted (Gazzaniga et al., 2002). Those criteria, again, are lenient for impulsive action.

States of action readiness represent the distinguishing mark of emotions, as distinct from reflexes. Their aims can be understood as potentiating sets of action schemas with equifinality. They thereby offer adaptive flexibility, by allowing selecting from among those action schemas that each may best correspond to different contingencies. Threat can be countered by fleeing and by freezing; harm infliction by others can be countered by physical as well as by verbal aggression, and by turning one's back, and by all three in succession (Van Coillie and Van Mechelen, 2005). The resulting flexibility is adaptive. Yet, it makes for the despair of those who seek to identify different emotions by identifying emotion-specific behaviors rather than emotion-specific aims. "Fear clearly involves a desire to avoid harm or loss, but from knowing only that they are afraid, we cannot predict whether people will sell their stocks, listen to the weather report, or start running." (Schwarz and Clore, 2006, p. 16).

A model of motivation developed along similar lines is lucidly worked out and examined empirically by Lang and Bradley (2010). It is applied to an analysis of what happens in response to pleasant and unpleasant (and neutral) events. The reported empirical work beautifully shows the engagement of autonomic, attentional, perceptual, and experiential response components, and their variation when eliciting circumstances vary, such as the distance to the eliciting event in the looming-simulation experiments, the appropriateness of response variations to momentary action requirements, and responsiveness to feedback from the outcomes of previous processing. Such widespread response activation leads to identifying "appetitive" and "defensive" motivational systems and their neural circuits. The systems are motivational. The appetitive system promotes enhancement of interaction of the individual with the environment; the defensive system promotes decrease of such interaction.

The reported empirical work focuses on autonomic reflexes, attention variations, and neural concomitants. But even when not elaborated in their exposition, overt action has a central place in the model. As Lang and Bradley write (p. 2): "the reflexes tune sensory systems and mobilize the organism for action. They instigate and support the execution and modulation of overt action, which the neural circuit accesses by way of the basolateral amygdala and dorsal and ventral striatum." (their Fig. 1).

One can augment the number of action-relevant processes that the motivational states instigate directly or indirectly, in conjunction with stimulus events: activation of preparatory or initial action components, such as advance salivation, muscular tensing, intention movements, cognitive processes that prime relevant stimulus events (e.g., Ferguson and Bargh, 2004; Markman et al., 2009), recall of possibly useful action schemas (Kruglanski, 1996), and elicitation of emotional feelings.

All these processes directly or indirectly serve dealing with the emotional contingency by overt action, mental action (attention, thought), or refraining from action. The driving force of the processes appears to be the moment's motivational aim: achieving a change from the present situation, by correcting what bothers, filling up what lacks, obtaining what attracts, enhancing what is remote or weak, or seeking to maintain or enhance whatever is satisfactory.

Operation of these motive aims proceeds on the whole along the lines of the traditional view that emotional striving results from states of imbalance. Motive states are traditionally viewed as due to perturbations or caused by encountering opportunities for achieving satisfactions, that is, when current state falls short of, or threatens to fall short of, the reference value given by the concern to which the event at hand is appraised as relevant. These formulations are those of negative feedback control, as for instance exemplified by Carver and Scheier (1998). All this is maintained by the perception, thought, or image of the eliciting event as appraised, and with an urgency that reflects the event's appraised importance and the discrepancy between current state and reference state.

4.1. Resource mobilization

The consequences of that urgency form part and parcel of emotions. They provide the event-elicited aim with the sense of urge and with suboptimal information gathering mentioned earlier as characteristics of much impulsive action. The various urgency consequences have been summarized elsewhere (Frijda, 1986, 2007) under the heading of "control precedence". They include priority setting for the actions involved, sustained attention, persisting in action, overcoming obstacles or opposition, seeking alternative action options upon failure or delay.

