

Time, Space and Agency: A Dynamical  
Approach to Narrative in New-Media Artwork

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*This work is dedicated to the memory of my father, without your presence I would not have even started, without your constant presence in my life through your memory I would not have been able to finish.*

*I would also like to express my gratitude to my family and especially to my mother, my brother and my grandmother for their constant support that allowed this research project to be completed even under the most difficult circumstances.*

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### **Abstract**

This thesis proposes a dynamical approach to narrative creation as found in the so-called new-media art field. It focuses on catastrophic models in order to conceptualise, analyse, and create narrative forms with multiple media and diverse formats. It deals with the transmedial nature of story and the phenomena that make it so. In that respect it treats narrative as a basic mechanism for understanding the real world and communicate meaningful artistic forms. The dynamical models proposed here are applied on current and long-standing narrative inquiries by the author, and their effectiveness in constructing multimedia narratives is investigated. The results are presented in the practical aspect of this research which focuses mainly on using the proposed modelling narrative techniques in order to compose and effectively communicate, through contemporary art practices and the use of 3D game engine platforms, narrative forms framed in the new-media art field.

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**Part I**

# **Introduction**

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# 1 Opening Statement

The present thesis is part of a research project concerned with the investigation of narrative complexity as established in new-media contemporary works of art. It proposes a conceptual and technological framework – informed by cognitive grammars and dynamical approaches to natural language analysis – for modelling the composition and analysis of media-based artworks. Since this venture requires identifying possible uses of narrative for analysis and composition of contemporary artwork – narrative as a strategy that is – this could raise questions as to the reasons narrative has made its way in a subject as such, and not a strictly literary one. The answer to this question is a current and ongoing research trend in social sciences, linguistics, logic, and even art, and is reflected on the significant impact narrative has made in these fields the last few decades. In the words of Brian Schiff,

[A]t the current moment there is a tremendous cross-disciplinary interest in the narrative concept. Narrative is a hot topic. It seems to be everywhere. (Schiff:2012, 33).

Emphatic statements concerning narrative may often be found in numerous works in the literature, as in the introduction of *Narratology in the Age of Cross-Disciplinary Narrative Research* by Heinen and Sommer (Heinen and Sommer, 2009), "narrative is everywhere...seems to be a kind of vortex around which other discourses orbit in ever closer proximity". Nevertheless this situation *fuzzified* the use of the term narrative and along with "widespread use of the term 'narrative' across different disciplines" came "ongoing debates on what that term might actually mean." (Page:2015)

It remains true though that the primary interest for a 'turn'<sup>1</sup> like this, re-

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<sup>1</sup>This is in fact a double 'turn'. It concerns the 'turn' of human sciences research towards narrative as a model for communication strategy, a modelling approach and an analysis

flects a fundamental understanding in narrative studies, that even outside the scope of literature and language-based activities, narrative may have a substantial research and analysis function<sup>2</sup>. If in its most common form we accept narrative as a modality of language, then its structural and systemic qualities may be approached.

This attempt is founded upon the basic assumption of structuralism, namely that the meaning-effects of language, particular apprehended meanings that occur in human affairs, are not simply intuited in some ‘mysterious’ way, but are generated and apprehended by means of a systematic ‘unconscious activity of the mind’ — or systematic activities — susceptible to scientific analysis and ‘accounting.’ Such systematic activities employ a basic system of relations — relations of contrariety, contradiction, and presupposition — which, like relationships, create the simultaneous possibilities of contrast and combination. (Schleifer:2017, 07)

The present scrutinies of narrative studies with new-media and technologies required expanding the investigation and adopting a view of art poetics as based upon elemental anthropogenic activities, and entailed examining their manifestations in different domains. This approach primarily places this research quest to a great extent as a project in audio-visual signification.

