

An Affective Perception: How “Vitality Forms” Influence Our Mood

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Abstract

The form of an action has a strong influence on the interaction between humans. According to their mood, people may perform the same gesture in different ways, such as gently or rudely. These aspects of social communication, named *vitality forms* by Daniel Stern, represent a mean to establish a direct and immediate connection with others. Indeed, the expression of different vitality forms enables us to communicate our affective states and at the same time the perception of these vitality forms enables people around us to understand how we feel in that moment. In the last years of research, different fMRI studies have been carried out to investigate the neural correlates of vitality forms recognition and execution. Moreover, recent psychophysics studies conducted from our research group have demonstrated the presence of an affective contagion effect, during which vitality forms expressed by an agent affect the action perception and the motor response of the receiver. This means that vitality forms expressed by others can influence our mood positively or negatively, modulating as consequence our behavior. Note that vitality forms pervade our lives in a continuous manner and thus they are not expressed and perceived only during social interactions. For example, when we observe an artistic representation at the theatre, the dynamic postures of dancers, together with an alternation of acceleration and deceleration in their movements, communicate to us different affective states. Also when we are in a museum in front of a painting, lines, colors and shapes used by the artist can elicit in us different sensations and modify our attitude. In this view, with the aim to extend the concept of vitality forms from neuroscience and psychology to other disciplines of study, we dedicate part of this review to discuss how art, in all its forms, can be considered a pure expression of vitality forms.

Introduction

Have you ever understood the internal states of others by observing their actions? Depending on the positive or negative mood of the agent, during social interactions actions can be expressed in different ways, such as rudely, gently, vigorously or hesitantly. These aspects of social communication, defined *vitality forms* by the psychologist Daniel Stern (Stern 1985), enhance the quality of interactions by enabling to communicate our personal feelings and perceive those of others. For example, if an action is performed rudely or gently, one can understand if the agent is angry or calm. Vitality forms pervade our life and modulate continuously and unconsciously our behavior. Indeed, we have recently shown that a request (conveyed vocally or mediated by physical touch) expressing vitality forms (rude/gentle) have an impact on our action perception and action execution. In particular, when an individual asks us something, his/her positive and negative attitudes, communicated through vitality forms, modulate our perception of actions duration and our motor response (Lombardi et al. 2021). During everyday life we have experience of vitality forms not only when we interact with other people but also when we experience the affective power of art, in all its forms. Indeed, in his book *Forms of Vitality: Exploring Dynamic Experience in Psychology, the Arts, Psychotherapy, and Development*, Daniel Stern dedicated an entire chapter to describe the deep link existing between the arts and vitality forms. As he wrote, we have all experienced moments in which we have been captured or moved by the vitality forms evoked by an artistic representation (Stern 2010). In the first section of this review, we explain results of a previous kinematic study followed by a discussion of results of our recent studies regarding the influence produced by vitality forms on action perception and execution. Thus, the first section of the essay is dedicated to describing the existence of an affective contagion effect produced by vitality forms during social interactions. Starting from these findings, in the second section we discuss how, besides social interactions, a similar affective contagion effect could also occur during an aesthetic experience. In particular, we first summarize Stern's theory on the perception of vitality forms in art, specifically in the form of music and dance. Secondly, we discuss the possible effect of art, specifically in the form of paintings, on the mood of the perceiver by giving specific examples. Finally, we conclude with interesting perspectives for the future regarding the role of vitality forms in art therapy.