The resource mobilization usually goes under the names of "degree of arousal" or "degree of activation"; it does so in Lang and Bradley's contribution. During picture processing it becomes manifest in skin conductance increases, pupil dilation, and late positive potential. In situations requiring more protracted mental or overt action, it is manifest in striving and in wanting (Berridge and Aldridge, 2009).

Much of this becomes behaviorally manifest in the dynamics and prosody of the actions: their speed, amplitude, power, scope, and the like (Frijda, 2007; Kafka, 1937; Strehle, 1954). All of these define the strength of motive states or the intensity of emotions (Ben-Ze'ev, 2000; Brehm, 1999; Frijda, 2007), together with the felt

inclinations, longings, hankerings, and feelings of craving (Tiffany, 1990).

An important account of behavioral phenomena and feelings of wanting is offered by Berridge and co-workers (e.g., Berridge, 2007; Berridge and Aldridge, 2009). They provide strong evidence that the phenomena reflect the consequences of midbrain dopamine activity, and that the phenomena of liking and of wanting are independent (Berridge, 2007; Leyton, 2009). The findings provide major challenges for theory, and for the question on how wanting (or "incentive salience") is established and maintained in the first place. An extensive review of evidence for distinct motivational circuits is offered by Panksepp (1998).

4.2. Motivational failure

A full understanding of emotional responding needs to include failures of the motivational systems. Events not always elicit organized action or circumscribed emotion to deal with the event or the aroused feelings. After threat or loss, loss of motivation may occur, resulting in apathy, undirected anxious restlessness or unrest, depressed mood, sense of disorientation, confusion, and emotional shock (Dumas, 1948). Some of such emotional states may well be intelligible from the motivational perspective. Apathy, diffuse restlessness, and undirected anxiety may be due to the absence of some relevant action schema, or absence of energy resources to put appropriate defensive action programs into effect, as under exhaustion and prolonged severe stress (Seligman, 1975; Strassman et al., 1956) or after loss of cognitive grip by cognitive disturbances or drastic changes in circumstances (Marris, 1974; McReynolds, 1976; Rimé, 2005).

The motivational perspective has powerful implications for understanding emotions.

First: states of action readiness embody the adaptive functions of emotions. When the time or occasion is there, they may become manifest in situation-adapted actions. Such readiness may persist for an indefinite time.

Second: states of action readiness may prevail and be felt without any manifestation in action, because action readiness does not necessarily generate action. Motive states may persist without action and impulsively orient perception, thought, and imagination. They may even do so nonconsciously, persisting as sentiments: representations of facts, issues, or persons that include appraisal aspects as their major properties (Frijda, 1986, 2007).

Third: what emotional events elicit in the first place are states of action readiness. Actions represent a possible but not necessary second stage.

Fourth: What is impulsive are states of action readiness. They emerge automatically upon event perception or thought, even when action only follows reflectively.

Fifth: motive state or state of action readiness: it *is* what emotion "itself" is, when it is observed that emotions cause action. "Motivation follows directly from the exciting fact, and motive state as it occurs *is* the emotion": that is how one may modify James' (1884, pp. 189–190) famous statement.

5. Motivation and motivations

Obviously, there are more kinds of motivation than appetitive and defensive ones. For instance, Gray and McNaughton (2000) proposed a Behavioral Inhibition System, manifest notably in anxiety, motivating reticence in the face of possible punishment. There also is cognitive motivation, manifest in wonder, interest, curiosity, exploration, and fascination, which all are elicited by unpleasant as well as pleasant events (e.g., Rimé et al., 2005). Hierarchical cluster analysis of the co-occurrence of emotion words used to interpret facial expression photographs in fact shows three bipolar clusters at the top of the hierarchy: pleasant–unpleasant, certain–uncertain, and interested–uninterested (Frijda, 1970).