Multidisciplinary (in correspondence to the multimodal nature of the object of study) allowed ‘fresh’ narratological deductions which could potentially

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method, and it is strongly coupled with a paradigm shift in narratological studies towards cognitive sciences as reflected in the theorisations of cognitive narratology. The main trait of these shifts is the admission that a conceptual structure underlying language and narrative may account for their compatibilities with action and perception. The classical thesis of the autonomy of syntax is challenged under the cognitive prism and the inseparability of meaning and grammars, and the primacy of semantic to linguistic structures is declared.

<sup>2</sup>An important analysis function of narrative, for instance, is giving an anthropocentric façade in faceless entities such as information. In a broader sense it has a primary communicative role for anything concerning human conventions in general.

inform contemporary art creation practices to emerge.

The subject of study in its core, regarded a concrete, everyday, and common (yet not trivial) phenomenon. This phenomenon concerned the manifestations and form of natural languages in relation to their structural qualities, accounting for the form and nature of meaning entailed in them. Particularly, the questions concerned how limited numbers of paradigms and syntactical operations may infinitely be expressed meaningfully, and may express meaning during discourse. A satisfying explanation to such a fundamental question was considered a valid initial quest in order to investigate similar mappings with different semiotic artifacts such as the audio-visual object.

Extending the previous question, to account for the type of meaning contained in narrative and language, it must be asked how expressed meaning may be grounded (paradigmatically) in reality, given its potentially infinite generativity in order for meaning to appear pragmatic (a predication on objectified reality). An aspect of this direction is not explicitly focusing on the relations between narrative meaning and its external references, but dealing also with the intrinsic sentential meaning of narrative compositions. In other words provides also for the linguistic and narratological meaning, and in such ways that formal, algebra-like symbolic theories may not.

It has been expressed that, in natural languages a speaker may potentially generate infinite and continuous discursive forms, given only a particular number of basic elements. It is also possible to fill in the gaps of the discursive act—regardless of the infinite potentiality of the generative process—in order to formulate meaning and meaningful production of discourse (Greimas, 1979, 1987).

These questions, appeared similar to this author's own personal concerns as composer in relation to new-media artwork creation, and early in the research

it was decided to include these deep, abstract, and fundamental notions within a heuristic approach.

The paths that have been traced during this research project, conclusively appear to steer modern technological and theoretical progress towards a trend for the mathematisation and, ultimately, naturalisation of the models and analytic theories describing certain perceptual and cognitive phenomena. The primary focus in this project has been on the naturalisation of theories in humanities, cognitive, and social studies, in which art and art expression represent a singularity.

The initially formal and algebraic nature of models<sup>3</sup> has intensely been the subject of critique by researchers in the last couple of decades, for their efficiency and degree of analytic "objectiveness", even validity, in the analysis of natural and conventional systems and processes, generally described by more complex mathematical approaches. To this day, such advancements established these naturalised frameworks as being more efficient in describing tangible and intangible aspects of reality and phenomena, thus became suitable candidates for further study. Nevertheless, attempts to reach formalised models capable of describing the natural processes, if anything, provided potentially important insights and directions for current and future research.

The most abstracted elements subjected to the research quest, do not deviate from the subject of inquiries of a whole tradition and school of thought, dominant in such areas as biology, language, arts, social sciences, and mathematics, and labelled as structuralism. These components concern the investigation of form, structure and their evolution. Inevitably whichever direction is taken towards an attempt at the explication of form and structure, will concern themselves with one of the fields or sub-fields of structuralism. In that

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<sup>3</sup>The problem with formal models is the exclusion in their rationale, of the complexities arising from the multimodal and cross-modal nature of the phenomena they aspire to model.

respect theoretical, artistic investigations of any kind, narrative research into any medium – and combination of them, ultimately arrives at a persistent initial axiomatic threefold question from which to proceed: *what is form, how do we describe its structure, and how does it evolve through time?*

The above may be considered more than just a subject for study, an aphorism not to be deflected when dealing with artwork creation of any form and type.

