Robotic creatures:
Anthropomorphism and interaction in contemporary art

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Abstract—**Technical developments, trends in popular culture and widespread interest in the scientific community can not account for the proliferation of robotic creatures in the art context, oddly neglected by art theory. In this paper we discuss robotic creation as a crucial domain for contemporary art theory taking as a point of reference the concepts of objecthood, interaction, conceptualisation and anthropomorphism.**

I. INTRODUCTION

Ed Inahtowicz's Senster, built between 1969 and 1970, could be considered as one of the earliest examples of robotic art, certainly a significant one [1]. The Senster was a robotic agent responding to audience voices and presence by means of microphones and motion detectors. When still, it as an imposing yet anonymous metallic structure. When activated, it would bend its head with curiosity, pull back in alarm, and move from bystander to bystander with life-like motion. Since then, robots began populating the art world.

Distinct from robots designed in engineering labs, these artistic creatures were dysfunctional: funny assemblages displaying neurological diseases, shy, curious, dumb, sick robots – a mechanical *cour des miracles* [2]. Technical developments, trends in popular culture or widespread interest in the scientific community can not account for the proliferation of robotic creatures in art context, oddly neglected by art theory. Indeed, the analytical, yet lacunose, framework on robotic art has been structured by artists themselves [3], in their attempt to illustrate their work and contextualise it.

II. BEYOND MODERNISM: ROBOTS IN THE CONTEXT OF CONTEMPORARY ART

Robotic art addresses a variety of factors that are indeed crucial in contemporary art. Interest, for art robots in particular but also for computer-driven "art systems" in general, stems out in the 60s from the dual influence of the Minimalist and Conceptual art practices. Robotic art, since its inception, has displayed expressive choices radically opposed to modernist aesthetics: focus on medium

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specificity; autonomy of the artwork from its environment; rejection of narrative; anthropomorphism and theatrality; and separation of high and low culture [4]. The tension and transit from modernist aesthetics to a new artistic sensibility – later embodied in technological art – is illustrated in Michael Fried's article Art and Objecthood, written in 1967 [5]

A. Objecthood in dispute

Michael Fried's critique is focused upon a particular kind of sculpture designed by artists such as Donald Judd and Robert Morris. This art is now labelled as minimalist, but Fried calls it literalist. The basic switch of sensibility identified by Fried lays on the fact that literalist art produces "objects in situation" which "[occupy] a position in the world" [5]. These works interlace relations with the spectators, losing the frame and separation from the surrounding world (as modernist aesthetics would), embracing "objecthood", and becoming mere objects in an environment. What is it about objecthood that is antithetical to modernist art? Following Fried, "objecthood amounts to nothing other than a plea for a new genre of theatre; and theatre is now the negation of art". In the first instance, objects produce "theatre" because they straddle categories (such as painting, sculpture) and theatre is "what is in between the arts"; in the second instance, objects activate a "theatrical relation" with the spectator. What is close to theatre immediately loses modernist legitimacy, since theatre denies art: "art degenerates as it approaches the condition of theatre" [6]..

B. Experience of the work as an interaction in time

All Fried's critique against theatre concerns the implication of the public presence and the focus on its perception as a conditio sine qua non for the existence of the artwork: theatrical is what acknowledges audience. "Literalist sensibility is theatrical because it is concerned with the actual circumstances in which the beholder encounters literalist work" [7]. Even if from a critical point of view, Fried indentifies not only a key aesthetic quality of minimalist art, but that of subsequent art practices, and especially technology–based art, the focus is on "experience" and interaction. The disruptive concept of the relation between work and spectator as a focus of the art process dates back to Robert Morris' "Notes on Sculpture" [8], in which he argues that the art objects should be designed for triggering physical participation by the visitor. In this way, the spectator is directly led towards her own perceptual activity which is, by the same token, revealed and disclosed

[9]. The "economy of tools" (to which is due the label "minimalism") is precisely intended to reveal the artwork as a relational system: the work is conceived starting from elementary parameters (light, shape, colour, size) susceptible to entertain continuous changing relations with the spectator, whose "task" is the physical exploration of the artwork. Conceiving art as experience and interaction means priming a process that can have place necessarily in time. Consequently, time is another issue questioned by Fried, since "the preoccupation of time is theatrical" while modernist works have to be appreciated in a timeless instant. "The experience in question *persists in time*". More precisely, minimalist preoccupation is with *duration of experience* – a theatrical paradigm – "isolating" the beholder as a subject. As for interaction and experience, duration and time have become a central aesthetic quality of many artistic practices from the 60s onwards. Technological art, happenings and video exist at an instant, function in time, and have duration.