Several motive states can co-occur in the response to a given event, and interact in producing action. Approach and inhibition together make for slow and hesitant approach, for instance. It can be argued that most emotion regulation is to be understood in this way: two opposing concerns generate opposite, mutually moderating action tendencies, as in the gentle anger sometimes elicited by a loved one (Frijda, 2009). The interaction of simultaneous motive states has been examined at depth in the interactions between appetitive and defensive motivation, usually under the heading of the structure of evaluative space (Norris et al., 2010). Appetitive and defensive motivation form separate systems (Gray and McNaughton, 2000; Norris et al., 2010; Watson and Tellegen, 1985). They can, however, operate independently, as in states of ambivalence or mixed feelings (Schimmak, 2001), operate by reciprocal activation, as when events or objects are rated on a bipolar pleasant–unpleasant scale, or by coactivation, as they do in the pleasure taken in suspense. Interestingly, as Norris et al. (2010) argue, the appetitive and defensive motivational systems appear to have different operation characteristics. It may be a challenge to also investigate other high-level motivational systems in this regard.

"High-level", because motive states can be distinguished at different levels of abstraction. Appetitive, defensive, and cognitive are distinctions at a higher level than anger, fear, and disgust, or curiosity and fascination. Such a lower level is reflected in emotion taxonomies, as well as in the intercorrelations of actions in social situations. Van Hooff (1972), for instance, performed cluster analyses of the co-occurrence and sequencing of chimpanzee social behaviors. The analyses yielded clusters such as "antagonism", "affinity", "sex", "play", and "excitement", which resemble human emotion categories and are readily understood as implementing different social (and some non-social) aims. The clusters suggest engagement of motivational subsystems, each wanting something different from all others. Fig. 1 illustrates this, with terms that allude to different modes of action readiness entering the meanings of different positive and negative emotion labels. Each of those modes or labels may be further specified. Seeking intimacy, for instance, can take the form of seeking emotional, sexual, or spatial intimacy (with sitting shoulder to shoulder or singing together as action schemas). The processes of specification of aims are well caught in the notion of motivational and emotional cascades (e.g., Bradley et al., 2001; Stemmler, 2003), in which

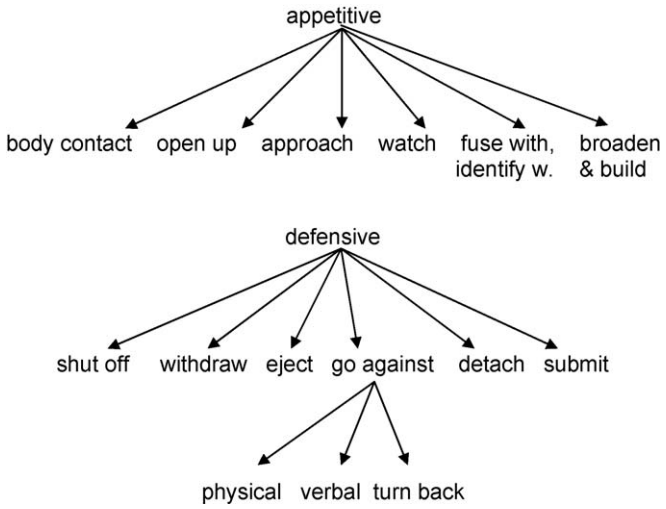

Fig. 1. Appetitive and defensive action tendencies.

processing increasingly uses further information to further specify the aims.

Which modes of action readiness and motivational systems can be meaningfully distinguished, can only become clear from observation of behavior co-occurrences and equifinalities in natural settings. Such observation can, in turn, only be obtained from ethological study of animal and human behavior and interaction in ecologically valid action surveys. Wilhelm and Grossman (2010) convincingly discuss the need for ecological valid assessments and for naturalness of observation and elicitation conditions. They also survey the host of methods to obtain such information that are presently available. As an example of such an approach to analyzing the motivational structure of action, I give an example from Kortlandt's (unpublished) observational studies of the behavior of cormorants.[2]

Cormorants catch a live fish of a pound, or a living half-meter eel, by opening their beaks, grasping the fish with much vigor, and swallowing it. They also feed their infants by predigesting their catch, regurgitating it, and keeping the porridge in their lower beak, and then with their beak grasp the infant's head, which then swallows the porridge. This latter grasping is done very prudently and with great care. The modification of the aim of grasping is presumably triggered by "mood-inducing" aspects of the mother cormorant's current state and the stimulus properties of a begging infant.