Before outlining specific landmarks in the structuralist tradition critical to the study of form and its analysis, the reader is invited to embrace a more comprehensive view of narrative. The object of study entails a broader narratological investigation, one accounting for aspects of a narrative that is transferable (with each retelling) from one medium to another, and treats those aspects in terms of their manifestation in different media. Thus, it prompts consideration of the narrative elements and narrativity outside the scope of the literary subject, and constitute the cognitive narrative act of identifying "reportable stories", as Ryan describes it, extended into domains other than the strictly language-based ones.

It is of great significance in the process of conceptualising narrative within a broader scope that, its manifestations be constitutionalised in equivalence to their deep case abstractions. This entails backward-tracing the transformational operations during textualisation (and discoursivisation ), and the identifying of the syntagmatisation and modalisation of content, which occurs, through the distribution of actantial roles, resulting in surface semantically invested manifested forms (figures)<sup>4</sup>.

An example may refer to a classic scene found in *Hollywood* movies. A scene, for instance, describing the protagonist (subject) kissing their partner (object of desire), may be presented neutralised, in the form of an acquirement of an

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<sup>4</sup>In the structuralist tradition this is referred to as the projection of the paradigmatic axis onto the syntagmatic here the reversal of the process is described.

object of desire by an actant. At the same time the object of desire is deprived of another actant, its antagonist. The current situation is one of a conflict of states, seen as a polemical structure. This structure is the recreation of the situation in the form of desires (modalities), actions, operations, and relations between abstract entities executing conflicting programs. This view provides the seed for a type of functional analysis of complex forms and breaks down perplexified scenic content into elemental logico-semantic relational structures among semes, constituents of basic semic categories. The protagonist then may appear as an embodiment of good, and the antagonist of evil, while the conflict between them as the primary conflict between good and evil. The object of desire appears as a veridication of this process of categorical deduction. It is important to note that actants are abstract logico-semantic entities that act (or acted upon) and are not necessarily human agents, but appear in narratives also in the form of a place, a situation, a contradicting force etc. The process in reverse presents as a composition of complex narrative objects (objects of complex meaning effect), starting this time from the basic abstract semic categories, and allow their constituents to complexify and manifest, after investments, into surface forms that explicitly reference perceived reality.

Nevertheless this attainment is not the final goal for the research, since the above descriptions reveal not much in terms of the dynamic capacities of the abstract scenic structure, only its static parts. As a result the deductions concerning its form's evolutions are purely based upon symbolic attributions arbitrarily assigned to its morphological components through presuppositions. The study of dynamical systems on the contrary suggests descriptions for both a structure's static and kinematic character. Inserted in the studies of narratives, provides significant insights allowing for analysis, prediction, and modelling, and offers a dynamical ever-evolving structuration. Another trait of the elementary

dynamical analysis is that it is local, meaning its models possess an organising center, and may provide for local interpretations of universal application, since the global dynamics may be analysed locally around the organising center.

Broadening the scope of narrative outside its language-based functions and modalities creates space in its entirety to acquire beneficial contributions from other disciplines and practices, (including art, information science, anthropology, and mathematics) and *vice versa*. This system of shared values and reciprocally reinforced statures could only benefit research amongst the different disciplines, as has happened in linguistics and literary-based fields.

On the one hand, this approach would make the operation of outlining a relationship between art and narrative appear more natural and instinctive, aiding the establishment of areas where the two intertwine. On the other, merits from the extensive research concerning the implications of the double articulation of natural language are applied; they could establish some sort of artwork poetics informed from years of linguistic, narrative and cognitive research. The first articulation deals with the semiotics of language and the second with its discursive constitution. Together they materialise in syntax and phonology.

The development of the thesis establishes this inquiry as vital in determining a relationship between the form of content and the form of the message<sup>5</sup> (communicated content); it ultimately determines stratifications resulting in attributed symbolic transformations that are regulated by this mapping process and presents the dynamics and evolution of their form.