C. Conceptualisation

One of the major trends in art after Modernism has been the dematerialization of the object, as framed by the famous definition by Lucy Lippard [10]. Lippard saw in such a dematerialization the unifying factor of the heterogeneous art practices of the 60s, from Land Art to video and happening. Such a trend has been pushed to its limits in conceptual art, reaching the elimination of the art object itself in favour of "propositions" or concepts: the object was not exposed anymore, in favour of the idea lying behind the work. After the Duchampian readymade, and further to conceptual artist Kosuth, art's quest consisted in presenting analytic propositions as to what art may be: its essential nature was therefore conceptual [11]. The products of this "analytical" art are objects such as Kosuth's Art as Idea series (1966-8), consisting of photographed dictionary definitions. Conceptual and technological art were born in the same period, but they have often been considered as two rigidly separated practices. While conceptual investigations into networks of meaning and structures of knowledge emphasized the traditional value of art objects, art and technology experiments have been interpreted as diametrically opposed to hardware art [12]. At first glance and in relation to conceptual art, technological art and robotic creatures seem to represent the exact opposite of the conceptual process: they manifestly express the materiality and spectacle of the mechanical apparatus. In the same way, conceptual artist Sol Lewitt, in his "Paragraphs of Conceptual Art" (1967) illustrates conflicts of conceptual versus technological art, warning that "new materials are one of the great afflictions of contemporary art. (…) [since they make] the physicality of the materials so important that it becomes the idea of the work (another kind of expressionism)". [14] As a matter of fact, relations between the two are more subtle. As one of the first critics exploring relations between art and technology, Jack Burnham questions these assumptions in his 1970 essay "Alice's Head" [15]: he suggests that conceptual art was actually linked to the traditional materiality associated with art objects. On the other hand, he claimed that art and technology may be an "attempt to produce aesthetic sensations without the intervening 'object". He curated the technology-related Software exposition, which included works by conceptual artists such as Les Levine, Hans Haacke and Joseph Kosuth. Photo-Electric Viewer-Programmed Coordinate System (1966–1968), by conceptual artist Hans Haacke, is an example of how technology was exploited as a means to enable art to become a responsive system that "merges with the environment in a relationship that is better understood as a 'system' of interdependent processes" [16]: interaction and its consequences, together with an auto-reflexive attitude, constitute the common ground between conceptual art and art and technology. In these new works, the object is but one of the terms in the newer aesthetics that include the spectator, aware of him-or-herself existing in the same space as the work, and aware of establishing relationships with it.

D. Interaction

Cultural trends began to steer art theory and practice towards concepts of interaction and perception at the end of the 50's. In 1957 Duchamp delivered an key lecture, The Creative Act, in which he argued that "the work of art is not performed by the artist alone" [17], since "ce sont les regardeurs qui font les tableaux" [18]: it was the dismissal of the Modernist conception of the art object's internal self-sufficiency in favour of a sense of its dependence on contingent, external factors such as audience participation. In parallel, in 50's in America, another aesthetic revolution took place about Art as [19]. At this time, John Dewey claimed that art production and fruition is about experiences displaying unique plots, inceptions, conclusions, movements and rhythmic features, and entailing artistic production with perception. His influence on Abstract Expressionism was crucial [20] [21], and in general on all the following art trends, even if Dewey showed little interest in the avant-garde art of his time. One decade later and around the same time the Senster was built, Jack Burnham wrote *Beyond Modern Sculpture [22]*. This work was explicit about how much interaction and perception are entangled to technology-based art. *Beyond Modern Sculpture* predicts the rise of an aesthetic of artificial intelligence. Burnham wrote that "the computer's most profound aesthetic implication is that we are being forced to dismiss the classical view of art and reality which insists that man stand outside of reality in order to observe it… The notion that art can be separated from its everyday environment is a cultural fixation… It may be that the computer will negate the need for such illusion by fusing both observer and observed, 'inside' and outside [23]. Since then, "interactivity" has become hype and fashionable in almost every domain of society: interactivity is proposed as a key topic in a growing number of pubic discourses, from marketing to entertainment and education.
In a McLuhanist sense, this trend has been anticipated and mirrored by art and developed through the years of