Vitality Forms Affect Our Action Perception and Execution

During everyday life the form of our actions and speech modulates our interactions with others. For example, when we are angry, we unconsciously reflect this negative mood on our action and speech style. Indeed, our gestures will be performed more vigorously and also our tone of voice will be ruder. From this simple idea, in 2017 Di Cesare and colleagues conducted a kinematic study with the aim to assess whether and how visual and auditory properties of vitality forms expressed by an agent influenced the motor response of the receivers. Specifically, participants were presented with stimuli showing two requests (“take it”, “give me”) expressed gently or rudely and presented in visual, auditory, or mixed modality (visual and auditory). According to the type of request, participants had to take or give a bottle placed in front of them. Results showed that the rude and gentle vitality forms modulated differently the individuals’ motor response. In particular, when the request was rude participants moved the object with a higher velocity and a larger trajectory. On contrary, when the request was gentle, they moved the object with a lower velocity and a smaller trajectory (Di Cesare et al. 2017). Starting from these findings, the subsequent idea was to understand whether, besides action execution, vitality forms expressed by an agent may also affect action perception and in particular the estimation of goal-directed actions duration. To this aim, we recently conducted a psychophysics study (Lombardi et al. 2021) at the Italian Institute of Technology (Genoa, Italy) in which participants were presented with video clips showing the initial part of a passing action performed with a rude or gentle vitality form and were asked to continue the action mentally and estimate the time of its completion by pressing a button (see Figure 1A). Particularly, for rude actions they observed 250ms, corresponding to 35% of the total duration of 700ms while for gentle actions they observed 420ms, corresponding to 35% of the total duration of 1200ms (see Figure 1B). Since the final goal of our study was to understand the effect of different vitality forms on the action estimation task, before the videos’ presentation participants received a request mediated by physical contact or vocally conveying rude or gentle vitality forms. More specifically, during the physical request a robotic manipulandum reproduced a rude (800ms) or gentle movement (3000ms) on the right arm of participants while, during the vocal request, they listened to a male or female voice (750ms) pronouncing “give me” (Italian verb: *dammì*) rudely or gently (see Figure 1C). Results indicated that a gentle request increased the duration of a rude action subsequently observed while the perception of a rude request decreased the duration of the same action performed gently. More specifically, when participants observed the initial part of a gentle action but were previously stimulated with a rude request (incongruent

condition: rude request, gentle action), they anticipated the end of this action compared to the same action presented after a gentle request (congruent condition: gentle request, gentle action). On the other hand, when they observed the initial part of a rude action but were previously stimulated with a gentle request (incongruent condition: gentle request, rude action), they perceived this action as lasting longer compared to the same action presented after a rude request (congruent condition: rude request, rude action). These findings are in line with data provided by other two psychophysical studies recently carried out by our group at the Department of Neuroscience in Parma (Di Cesare et al. 2021a). The experimental paradigm was very similar: participants listened to gentle/rude vocal requests and then observed the initial part of a passing action consisting in different durations (200ms, 250ms, 300ms, 350ms for rude actions; 340ms, 420ms, 500ms, 600ms for gentle actions). As in the study described before, once the action was obscured, participants were required to continue it mentally, indicating its end. Results showed that listening to rude/gentle vocal requests influenced the perception of actions subsequently observed. In addition, we quantified the duration of this effect by adding five time delays (0ms, 200ms, 400ms, 800ms, 1200ms, 1600ms) between the vocal request and the video's presentation, finding that the effect lasted 800ms and then started to decay.

Altogether, these findings suggest the role of vitality forms in influencing others from an affective state point of view. In particular, we provide first evidence that by observing a goal-directed action, besides the goal, the observer is able to internally simulate the vitality forms of that action. In the last few years, research has been carried out to identify the neural mechanisms underlying the ability to processing how actions are performed (i.e., the vitality form). Particularly, in a recent fMRI study, Di Cesare and colleagues identified the dorso-central insula (DCI) and the middle cingulate cortex (MCC) as the neural substrates underlying the observation and execution of vitality forms (Di Cesare et al. 2021b). These brain structures modulate the parieto-frontal circuit, specific for action goal understanding (Rizzolatti and Craighero, 2004; Iacoboni and Dapretto, 2006; Fabbri-Destro and Rizzolatti, 2008; Keysers and Fadiga, 2008; Caspers et al., 2010; Grosbras et al., 2011; Molenberghs et al., 2012; Rizzolatti and Sinigaglia, 2016), determining how actions are executed. Thus, the dorso-central insula and the middle cingulate cortex formed a circuit with mirror properties specific for vitality forms encoding and processing. In this respect, it is plausible that this circuit may transform the vitality form information into a motor domain allowing people, during social interactions, from one side to understand vitality forms expressed by others and from the other side to prepare an adequate response.