Ethological study of human action is sparse, but some exists. Examples are observational studies of opposite sex encounters (Grammer et al., 1998; Perper, 1985; for a survey of other studies, see Eibl-Eibesfeldt, 1989). Failing such work, useful information can come from systematic self-report studies. There exist valuable surveys of angry actions based on human action self-reports (e.g., Hall, 1899; Van Coillie and Van Mechelen, 2005), showing the predominance of offensive and destructive actions, augmented by offensive and destructive action tendencies that are not followed up.

Very useful insight has come from the analysis of descriptive items used by subjects in describing a variety of emotion experiences by Davitz (1969). The items were turned into questionnaire format. Cluster analysis of item co-occurrence resulted in medium-level clusters labeled "moving towards", "moving away", "moving against", "helpless", "submission", "rest", "in command", "excited", "disinterested", and "undo", which more or less matched groups of different emotion labels. The outcomes, divided by a top-level appetitive-defensive clustering, and phrased in action-tendency terms rather than emotion labels, are illustrated in Fig 1.

Each mode of action readiness may appear in somewhat different contexts that specify them a bit more. Submission, for instance, shapes the emotions of shame, embarrassment, humility, and deference.

Each mode of action readiness may instigate physical as well as mental actions. The many modes of avoidance illustrate this: there is physical avoidance, glance avoidance, avoidance of emotional encounters generally. The latter is observed, for instance, in dismissive attachment styles in the elderly (Jain and Labouvie-Vief, 2010). They include action readiness directed at emotional action itself, in the action modes of restraint and enhancement of emotional action, differentially stirred by emotional control and emotional "authenticity" values, themselves empowered by more encompassing values of social harmony and individual singularity (Mauss and Butler, 2010).

[2] Toning down the force of actions already begins when the female cormorant is on the point of laying her eggs (Kortlandt, 1995). Male and female begin to treat each other with more trust and "friendliness", that is, by showing decrease of the watchfulness action of pointing their beaks forward.

5.1. Hierarchical organization

The relationships between motive states just mentioned have given rise to the hierarchical model of motivation, described by Gallistel (1980). It originated largely in the observational ethological work of Kortlandt (1940, 1955, labeled "brilliantly erudite" by Dawkins, 1976, p. 11) and of Tinbergen (1951).

Hierarchical organization indeed represents a general principle of action control (Miller and Cohen, 2001): activation of an encompassing system stepwise potentiates its dependent subsystems. It can take several forms. In one form, activation of a motivational system state is implemented by successive activation of several lower-level systems. For instance, seasonal activation of the reproductive system of the male three-pined stickleback activates motivations for fighting, nest-building, mating, and care for offspring, in that order. Activation of the mating subsystem in turn motivates performing a zigzag dance in front of the female, leading her to the nest, showing her the entrance, quivering, and fertilizing the eggs, again in that order (Tinbergen, 1951, p. 104). In another form of hierarchical organization, a higher-level motivational system may activate one of several lower-level motives, dependent on situational specifics.

A major example of this latter organization is presented by Harmon-Jones et al. (in press). Aversive stimulus events may be assumed to activate the defensive motivational system proposed by Lang and Bradley (2010). Usually, such activation, in turn, arouses withdrawal motivation. However, as Harmon-Jones et al. (in press) extensively show, the defensive motivational system sometimes activates approach motivation, as shown both by approach behavior and left frontal neural activation. It does so when internal or external cues also activated a hostile or "go against" motive state, that is, a state of anger. Approach motivation can evidently be activated by defensive as well as by appetitive stimulus events.