minimalism and fully blossoming with technological art. Fried's case brought into focus some deeper features of the "pre-interaction" work/viewer relation, such as the focus on the space of the work and the viewer's place in it. Minimalist elementary parameters of relation with the art work then evolved by means of technological art towards technological art dispositive [24], designing specific and complex ways in which to implicate the spectator, and exploring different relational styles and nuances. Robotic and installation art pieces are often activated only when someone physically enters into the space of the work and interacts with it.

E. Anthropomorphism

Anthropomorphism is a key concept for creating work/viewer relations. This term comes from the theoretical production of Judd, and he associates it with the "part-bypart" and relational character of most sculpture: "A beam thrusts; a piece of iron follows a gesture; together they form a naturalistic and anthropomorphic image. The space corresponds" [25]. Unsurprisingly, Fried saw this attribute as negative, stating that this kind of "hidden naturalism, indeed anthropomorphism, lies at the core of literalist theory and practice" [26]. Again, anthropomorphisation is to be biased for giving rise to a subtle relation linking spectator and object, since the work "depends on the beholder, is incomplete without him, it has been waiting for him. And once he is in the room the work refuses, obstinately, to let him alone – which is to say, it refuses to stop confronting him, distancing him, isolating him" [27] This use of intentional verbs is very interesting: indeed, being confronted with a literalist object "is not entirely unlike [being] distanced, or crowded, by the silence presence of another person" [28]. In literalist art, the impression of being confronted by a "person" is identified in the size of the work (not too big, or it would become a monument) nor too small (it would become an object) as Tony Smiths claims about his six-foot cube, "Die". The link between anthropomorphism and interaction, absent in most video and installation art, is powerfully re-enacted in robotic art, producing artificial life creatures. As Burnham foretold, technological art continued the trajectory of anthropomorphism in Western art, since "living" artwork inherited – simulating behaviour – the role of works that only mimic the living creatures' external appearance.

III. AN ANTHOLOGY OF ARTISTIC ROBOTS

Technological-based art can not be grouped in a vast, indistinct category. Experimentations in a still raw area of technology can last a few years without leaving significant traces, or give birth to a body of artistic work and commentary. In general, a critical view on techno-art is difficult since these kinds of practices are a moving target: experimental artworks created a few years ago can become obsolescent and archaic, and a complete survey necessarily includes continuous updates about technological and artistic state-of-the arts and new trends. Art practices such as robotic art oscillate between the two poles of continuous experimentation and analytic tradition. Like the other fields of technological art, one of the most problematic issues of robotic art is the definition of the medium. Indeed, robots are an assemblage of mythological and folkloristic traditions, popular science-fiction imagery, often detached by the operational definition of robots as found in scientific research and industrial applications. Indeed, popular imagery and research agendas influence - but do not coincide with - artistic trends. Up to date, the theoretical framework that has been applied to robotic art has been the chronological outline proposed by Eduardo Kac [3]. In this second section, without the pretention of establishing a new framework of analysis, I will further explore an anthology of robotic artworks by the light of the previous section.