## 1.1 The Purpose and Scope of this Study

The main aspiration of the current research is to establish a framework of practice for the naturalisation of the phenomenology of art-forms (e.g. visual, sonic,

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<sup>5</sup>The main issue here is accounting for the emergent complexities from the cross-modal and multimodal nature of the interactions during communicative practices.



linguistic), as they materialise in the contemporary new-media art field. By naturalisation , it is suggested the presentation and description of the emerging phenomena during the conceptualisation , creation, and interpretation of an artwork, as natural phenomena, and therefore, rendering them subjects to mathematical descriptions. This sanctions the development of methods for composition and reception strategies informed by the morphodynamical profiles of the manifested forms, while the study of their morphologies may reveal the operational apparatus that brought them forth comprehensively. A mathematical framework appropriate for this type of mathematical modelling, is Catastrophe Theory (*CT*) and the description of Elementary Catastrophes (*EC*) as topologies of its morphological archetypes. The purpose of this naturalisation , is to provide for a theoretical and practical understanding of the link between perception and syntax as they may correspond and apply, as notions, to new-media artwork, covering in a homogenous fashion the composition and reception sides.

The output of the analysis with the proposed framework is the input to computer simulation, mainly using 3d visualisation with modified versions of 3d game engine platforms, real-time digital signal processing (*dsp*) and statistical techniques. The real-time findings of the computer simulation are, in turn, used as narrative operators and arrange, as well as, control the narratives' evolution in real-time.

The narrative models found here, are primarily derived from the catastrophised interpretation of Greimas' semiotic square and of imagistic cognitive linguistic models, perceived here as the square's cognitive modelling evolution (such as Fillmore's *case scenes* and Talmy's *force dynamics*). They act not only as scenic operators and arrangers, but also as facilitators of the deep semantic narrative components.

The methods proposed, call for a narrative understanding of the artworks,

in a comprehensive sense, that describes their morphological and syntactical components, accounts for their multimedia nature, and designates their modal identity. These assessments, may then constitute a narrative substance embodying the structured forms of content. These forms may appear as perceptual, structural, semantic, cognitive, and pragmatic in their nature, and may evoke an embodied understanding of the artwork experience; thus, they may be perceived as meaning-effect forms of semio-narrative structures, in the sense of Greimas' work. The main endeavour is to present conceptual and mathematical models of the relations between the perceived manifested artistic content and the compositional syntactic operations that shape it. This way a correspondence between the routines activated in these two seemingly separate processes (composition and interpretation), is established. The establishment of a link between those, is provided by the CT models, as they afford this necessary association between surface and deep structures allowing for the analysis to take place in the same level.

Assuming a *naturalist* approach to study the structures under investigation admits that structural phenomena, too, may be defined and interpreted as natural phenomena. Thus, the current work embraces a *dynamical structuralist* stance for the descriptions of the multimedia, narrative arrangements. The research method involved extracting explicit information concerning the morphological nature of the narrative forms under scrutiny, using the mathematical models from morphodynamics, that facilitated their categorisation in a *non-symbolic* fashion. They were arranged, into related syntactic frames and scripts, that translated into symbolic syntactic structures, providing a distinguishable connection between the morphological and the symbolic narrative components. The *morphodynamical* models used in this research, have previously been applied to structural phonetics, categorical perception, and visual

perception (Thom:1975, Petitot: 1992), and also, to structural syntax and structural semiotics (Brandt: 2010, Wildgen:1982). There is a provocation to this paradigm, entailed in the idea that abstract structures of meaning may be natural structures available to their modelling as a type of physical and biological phenomena, and in turn provide a “physics of meaning” (Petitot:2011). The naturalisation of semio-narrative multimedia constructions as encountered in the current research context, requires an appropriate type of gestaltic comprehension of them, and may be eased by the abandonment of formal models, for their description, in favour of local reconstructions of universal character – an approach favoured in morphodynamical analysis.