5.2. Lattice hierarchy

As these findings show, the various motivations do not really form a hierarchy. Evidently, any motive state may employ any other motive system in seeking to serve its aims. Each motivational system has a large measure of independence, can be relevant in very different motivational contexts, and be called by various different motivational systems that then function as being of higher order.

The organization of motivation is therefore best described as a hierarchical–heterarchical or *lattice* organization (Gallistel, 1980). The approach system in the left frontal cortex can in fact be activated not only by the appetitive and the defensive systems. It can also be engaged by the investigative system. One approaches and stretches one's head forward to get a better look, to be closer in desire, and to hurt in anger.

Interesting examples of multiple motivational engagements can be found in animal instinctive behavior sequences. They represent, in fact, the strongest instigations for viewing complex actions as outcomes of interactions of motive states, rather than as fixed action patterns (Kortlandt, 1955). Recall the example of cormorants, feeding their infants: the act of grasping the head of those infants. The action is of the same sort as that of grasping a heavy live fish, but performed with more care and less vigor. A similar variability is shown by cats. Cats – all cats, from house cats to tigers – grasp the neck of others with their teeth under several different circumstances. Play elicits it, with considerable restraint. Nurturant motivation does it, with more muscle power, for carrying infants back into the nest. Predation does it, with great power and speed, to kill prey (Leyhausen, 1979). In the sexual repertoire of European cormorants, tenderness also occurs:

seeking comfortable bodily proximity or contact. Relevant actions include turning one's beak away from the other (a general prudent social acceptance action); touching the other's head with one's own head; putting one's neck alongside the neck of the other (Kortlandt, 1995). Tenderness also occurs in the male walrus, which may casually put its flipper on the head of a passing female, and not only as an introduction to mating (personal observation). The structure of human tenderness is similar. The lattice structure is evident throughout action. For instance, aggression occurs as impulsive defensive action as well as deliberate instrumental action, with different contexts of autonomic engagement (Scarpa et al., 2010).

6. Arousal, motivation, and emotional feelings

Autonomic specificity of emotions is of interest because, if it exists, this might support the hypothesis of innate basic emotions. It also, as James (1890) supposed, might form the substance of different emotional feelings. But, alternatively, it might reflect acute resource requirements of different modes of action readiness and action, and thereby indirectly correspond with different emotions.

Kreibig (2010), in her very careful and insightful review, clearly comes out in favor of the latter view. Autonomic responses appear largely to result from anticipation of action requirements, action preparations, motivated abstention of action, and immobilization. Functional interpretations along these lines are supported by the observed response variations following variations in appraisal over time that result from the fine grain of events during the course of a given emotional episode. Such variations are detailed by Lang and Bradley (2010) and by Kreibig et al. (2010). The multi-channel second-by-second studies and their growth curve analyses show a veritable anatomy of emotions that goes far beyond mere knowledge of autonomic response variations. The functional level of analysis also shows its fruitfulness in Kreibig's (2010) treatment of autonomic response differences between emotion subtypes, such as those between anger in and anger out, and between fear and anxiety. It also fits the occurrence of autonomic responses when no meaningful action appears possible, as in emotional shock (Dumas, 1948) and helpless despair (Seligman, 1975; Stemmler and Wacker, 2010).

It has become abundantly clear that autonomic responding cannot be subsumed under a single construct such as Cannon's (1927) emergency response. Different functional response patterns are observed, such as the patterns of active and passive coping (Obrist, 1981), and of challenge versus threat cardiac response (Mauss and Butler, 2010). Pattern differences are confirmed and extended in several of the contributions (Friedman, 2010; Stephens et al., 2010). The range of functional interpretations is enlarged, for instance, when Pu et al. (2010) discuss the possible role of vagally controlled heart rate variability in expression regulation; Mauss and Butler (2010) observed that patterns of cardiac response differed with the culturally determined meaning of emotion control as manifesting positive social sensitivity or personal authenticity (at least among subjects high in emotion control).