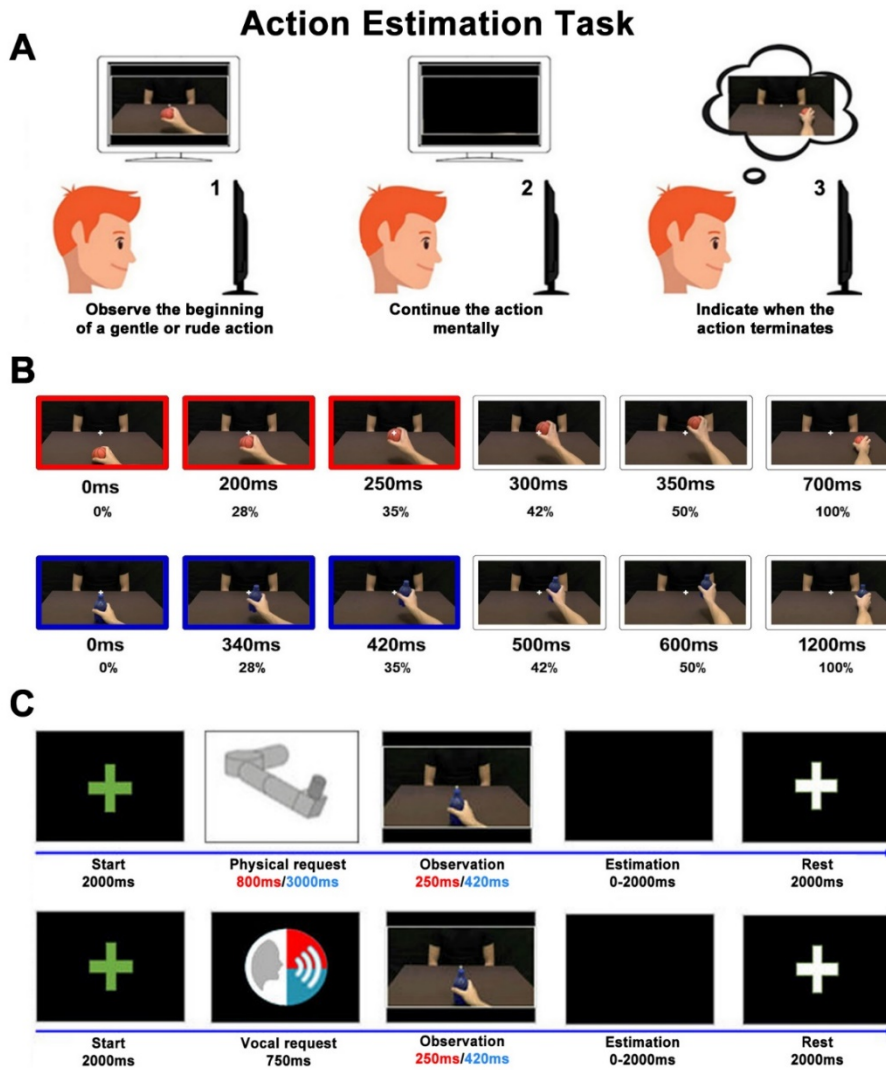


Figure 1. A) Action estimation task: 1. Participants observed the initial part of the passing action, 2. Continued the action mentally, 3. Estimated the time of its end. B) Experimental stimuli presented to participants. For rude actions (red) we presented 250ms, corresponding to 35% of the total duration (700ms). For gentle actions (blue) we presented 420ms corresponding to 35% of the total duration (1200ms). C) Experimental paradigm: before the action estimation task (Observation of the initial part + Estimation) participants received a physical request (rude:800ms, gentle:3000ms) or a vocal request (750ms for both rude and gentle vitality forms). Figure adapted from (Lombardi et al. 2021).