In addition, these mathematical models inspire and inform a set of tools and practical implementations for the real-time analysis of content (digital signal processing modules, mainly for visual and sonic material), facilitating an enriched understanding of the artistic material in terms of the descriptions above. These tools are considered important for the shaping of the presented portfolio, since, they enable choices and predictions, through simulation, for the ways the content may be organised while accounting for its meaning-effect. In relation to the naturalist view, proposed here, the algorithms feeding the tools and computer simulations are considered the natural substrates for the catastrophic processes. The tools’ architecture as appears here, suggests a homology, in the mathematical sense, to the decoding of cognitive routines taking place during reception by a participant, enabling the simulation and prediction of the content manifestation in terms of its potential interpretations. In that sense an appropriate syntax may be articulated, that informs consistent and uniform descriptions of the double articulated content (the form of content as constituted through composition, and the form of content as manifested through communication).

Since the dynamical narrative models as described here are topological in

nature and provide geometrical explanations, they may also provide for the organisation of the scenic content, and the arrangement of narratives in spatio-temporal terms, establishing in the proposed spatio-temporal arrangement a direct morphological correspondence to the narrative's conceptual architecture and symbolic character. The practical aspect of the current research, utilises modern day 3d game engine technologies to bring to life and enable for performance such narrative constructs, that are formulated by dynamical narrative conceptualisations and structurations. Hence, the mathematical, topological narrative descriptions, are also employed for the scenic organisation of the narrative frames in a virtual environment.

The use of extended reality (*XR*), virtual production and 3d spatial audio processing, along with the generative catastrophic organisation of narrative components, facilitates the syntactic arrangement of the visual, aural, as well as, the semantic narrative components, and provides for a long for mediation, at least to an extent, between the compositional space and that of the performance (which includes the recipient) – and in turn a mediation between the composer's intentions and the potential interpretations during reception.

It is considered common practice these days the use of 3d game engines for real-time 3d visualisations and artwork performance. Extensions of their functionality is possible, which can enable real-time computations to take place, rendering them not only a strong performance, but also, an analysis platform. The correlation of the scenic content arrangement to that of the narrative semantic forms entailed in the manifested content, is established conceptually through the descriptions of *case grammars*, and *imagistic* cognitive theories of meaning formation, that encompass a strong spatio-temporal component in their articulation. In addition, their computational value is reflected in their use in artificial intelligence and knowledge-based systems, where the notion of *case frames* is

considered an efficient approach for representation of encyclopaedic knowledge. This research approaches the subject in combining the conceptual paradigm of *case grammars*, with the local reconstructions the dynamical systems analysis proposes. In that sense each composition is conceived as a micro-universe of knowledge and meaning, as it relates to its local morphodynamic components, and is stratified in terms of paths on EC topologies which are found analogue to elementary structures of forms of meaning. These paths determine the operations, the interactions, and the evolution of narrative in general, as well as, its structural profile at a given moment.

It is worth mentioning here that this approach aspires to transcend systems of semiosis, and media content; and in that sense, may be utilised as an uniform modelling method for multimedia artworks. In other words, a unified parameter space may be defined for each composition, for which the catastrophic models offer stratifications and categorise it, regardless the transmission media.

In a more general sense the descriptions above suggest an understanding of the artistic narrative objects under investigation as dissipative structures. Structures that are open (even if they are stable), interact with their environment, are far from equilibrium and evolve in patterns as the result of self-organisation and environmental influence.

The employed analytical methodology in the present research relies strongly upon the work of Jean Petitot and his studies on analysis of morphodynamics in image and perception (Petitot:2011). The basic scope of Petitot's work is to provide a relation between syntax and perception, and the primary conclusions of his studies sum up to the following:

[S]yntax is to perception what algebraic topology is to differentiable manifolds. (Petitot:2011, 11)

This conclusion entails the methodology that demystifies the relation between

syntactical operations and the resulting perceived manifestations. Algebraic topology makes explicit observations on differentiable manifolds and provides a basic categorisation for them, based on abstract invariants in their morphologies. In other words, it studies the qualitative properties of geometrical configurations that remain invariant under transformations and continuous mappings – it provides methods to study invariance. These invariants can be rearranged and reconsidered as syntactic constituent-structures in the words of Petitot (2011). This research investigates the artistic multimedia forms, including the conceptual forms that shape their ‘material’ manifestations, and using specific mathematical processes translates them into syntactic non-symbolic programs which may be interpreted into symbolic syntactic structures. The basic mathematical operations performed provide information in terms of homotopy, meaning the investigation of the continuous transformation of one form into another, and homology i.e. the investigation of the associations between an explicit typology of forms to another (a conceptual structure to an aural structure, for instance).