These functional conclusions are relevant to the hypothesis that different emotion feelings correspond with different patterns of autonomic feedback. This question has been extensively analyzed by Friedman (2010), who concluded that an answer is possible only when comparing the patterns occurring with different basic emotions (Stephens et al., 2010). Development and application of new methods for pattern comparison has found considerably more consistency in pattern differences between different emotions than would have been expected from Cannon's (1927) critique and later discussion (Friedman, 2010; Kreibig, 2010; Stephens et al., 2010; Stemmler and Wacker, 2010). Stephens et al. (2010) obtained above chance assignment of arousal patterns to the different emotions involved in their experimental study. Kreibig et al. (2010) found differences between different emotions (interest, pride, joy, and surprise) in autonomic reaction patterns for emotions during task performance and goal achievement, reflecting active coping or action readiness enhancement.

At the same time, these emotion differences appear insufficient to explain the distinctions between the emotional feelings. Within states labeled by the same word, autonomic patterns still vary (Friedman, 2010; Kreibig, 2010; Wilhelm and Grossman, 2010). Also, support for the autonomic specificity hypothesis, drawn from differential autonomic response patterns elicited by voluntarily adopting different facial expressions (Ekman et al., 1983, and mentioned by Friedman, 2010), is weak. The data have been contested (Zajonc and McIntosh, 1992). Moreover, voluntarily adopting facial expressions influences respiration rate and requires effort, and does so differently for different expressions. The autonomic effects in fact correlated with the number of facial action units engaged in the expressions (Boiten, 1996).

I think that the current evidence offers support neither for general autonomic specificity of basic emotions, nor for equating emotional feelings with patterns of autonomic feedback. The observed differences found are apt to be due to the action and action readiness differences that in turn are reflected in emotional feelings and emotion labels. It has to be taken into account that reported differences in body experience usually represent mixtures of autonomic awareness and awareness of action tendencies and action (Friedman, 2010; Nieuwenhuyse et al., 1987). Theory should keep these two kinds of body experience separate. Awareness of action readiness as such probably provides much more distinctive information than autonomic feedback can provide (Frijda, 1986, 2007).

7. Emotion elicitation

In the present perspective, emotion elicitation amounts to elicitation of a change in action readiness. Such elicitation is due to a conjunction of external or mental events and inner conditions. The external events, as was mentioned, include the fates (initiation, progress, obstruction, and success) of actions and interactions (Kreibig et al., 2010). The inner conditions have been labeled "concerns": dispositional motivations such as needs, sensitivities, attachments, and other sentiments. The impact of events upon concerns is what renders events meaningful to the individual. Registering and foreseeing that impact is what allows the individuals to function as "autonomous systems," that can fend for themselves in uncertain environments. It needs the use of information in addition to brute sensory stimulus inputs. Emotion study tends to collect these information processes under the label of "appraisal" (Ellsworth and Scherer, 2003; Frijda, 2007; Scherer, 2005).

As I mentioned, the processes of appraisal are largely automatic and nonconscious (e.g., Moors and De Houwer, 2005), and so is much of the information that they use. One need not be aware of them for their contributing in the elicitation of affect and action readiness changes (Frijda, 2007; Lambie and Marcel, 2002; Scherer, 2005). That assumption is largely confirmed by the studies on the effects of nonconscious priming (e.g., Hassin et al., 2005). Some of the appraisal processes are effected cognitively, by using information from an event's spatiotemporal context and stored previous experience. But much of it emerges directly in actual confrontations and interactions with other people and events (Parkinson, 2007; Parkinson et al., 2005). One perceives that one's ongoing actions succeed or are opposed, one is acting but bumps into things, one's competences proceed smoothly or are challenged

or fail, one's action yields satisfaction or disappointment. One's perceptions are perfused by the precipitates of previous and potential interactions by way of the perceived affordances of objects and events: perceiving the fitness of objects or situations for specific actions (Gibson, 1979; see also Frijda, 2007; Rietveld, 2008a,b).