A. Robot and theatre – actor robots, puppet robots

Robots, being surrogates of individuals, are inherently theatrical: the word "robot" itself derives from theatre and appeared for the first time in the play R.U.R. (Rossum´s Universal Robots) by Czech writer Karel Čapek. The concept itself, a transposition of the Golem legend into a modern form, addresses the mechanisation of man in the age of industrialisation: "I was thinking about an expression that would refer to humans capable of work but not of thinking" [29]. The cultural "ancestors" of robots, the anthropomorphic automatons, were machines designed to astonish the public with their virtuosity, mimicking some human competence without a pragmatic function, such as The Writer, The Draftsman and The Musician by Pierre and Henri Louis Jacquet- Droz [30]. Some robotic artworks are explicit in their relation with the theatre: such is the case with the production of Louis Philippe Demers. This artist, with a background in robotics and theatre lighting, brings robots on stage and into public spaces. One of his most representative works, designed in collaboration with Bill Vorn, is Le Procès (after Kafka). The aim of this robotic play is to stage the relation men-machine within the framework-metaphor of the trial. The theatrical performance stages exclusively robotic actors performing as a reflexive tribunal "where identities intermix, where judges, jurors, victims and accused, take flesh in metal creatures born from our own conception of the world, of what is good and what is bad, of what is alive and what is not" [31]. The protagonists are different "families" of robots, The Swinging Machines, the backing Machines and the Main Act Machine. They Swinging Machines are frenzied robotic arms hanging from the ceiling and behaving "like hopeless puppets"; the Backing Machines accompanies the "main act machine", and they are contained in frames that are attached to the moving catwalks, as they were caged. While they are trapped in their cages, they are animated by spasms and rapid. The Main Act Machine is the main character and the most complex robot of the group, acting with 9 degree of freedom. Still, in the theatrical dimension, robots share their ontological status more with puppets than with actors. Their common characteristic is the "inescapable tension" that Steve Tillis identifies as being between the

material object itself and the object as "signifier of life" [32], setting up a conflict between the puppet as object and the puppet as life. Indeed, a marionette elicits a double point of view on the spectator: it is indeed an object but one onto which the viewer projects her own emotions. When attending a puppet show, the spectator is drawn, little by little, towards increasing her suspension of disbelief, finally granting the puppet the status of an actor.

Besides robotics, a proliferation of puppetry imagery has been blossoming in contemporary art. It takes, as its historic point of departure, Alfred Jarry's 1896 puppet play "Ubu Roi". Later, other puppets were featured in works from international well-established artists. Cohen [33] identifies a first wave of puppet imagery appearing in avant-garde art coinciding with the Western appropriation of masks and other artefacts from exotic culture and folk art. He specifically refers to the Bauhaus and Futurist artists Jan Toorop and Paul Klee who created abstract puppet spectacles using geometric figures. In this period Picasso, Cocteau, Calder created mobile sculptures and puppets; Joan Mirò designed an experimental puppet show, Death to the Bogeyman (Mori el Merma, 1978), with monstrous painted body puppets drawn from Ubu Roi. Where dose this artistic interest in puppetry stem from? Puppets challenge the audience's understanding of object and life, and question a complex relation with 'acting, non-living beings'. This issue is crucial to our technology oriented society. Indeed, studies demonstrate that our relationship with machines is both natural and social, and our brain mechanisms evoke empathy, trust, uncanniness, etc. towards an assembly of circuits or mechanical pieces. A technological object can suspend our disbelief, just as would a literary character, or indeed a puppet; moreover, we project our feelings and attachment more and more on virtual worlds, and we became operators of many "online" puppets that represent ourselves or others in the digital realm. Robots, like puppets, are an example of the ontological paradox that can take place in our technology saturated environment, as entities simultaneously "occluding" and exposing their artificiality.

B. East Meets West

Puppets display their "objecthood" both by means of their form and exposure of the actor operating it. Such an exposure – the enactment of the "animate versus inanimate" contradiction – is something highly meaningful to puppet theatre: it is generally provocative to Westerners (but it is even said that, among a tribe of Nigeria, if the means behind the puppets' control is exposed to the audience, the operator must pay with his life. It is rather not relevant in the East, in Ta'ziyeh and Kabuki theatre [34]. Japanese culture has an alternative vision on categories of 'aliveness'; such an attitude is generally ascribed to Shinto tradition, an animistic religion in which deities are frequently associated with animals or things which serve as incarnations or messengers of spirits [35]. In Shinto, natural phenomena, animals objects can be worshipped as *kami* – a category which encompasses

different concepts and qualities (indeed, even within Shinto, there are no clearly defined criteria for what should or should not be considered as *kami*). *Kami* includes ancestral spirits, men of virtue, guardian spirits of the land, occupations, and skills; all things organic and inorganic. The Shinto animistic attitude increases the scope of what can be perceived to be "alive", and blurs the distinction among human, animal and machines: this implies that Japanese society generally has a more positive attitude towards robots - while western culture is preoccupied with robots harming humans and rebelling, Japanese robots are generally keen to help and protect humanity. Just as for robots, the effects of this attitude can be traced also from puppet tradition. For instance, until the late nineteenth century, puppets were not thrown away or recycled, but buried in cemeteries, this practice indicates that puppets were culturally perceived as living entities, suggesting "an awareness that while matter and spirit may appear to be separate orders, once spirit has encountered a material form, the latter cannot return to mere matter set apart. A dilapidated puppet - a head, arms, perhaps a costume, rattles, flutes, masks - will never again be merely a sum of parts. Today, they are put in museums or glass cases a practice that worries many older puppeteers" [36].