The transformation of the abstract concepts presented here into a method for practical implementation, required a necessary association of cognitive notions and particularly those associated with narrativity, and signal processing processes relevant to visual and audio processing, and topological (geometrical) representations relevant to qualitative deductions in terms of structures and their dynamics. This link was found in the deductions of Jean Petitot in respect to low-level vision processing in the brain, that provided an approach to representing signal processing as both geometrical and morphological analysis.

The visual system in its nature “imposes a *geometrical format* on the signal” (Petitot:2011, 77) [*italics* in the original]. Since the signal is not a geometrical object in nature, appropriate transformations need to be employed, in order to render it susceptible to geometrical descriptions. The most significant of these

transformations, as used in the present research, concern operations of contour extraction and boundary detection, scale-space analysis (diffusion equation) for a solution to space segmentation, convexification for the reduction of space into a trivial description, non-linear diffusion processing to provide a hierarchical organisation of constituent structures, grouping operations, skeletonisation and cut locus, and modelling and propagating space through patterns formed by oscillator networks. The idea of space here refers to topological space and applies to conceptual, visual, or aural structures. While the previous processing operations on signals provide comprehensive mathematical and geometrical descriptions for the notion of an ‘object’, at the same time provide descriptions for the relations between objects and their dynamics. Cognitive imagistic theories, that entail a strong spatial component in their considerations of conceptual structures, are the decisive mediation between the geometrical explanations of the signals to the symbolic nature of the narratological resolutions of artistic forms that the current project aspires to address.

To the author’s knowledge there has not been so far, an extended corpus for the application of morphodynamical models in the field of new-media, and contemporary art practices. The present research’s primary contribution is providing a comprehensive methodology for possible applications for analysis, as well as, investigating the capacity of these mathematical classifications as programmatic and computational paradigms for synthesis. Moreover, while the use of these models in cognitive sciences and narratology is noteworthy, the analyses mostly concern classical narrative paradigms. There is not extensive use in terms of analysis and appreciation of contemporary art-forms which may be considered a singularity in the recent narratological developments. In that sense dynamical approaches to a cognitive narrative construct, as that which is admitted here, have neither been adopted, nor assessed for their effectiveness

in contemporary art expressions and the narratological paradigms expressed through them.

This is where the opening for the current research may be located, where the use of the morphodynamical analysis is applied to contemporary sonic, visual forms, and compositional paradigms, enabled by modern media settings. At the same time, contemporary questions concerning art poetics, many of cognitive nature, appear to be exactly the type of questions a dynamical proposal is equipped to answer. Catastrophic modelling has been extensively used in the current research for musical form analysis, visual form analysis, structural operations, and content classification, proposing it as a valuable modelling approach for multimedia structures. This extends the applicability of the framework outside its trivial scope and enriches its cardinal value as a modelling tool. This extension may be considered novel in the sense that it proclaims and authenticates its effectiveness in mathematically describing abstract multimedia material, and its structural organisation, in a comprehensive manner resolving the conceptual deficiencies raised in symbolic formal attempts. The narrative questions raised in the present research are an active field of investigation in a complex media scape constantly evolving. The current proposals in relation with the new available for narrative media, are mainly based on classical approaches, even considering the case frame based computational narrative models found in knowledge-based systems. In all of the previous approaches, the morphological and kinematic nature of the narrative forms and components, the structure of their parameter space in relation to these morphological and dynamic qualities, is necessarily ignored to provide for the models' consistency.