As also already mentioned, appraisals may continuously change over the course of an emotion episode and as a result of the ongoing interaction. They also change very considerably over the lifetime, as a result of increases and subsequent decreases in emotional coping potential, as demonstrated by Jain and Labouvie-Vief (2010), in particular among those individuals who tend to respond with an avoidant or dismissive motive state or affiliation style.

8. Action selection

Under the present perspective, emotional events elicit aims that may activate action schemas that, at some level, may fulfill them. The outcomes of the activated schemas at some level match the aims. With impulsive actions, this occurs automatically. How does that proceed?

Current theory posits that impulsive actions are automatic because they are overlearned (Strack and Deutsch, 2004). That would not appear to apply to most of the impulsive actions with which the present paper is concerned. Newborn babies may cry and thrash about when hungry, suck when their lips touch the nipple, which may be a reflex, but begin to root soon after. They also soon start to focus their eyes on salient visual stimuli. When, a little later, they see something of interest they stretch their arms and seek to grasp. They begin to do it before it is either goal-directed and planned and overlearned. Sure, it gets well-trained, by doing it over and over again (Piaget, 1936), and it gets effortless and automatic in that sense. But it was impulsive from the beginning.

What then allows impulsive actions to be automatic? I would suggest that many impulsive actions are part of a basic repertoire of elementary skills that are rooted in how the body is built and in biologically prepared "coordinate structures" (Bernstein, 1967) that are exercised daily. Moreover, they all –crawling, walking, grasping, throwing, biting, approaching, and withdrawing – are of wide applicability. Biting is used to break up a piece of cracker, to evoke sounds from the mother, to draw in a blanket, to hold a toy, and to defend a possession. Walking happens to move oneself forward, thanks to neural oscillators. And so forth. All these actions are not "learned" in the way that using a pencil is learned, but only by learning to adjust various parameters to each other and to external cues. Those external cues are, I think, essential in impulsive actions. The aims that drive those actions operate in conjunction with information from the situation at hand, since appraisal of this information is what elicited the aim. Dual determination of action by motivation and by stimulus context forms a basic general principle of action generation (Morgan and Stellar, 1950).

In addition, the outcomes of these actions visibly correspond with their geometries. It is no surprise that moving forward brings you closer, in the way that pressing a button surprises you when it yields a pellet of food. Outcomes fit the completion of those actions, and they do so gradually during their execution. Turning its head away from a stranger and creeping back to the mother diminishes the former's nearness and increases that of the latter. Outcome learning of actions, in action theory, is explained by association, and as following the principles of contiguity and consistency (Prinz et al., 2009), but that does not appear to represent the main mechanism here. Automaticity of impulsive action, I think, is not primarily explained by association but by information. Contiguity and consistency probably are poor principles for action learning. Gallistel and Gibbon (2000) indeed have argued so. Infant action acquisition brims with little insights, as is evident from the work by Premack (1990), Spelke and others (1995). Outcome expectancy generally results from noticing similarity or overlap, their perceptual causality links, between features of situations, actions, and their affective and material outcomes. Those features may well be primary in establishing their coherence (Dickinson and Balleine, 2009). They may well form the essential elements in "common coding", the integration of event knowledge and action knowledge (Prinz et al., 2009).

Many complex and acquired actions probably fit their outcomes in similar informational fashion. Drawing a knife can be an automatic impulsive action, not because one has killed or wounded so often before (although it may help), but because sticking-inside, and forward, and with force, match the dynamics of effecting change by bare fist movements towards any object that offers resistance. Action selection from one's action repertoire probably profits from previous and actual "sculpting the response space"—examining and reordering the relationships between stored mental elements when perusing the response space in search of fits (Fletcher et al., 2000).