The fact that more artists use robotic as a medium in the Western world then in Japan can seem paradoxical. Actually, the approach to robotic creation is quite different in the two cultures. While Western artists have essentially been concerned with the design of behaviours and emotion triggering, Eastern artists have inclined to use the robotic medium as a tool to produce art. One of the first works that can be defined as robotic art was designed by Japanese Gutai artist Akira Kanayama, an electromechanical device that enabled him to create inch painting, distancing the hand of the artist from the work [37]. In one of the few established robotic art exhibitions, ArtBots, featuring robotic artworks (established in 2002) [38], only one Japanese author has been exhibiting a work, Koichiro Mori with *gossamer-1*, a painting installation with a robot generating abstract painting automatically and simulating Jackson's Pollock action painting. It may be that the different attitude noted by Kusahara is responsible of this approach; while the Japanese concepts of distinction animal/man/machine is not crucial, Westerners continuously define themselves in comparison and in contrast with the machine and the animal. Western art helps us to reflect and elaborate upon these issues.

C. Robots in the World: an Artistic Discourse on Technology

In this sense, robotic artists with their work have been questioning our perception of science and technology as well as its influence on society, staging robots in typical human analogies and situations. Robotic art in this regard can be defined as conceptual, since it embodies a self-reflexive and meta-critical process, challenging both conventional scientific and art-related concepts (such as aesthetic categories or functions). In the west, robotic art has developed a cultural discourse inclined towards

humanization of technology, by operating a sort of ironic resistance and cultural commentary and, at the same time, establishing a link with it. Even though scientists and technologists may give heed to the context of their funding or research agendas, artists are much more likely to deeply explore the cultural context underlying the research activities. What really unifies these heterogeneous practices is the artistic will to change the perspective, give another function and exposing and commenting the cultural underpinning of technology, often in a humorous and troubling way. Robots as part of the surveillance power tructure are deconstructed by Critical Art Ensemble via "Contestational Robotics" [39], seeking to develop robots to serve as resistance forces, such as robot pamphleteers that can safely counter the police robots or graffiti robots. In the same way, the artists using kinetics have been creating mechanical installations pursuing cultural agendas unaddressed by mainstream industrial applications, or devices devoted to conceptual explorations rather then utility. Possible mistakes and the "unpredictability" of the machine is one of the main features of the Survival Research Lab (SRL) work. The SRL push things far from equilibrium, to that point of unpredictability: "you don't know whether these machines are going to attack the audience; the question in everybody's mind is, "Hey, are these guys really in control"? [40]. Bill Vorn too investigates the same concept area by ideating machines that are not "clean" in the technological way. In Vorn's "Court of Miracles", a "universe of faked realities loaded with pain and groan (…) induce empathy in the viewer towards these characters which are solely articulated metallic structures" [41]. Infused with irony, the "Helpless Robot" by Norman White embodies the principle of deconstruction, being an artificial personality that responds to the behaviour of humans "pushing her", as she requests, by using its electronic voice which speaks a total of 512 phrases. The speech depends on its present and past experience of "emotions" (how hard and quick she has been pulled) ranging from frustration and boredom to arrogance [42]. Failures and mistakes are factors that both in the West and the East appear as crucial in conveying emotion and believability: the 'Yumihiki Doji' (archer doll), one of the masterpieces of Edo mechanisms' art, picks up an arrow and shoots it at a target. One out of ten times, the mechanism is designed for the arrow to miss the target, to create an element of suspense and believability for the audience [43]. Unpredictability and irregularity are very often part of artistic robots' behaviour, and this could be an important factor in eliciting those feelings stimulated by the perception of biological motion. One of the most representative projects in this regard is "Petit Mal", an artwork by Australian artist Simon Penny, explicitly attempting to explore autonomous behaviour as a probe of emotion, expression, and believability. "Petit Mal" (an epileptic condition, a lapse of consciousness), displays an unpredictable behaviour and is not only an artistic exploration of a medium's potential but also an act of humour on the typical conventional idea of control in robotics: the device is "anti-optimized" to induce the maximum level of personality. Thanks to its sensors, Penny's "Petit Mal" senses and explores architectural space, reacting to people in its environment. Its form and behaviour are neither anthropomorphic nor zoomorphic, but it is clearly perceived as a living creature by observers interacting with it, since they never gain complete control over the system (as in traditional man/machine interaction). This "reactive" model is a communication scheme which is closer to the relationship between living organisms and their environment if compared to the common interactive model where the system is waiting for an input from the user in order to react. In a reactive context proper to autonomous systems, the objects react on their own "will", by themselves, and without the required presence of viewers, communicating a personality through motion [44].