## 1.2 An Overview of the Present Volume

The interest in narrative as a method for meaning organisation culminated a ground-breaking tendency in interdisciplinary humanities studies including art. Correspondingly it appears to have a notable impact in the field of contemporary art both as a compositional approach and as an analysis method, facilitating the appreciation of the meaning-effects and signification of form as it may be manifested in present-day artworks. Conducive to presenting a comprehensive framework for a perplexing subject as such and provide for the implicated theoretical and practical investigations, the current document is divided in seven main parts each contributing a different aspect to this examination.

The current part serves as an introduction to the research question. It situates the current research in relation to present trends in humanities that are largely concerned with the cognitive aspects of narrative that render it subject to interdisciplinary research; here an outline of the link to contemporary art practices is presented. In addition the primary question of linguistic and narrative research is discussed, namely the question of a comprehensive explication of forms, their structure, and temporal evolution. This question is an elemental attainment of the structuralist tradition, a field encompassing many areas of study be it in biology, linguistics, narratology, and art. The main method of study as proposed here is based on catastrophe theoretic modelling of deep narrative components, constituting semio-narratives that are the underlying structures regulating meaning in surface manifested complex forms.

Part II, advances to a deeper examination of the ‘problem of form’ as was approached from emblematic studies in signification of the structuralist tradition. The studies are presented in such a manner that bring forth the cognitive aspects of this research, as deduced in the works of Greimas on narrativisation and elementary structures of signification, a precursor to what later came to

formulate narrative grammars. An important aspect of this research deals with the autonomy of story and its main attribute of being able to be retold, communicated, and understood under different settings and situations. Hence the deep elements of narrative structures are exposed and several basic transformations performed on them with each retelling and transposition are presented. It should be noted here that throughout this volume the term ‘storytelling’ is rarely used to refer to narrative. In that sense the act of communicating narrative is distinguished from the actual process of narrativisation responsible for the meaning that may be found in these discursive forms of narrative generated during storytelling. Focusing on the cognitive aspects in the study of deep narrative components, enables the transition to a domain of interest of recent cognitive narratological and linguistic inquiries that in several occasions may be found relevant to art studies. The main ideas approached in Part II concern imagistic views on meaning as found in communicative acts and their scenic organisation accounting for an encyclopaedic understanding of knowledge. The main apparatus for an account and an approach to understanding and modelling narrative phenomena in terms of their manifestation in contemporary art practices, that may be considered a cognitive quest, are given by the tools provided by topological mathematical research and dynamical systems analysis and their application to cognitive sciences, namely Catastrophe Theory of Rene Thom.

The dynamical approach to narrative research in terms of the mathematical tools mentioned above is the subject of Part III, which is divided in three main sections. The first presents the work Jean Petitot in providing a catastrophic explanation of semio-narrative structures. The second section presents an explanation for the catastrophisation of the case, as described by Fillmore’s case-grammars, providing a stepping stone for catastrophic modelling of cognitive domains, a descendant concept from the notion of case-frames. In the

third version a set of low level and statistical operators, complex tools for visualisation, and dynamical regulators of content are presented as implemented by the author in order to facilitate the Gestaltic bottom-up construction of a scene based on *attractor syntax* (Petitot: 2011) and morphodynamical analysis. The tools proposed are based on simulation technologies and mathematical computations relating to the processes found to dictate the formation of meaningful representations in the visual bio-cognitive system and are based on research contacted by Petitot on the subject. The application of Petitot's proposal entailed the use of simulation and computation to address space segmentation, space integration and propagation, and the formulation of attractor syntax based on dynamical regulations.

Part IV presents the practical outcome from the extensive use of the proposed theoretical and computational tools in the formulation of a series of multimedia narrative composites presented in the accompanying to this thesis portfolio named *X Short Stories*. Each of the artwork is analysed in terms of their structural properties, morphological components, their dynamical profile, and expositions are given of the compositional and performative strategies employed during their creation.

Part V is the concluding section of the current research. A review and consideration of the research outcomes is presented, as well as, the future directions that may be taken originating from the current findings.

The cited bibliography as presented in the current text is available in Part VI.