The Role of Vitality Forms in Human-Robot Interactions

As mentioned in the previous section, Di Cesare et al. (2017) showed that, during social interactions, participants' kinematic features were influenced by vitality forms expressed by an agent through visual and auditory stimuli. These findings rise a question: can also robotic attitudes influence human actions? To address this issue, our research group conducted a kinematic study at the Italian Institute of Technology of Genoa, Italy (Vannucci et al. 2018). The challenge we address was twofold: 1) to endow the humanoid robot iCub with vitality forms, allowing it to generate gentle and rude actions; 2) to investigate whether and how the observation of these actions influence the motor behaviour of the human partner. In the first step, by using a motor tracking system, we recorded the human kinematic of a passing action and remapped it into the joint space of the robot. Additionally, we produced a robotic voice pronouncing the Italian action command "prendi" (English verb: "take it") in a rude or gentle way. During the experiment, participants sat in front of the robot with headphones to hear the robotic voice indications. After the iCub action execution (passing the object) or verb pronunciation ("take it"), participants had to take a ball. Particularly, between the participant and iCub, we placed a small table with marks indicating the starting position of the right hand and two different targets on which the ball had to be placed by the participant. The robot action/voice could express two different vitality forms, rude or gentle. Results showed that the kinematic parameters of the robot action as well as properties of its voice are adequate to express different attitudes, consistently perceived rude or gentle by the human partner. Participants motor response has a tendency to show an increase in hand acceleration and speed of grasp aperture in response to a rude rather than a gentle robot behaviour. Starting from these results, we improved the experiment adding a video-phase, in which iCub was not physically present in front of participants, as in the live human-robot interaction, but was shown in a monitor in front of them. Vitality of the action modulates the speed of the participant, especially in the reaching phase of the movement where the speed difference between gentle and rude is extremely significant for both the video and live parts. Approximately, the same results were found for the voice condition.

EXPERIMENTAL SETUP DURING LIVE HUMAN-ROBOT INTERACTION



Figure 2. Experimental Setup during live human-robot interaction. The face of the robot was covered to avoid bias regarding eyes or facial information.
Figure adapted from (Vannucci et al. 2018).

In summary, it is possible to endow a humanoid robotic action/voice with vitality forms. More interestingly, also during human-robot interaction, vitality forms expressed by the humanoid influence the human partner from an affective state point of view, modulating his/her motor response. The opportunity of humanoid behaviour to express rude or gentle attitudes opens interesting future perspectives for robotics research: the kinematics and the voice can become a valuable tool to make the robot appear more "commanding" and "assertive" or "polite" and "kind", ensuring an effective and *affective* interaction with humans.

Art: A Pure Expression of Vitality Forms

In his book *Forms of Vitality: Exploring Dynamic Experience in Psychology, the Arts, Psychotherapy, and Development*, Daniel Stern describes vitality forms as a Gestalt, a whole of five elements (movement, time, force, space, and intention/directionality), the awareness of which gives rise “to the experience of vitality.” (Stern 2010). Stern applies this conception to the arts, specifically to music, dance, theatre and cinema. Each of these arts shows forms of vitality in a relatively purified way, in the sense that the dynamic features of an artistic representation grow and decrease continuously, allowing our arousal system to be constantly stimulated. The term “dynamic” in music, as Stern highlights, refers to sound volume, which is directly associated to force. Indeed, in order to obtain an intense sound, a musician needs to apply more force on the instrument, and this is immediately notified by the listener. Moreover, rhythmic variations characterizing a melody have an immediate effect on the arousal system, evoking a sense of vitality in the perceivers. A particular attention in Stern’s book is given to dance, a form of art which, with the affirmation of modern and contemporary styles, has started to give place to improvisation and thus to the spontaneous expression of personal internal states. Notably, Stern cites Rudolf Laban, known as the founding father of expressionist dance, in which the movements of dancers become a pure expression of their most internal vitality affects. In this way, by observing dancers while moving in the stage, we can be able to understand “their” feelings. We recognize particular accents, dynamic postures, acceleration and deceleration in their movements, and from them (i.e., expression of vitality forms) we can perceive what kind of feeling the dancers are expressing as if it were their own. Even if it is only performed and thus feigned (or simulated) (Sauer 2020). Although Stern takes into consideration only time-based arts, similar remarks can be done also for classical forms of art, such as paintings, sculptures, design. In this case, we can’t talk directly about sounds, movements, accents but we can reformulate the concept of “affective-vital perception” considering features that, since ancient times, artists have used to reveal their most intimate vitality affects, such as planes, lines and colors. In this regard, different colors, lines and shapes are a mean for the artist to freely express the internal states he/she looked for and thus can create a direct connection with others. By processing them as vital or living forms, the viewer finally gets the feeling of virtual vital images as Stern notes with reference to Susanne K. Langer (Stern 1985, 158-159). This feeling forms the basis of the viewer’s mood and colors the content of the artifacts (Langer 1967, 324, cf. also Cassirer 1944, 194, Sauer 2023 forthc.). An example will show this.