Robotic art has been linked with Artificial Life (AL), both with regard to techniques and theoretical thinking since the naissance of this field, AL is the study of artificial systems that exhibit behaviour characteristic of natural living systems with a bottom-up approach, in contrast with the classical AI (Artificial Intelligence) top-down approach. Robotic artworks can thus be defined as A-Life sculptures, or, as in the work of Yves Klein, "living sculptures". These works integrate organic forms with complex interactions guided by neural network programming. The process of creating a "living sculpture" involves developing technologies for gesture, locomotion, sensory input, and behaviour to achieve a unified sculpture. For instance, Octofungi is an eight-sided polyurethane sculpture that uses a neural network to integrate current events via multiple sensors and shape-metal alloy for silent, nonlinear motion. In this case, motion provided to the robotic creatures is specific to biological forms: "chain reactions, propagation and aggregation behaviour, herds and swarms" [45]. The same interest for biologically specific motion is to be found in Flock by Ken Rinaldo. The Flock consists of an assemblage of hanging robotic arms that interact with one another and with viewers, to manifest a "flocking" behaviour that develops from an awareness of each other and the environment. The artworks' behaviour is analogous to the flocking found in natural groups such as birds, schooling fish, or flying bats. Flocking behaviours demonstrate characteristics of supra-organization, of a series of animals or artificial life forms that act as one. They are complex interdependent interactions which require individual members to be aware of their position in relation to others. Jack Burnham argued [46] that since mimesis (the imitative representation of nature and human behaviour in art and literature) has always been the concern of sculpture, from the caveman to early modernism, it could be said that anthropomorphic robotics is the successor of the sculptural tradition, and that automata from the 18th century are significant predecessors of this phenomenon. From this perspective, minimalist/literalist art can be seen in this framework: literalists have, for the first time, delivering anthropomorphic and mimetic content in their works, not by means of representing life in a human form, rather by simulating the feeling of presence and interaction (minimalists work are a kind of statue; a surrogate person).

We could argue that the attempt of robotic art is, in this approach, to simulate appearance of life by means of behaviour, motion and interaction. As Woody Vasulka, sculptor and electronic media artist, says, "at a basic level, traditional sculpture and Artificial Intelligence have similar goals: the simulation of the human".

IV. CONCLUSION

While traditional categories of beauty and harmony or modernist "presentness" are not applicable to it, (as it is the case for the most of contemporary aesthetic experiences) robotic art addresses questions on how we view, perceive and interact with art.

Specifically, robots, puppets, and "things" crossing category boundaries, question what we perceive as "life". They suggest that there is no such a thing as a discrete gap in our perception between animate creatures and inanimate objects, rather a continuous category. Moreover, in their paradoxical status of quasi-living entities, they are agents of cognitive dissonance, addressing the ambiguities of our perceptions and confronting us with stimuli that we "know" are deceptive or fictional, but accept as "true" or "real", operating a "suspension of disbelief". From a McLuhanist perspective, these works are paving the way to a time where we will have to interact more and more with artificial creatures, in a technological world in which emotion and its affect will have an increasing prominent role in technological artefacts [48]. In the future we will probably interact more and more with objects crossing category boundaries, as the borders between artificial and organic will be less and less clear. Both in terms of theory and practices, interaction between art, science and technology can help stimulate a new way of feeling and thinking not achievable through purely rational inquiry.

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