9. Impulsive and reflective action

Action selection in implementing aims is not restricted to selecting impulsive action. No adequate impulsive action schema may be available, or any impulsive action may be considered to have its disadvantages, among which its very impulsiveness in the first place. This is the point where impulsive action is replaced by pausing or by reflected action. Generally, reflection sets in when hitting an impasse in impulsive responding (Norman and Shallice, 1986). Reflection proceeds by replacing or augmenting the aim – change from now – by setting a goal: forming a representation of a desired future state, planning and forming some implementation intention, which together characterize goal-directed action (Gollwitzer, 1999). Transforming an aim into a goal can occur at once, or it can occur hours or years after the emotional event, if plans have persisted, or if aims re-emerge when recollecting the event or issue that generated the emotion in the first place. Acts of revenge are often of this nature (Frijda, 2007), and so are acts of erotic and of intellectual pursuit.

Reflection allows search for and construction of appropriate action schemas as goal-directed action theory proposes (Kruglanski, 1996; Prinz et al., 2009). In other words: actions of any sort or complexity can be caused by emotions. Reflective processing forms a tool for the formation and selection of emotional action. It can go long ways in handling subgoals in reaching the emotional aims, in handling obstacles met on the way, and in dealing with motivational complexity, the interferences of action due to the multiple concerns that actions and their expected outcomes may evoke. Emotion regulation generally is caused by such interferences (Frijda, 2009). Actions serving regulation thus, for the most part, are a long way from the impulsive actions that are caused by emotional motive states. Actions may also serve mood repair, which again is a long way from the actions directly instigated by the emotional action readiness. Recognizing the manifold indirect ways in which emotion may lead to actions, and notably control by reflective processing (as transpiring in the contributions by Pu et al., 2010, and by Jain and Labouvie-Vief, 2010) clarifies the predicaments of Barrett (2006), Baumeister et al. (2007), and Kagan (2006), mentioned in the beginning of this paper, concerning the emotion–action relationship.

Impulsive and reflective processing thus intertwine in the generation of emotional action and experience. In fact, I think it is inappropriate to consider them as products of impulsive and reflective systems, respectively. There is no impulsive processing

system, because impulsive processing is the basic mode of operation of each mental system capable of action,—of each autonomous system. Only in *Homo sapiens* is that mode of operation augmented by reflective provisions. On occasion it still manifests itself almost unmodified and unaugmented, as when an alcoholic frantically peruses the house for the tenth time while knowing for sure there is not a drop of drink left anywhere.

10. Coda

In this paper, I explored the relationships between emotions and action. I concluded that the relationships are close: with emotions as appraisal-elicited motive states leading, in the first place, to impulsive actions. Thinking is for doing, wrote William James. So is emotion. Much in the preceding contributions suggested and supported this conclusion, among other things by the action-readiness-related phenomena of autonomic response.

I advanced the hypothesis that the emotion–action relationship passed by the intervention of motivation, generated by the appraisal of relevance of events to concerns. Appraisal includes, but is not restricted to, the intrinsic affective value of sensory stimuli. I hope to have clarified a bit more the role of motivation in emotional processing and the instigation (or non-instigation) of action.

In this exploration, I introduced a number of more specific hypotheses, in many cases on somewhat slender bases of facts. I introduced some concepts that appeared useful, such as the distinction between preset goals and appraisal-generated, affect-driven aims.

Several of the hypotheses need being explored with respect to underlying processes. First, motivations lower in the motivation hierarchy than appetitive and defensive may result from motivation-specific neural circuits, as argued by Panksepp (1998) or, rather, result from sets of action schemas or acquired networks. This would seem one of the major challenged and challenging questions for further research.

Another research question concerns testing the surmised process of aim formation, and its implications such as the processes responsible for what I called control precedence. The main question here is perhaps to verify whether or not all emotional aims – appetitive as well as defensive ones – involve neural activation of the midbrain dopamine system, or that other neurohumoral systems such as serotonine and acetylcholine carry a major role.

Research should be focused on the factors responsible for the transitions from aims to goals and, thus, from stimulus control to control by goal representations. Parallel with this is examination of the question whether indeed automatic responding is not confined to overtraining antecedents. One should extensively verify the role of non-associative factors in the emergence of action dispositions.

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