The “fundamental dynamic pentad” characterizing vitality forms experience can be perfectly associated to artists which have made energy, movement and vitality the basis of their work of arts. “Dynamism” was a magical word for the Futurist artists, who translated the kinetic rhythms and the intense sensations of modern life into potent visual forms, creating works of extraordinary emotional impact. In their Manifesto, Futurists said the goal of their paintings was “to put the spectator in the center of the picture” hoping that, through the perception of specific forms and colors, they were allowing the work of art to take effective possession of the observer’s mind and express intense sensations (“Futurism”, www.moma.org). Following the futuristic principle “*To paint a figure, you must not paint it; you must render its surrounding atmosphere.*” Umberto Boccioni’s *States of Mind* (1911) can certainly cited as one of the most important works in the movement. Each tripartite version of *States of Mind* contains the same titles for the individual images: *The Farewells*, *Those Who Go*, and *Those Who Stay* (Figure 3). The lines in each composition depict change or movement as an energy permeating our existence and suggest a particular mood, also underlined by colors. Choosing a train station as landscape, in *The Farewells* Boccioni captures the dynamism of movement and chaos through circulating and diverging directional pulses of lines and the power of complementary green and red forms. Oblique blue lines changing from dark to light in *Those Who Go* move diagonally leaving behind divergent shapes and thus evoking evanescent impression, resembling the effect of the view through the window of a fast-moving train. In contrast, *Those Who Stay* is characterized by vertical lines anchored in the frame conveying the mood of those who stay, fixed or even frozen in place. Moreover, the almost monochrome use of colors (blue and green) conveys the sense of cooling, creating a pervasive atmosphere of melancholy.

***States of Mind* - Umberto Boccioni**

A. The Farewells

B. Those Who Go

C. Those Who Stay

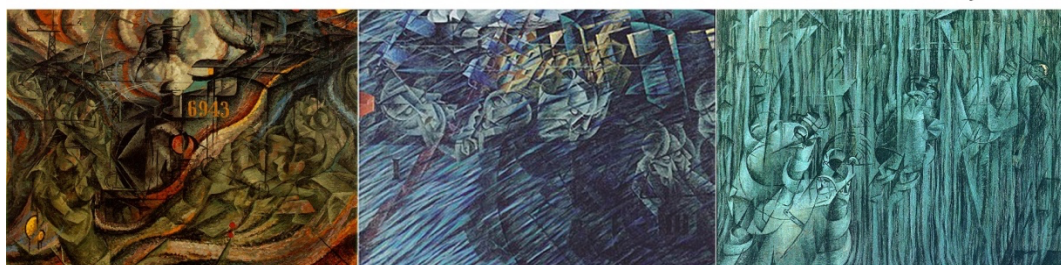


Figure 3. Umberto Boccioni, *States of Mind*, 1911, three-part, oil on canvas: A) *The Farewells*, 70,5 x 96,2 cm, B) *Those Who Go*, 96,5 x 70,8 cm and C) *Those Who Stay*, 70,8 x 95,9 cm. with friendly permission for noncommercial research use MoMA, New York.

The result is that, by observing the work of art, one can perceive what mood the artist conveyed with his/her creation, what particular sensations the artist wanted to communicate and in what kind of atmosphere the artist wanted to immerse the observers. As consequence, the observers can change their mood, creating a moment of full empathy with the respective topic the artist realized. The link between empathy (English translation of the German term *Einfühlung*) and aesthetic experience has been theorized by Robert Vischer (1873): observing a work of art the vital properties which we experience through our imaginary bodily perspective are thus bodily "projections". Indeed, the term "Einfühlung" literally means "feeling into" and refers to an act of projecting oneself into another body or environment. By "feeling into" a portrait or a sculpture, or a tale of a human being, it is supposedly possible to understand what it would be like to be that human being and thus to understand its mood (Ganczarec, Hünefeldt and Olivetti Belardinelli 2018). An interesting question is to understand how it is possible. Neuroscientific research, particularly from the Department of Neuroscience of Parma founded and led by Giacomo Rizzolatti, clearly showed that vision is a multimodal process that involves activations of brain circuits not only "visual" but also visceromotor and affective. From Parma's group, Vittorio Gallese interpreted mirror neurons as neural expression of the "Embodied Simulation" (Gallese 2009), and related art to neuroscience (Gallese 2019): the same structures involved in the subjective experience of sensations (with affective value) are also active when such sensations are recognized by observing a work of art.

To summarize, in this section we discuss the possibility to reformulate the same principle we apply to vitality forms expression and perception during social interactions for art, in all its forms. Indeed, on one hand the artist uses his/her creations to express internal states and on the other hand the recipients are able to capture immediately these affective states, sharing a moment of pure empathy with the topic of the creation and thus changing accordingly their mood. As Stern already said, art can begin an inner movement that promotes processes of inner change. With this idea in mind, we can additionally associate to art a potential therapeutic value, made of a free and powerful expression of our most intimate vitality affects. The idea is that people may use materials in various ways (i.e., vitality forms), working slowly or rapidly, making heavy or light quality of marks, and creating different color, shape and texture. These may be indicative of their state. In this regard, the expression of vitality forms in art therapy, which remain since now a relatively unexplored area, may become an interesting perspective for the future.

Conclusion

To conclude, this short review summarized the role of vitality forms in influencing our mood. Vitality forms concern the "How", the manner in which actions are performed and by observing this fundamental component of social communication we can simultaneously capture other's internal states and communicate ours. Vitality forms pervade social interactions and are responsible of our attitude change. For example, if we perceive a rude vitality form in someone's gesture, we first understand that the agent is in a negative mood and we accordingly (and sometimes unconsciously) move more rapidly or perceive everything in a rude optics. Is it possible to reformulate this effect in other moment of social life such as the aesthetic experience? For example, by observing a painting, are we able to understand what mood the artist expresses or what kind of atmosphere want to create in us? As reported in the second part of the essay, art in all its form represents a pure expression of vitality forms. Thus, the work of art becomes a mean for the artist to communicate the most internal feelings corresponding to a topic to the observer. The result is that the observers can perceive these internal states and consequently change their mood. For this reason, art represents a powerful mean to give free expression of our personal internal states and communicate them to others. In this view, the last part of the essay gives space to the fascinating perspective to make art an effective therapy to reveal our most intime affective states.

Authors Biography

Giada Lombardi obtained her Bachelor's degree in Biomedical Engineering at the University of Genova, Italy (DIBRIS) and specialized at the same University in Neuroengineering (110 cum laude). She carried out her Master thesis at the Italian Institute of Technology (IIT) of Genova, where she discovered Giuseppe Di Cesare's project on vitality forms. She continued her research applying for a PhD on the same research theme. From November 2020, she is a PhD student, supervised by Dr. Giuseppe Di Cesare and Dr.ssa Alessandra Sciutti, at the IIT of Genova (CONTACT lab). Thanks to a collaboration with the Department of Neuroscience at the University of Parma, Italy, she is improving her skills with neuroimaging techniques such as fMRI and DTI.

Giuseppe Di Cesare graduated in Biology at the University of Rome and obtained the PhD in Neuroscience from the University of Parma, Italy. During his PhD he learned neuroimaging, psychophysical, kinematic techniques and applied them to several studies on vitality forms. He is lead author of the Vitality Project, aiming to investigate the neural basis of these forms of communication expanding the study of vitality forms to autism and robotics. Since August 2019, he is working at the Italian Institute of Technology (IIT) in Genova, Italy (CONTACT lab) where he is designing and carrying out experiments on human-robot interactions involving fMRI and kinematics data collection which is part of the ERC starting grant awarded to Dr. Sciutti (G.A: 804388).

Martina Sauer studied art history, philosophy and classical archaeology at the University of Heidelberg, Germany (mid-term), Paris, France (Socrates fellowship) and Munich, Germany (graduation) and obtained the PhD in science of art from the University of Basel, Switzerland. After her PhD on affective affects and effects of abstract modern art and their consequences, she followed this idea in research and class at the universities and academies of Witten-Herdecke, Weimar, Bremen, Basel, Zürich and currently at Academy Mode & Design Hamburg and Düsseldorf. Martina is advisory board member and co-leader of the section image of German Society of Semiotics and the Society of Interdisciplinary Image Science and senior editor of *Art Style*, *Art & Culture International Magazine*. (bildphilosophie.de/en-gb)

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