Finally Part VII presents the Appendices of this volume. The appendices additionally contain a number of multimedia material that is available for download. In the case of multimedia appendices relevant references to the link are given in the included text.

Part II

# Structuralism in Narrative and Cognition

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## 2 Narrativity in Contemporary Artworks

This thesis describes morphological and topological methods of analysis and composition of structural content formations, based on the notion of narrativity, as may be applied in the context of multimedia contemporary artworks. The methods described here have partially been the subject of analysis, or partially used for analysis in the contemporary art field of the twentieth century.

Situating narrative outside the narratological intent of treating it as a form of art and under the influence of cognitive approaches, shifts the intent of the investigations to narrative as a way of thinking and understanding (Ryan:2010). At the same time consideration of the degree of narrative realism<sup>6</sup> in adopting narrative as a tool for artwork analysis is necessary since it is dependent upon the degree of references and abstractions found at the semiotic artifacts that are projected or received as artistic objects. In that sense narrative form as a form intersects cognitive constructions found in conceptualizations to different measure and depending on context and content. Never the less this serves exactly the purpose of this research that attains to present a broad understanding of narrative form, and all it entails, as a mode of appreciation of artistic forms.

The initial motives for the initiation of a research project involving narrativity, and topological methods in contemporary forms of art, has emerged from the author's involvement in the *acousmatic* music field. Appendix 1 briefly expands this argument of narrativity in contemporary artworks and its value, by offering an overview of two acousmatic works (*L' Inconscient de la Forme* by Francois Bayle and *Spectral Lands* by Denis Smalley) and a kinetic installation (*Self-Space* by the author), and may be regarded as a reinforcement of an argument for a cognitive narrative understanding of contemporary art-forms. In Appendix 1 the composers' commentary concerning the reviewed artworks

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<sup>6</sup>Artistic narratives are not bound in describing and analysing the real world as experienced but are free to reference fictional worlds.

heavily utilises narrative terms to provide a comprehensive description of the object-forms used in the compositions, and their function in them. It is in that sense that an argument for narrative organisation found in artistic compositions allowing for artistic arrangements based on narrative logic may be initiated.

The two acousmatic compositions were chosen since the acousmatic form may be considered a competent subject to all sorts of deductions in terms of a cognitive narratological analysis. The ambiguity of these forms, along with the medium's capacity to 'carry' referential and abstracted meaning, as it may be represented in the manifestation of sonic-forms, render them strong candidates for cognitive narratological scrutinies. In the article *Narrative in Form: a Topological Study of Meaning in Transmedial Narratives* (Giannoukakis:2016), the author investigates further, as an aspect of this research enterprise, the sentiment of the *sound-image*, as presented by several authors in the field namely Francois Bayle, Trevor Wishart, John Young, and James Andean. The written works by these composers are by no means the only relevant literature in the subject, nevertheless their expositions are found by the author to concern a cognitive interpretation of sound-forms, based strongly on a deep morphological component, as this research aspires to investigate for contemporary multimedia artworks in general.

### 3 The Cognitive Dimensions of the Narrative Act

By framing narrative<sup>7</sup> as a strategy in the opening statement and for the most part in this research, the cognitive character of narrative acts is referenced, as revealed in its discursive and communicative manifestations. The modality of narrative is of ongoing concern in the field of narratological studies and aligns with the subject of inquiry of cognitive narrative semantics research. Several researchers, Marie-Laure Ryan amongst them, identify as the task of cognitive narrative research to provide descriptions for the functions and operations of the narrating mind.

In that sense narrative is conceived as a fundamental instrument of thought (Ryan: 2004), an "embryonic tendency" of the human mind to compose stories about the perceived subject, inherited in the act of perceiving (Ryan:2004, Turner in Ryan:2004). Aspiring to the *regrounding* of narratology, modern narratological pursuit aspires to the study of narrative functions as a basic tool of thinking (Herman: 2003).

This type of narratological stance is not as radical as it may at first appear. It does not detach narrative from its commonly admitted purpose. Narratology, as a project upon conception, was considered to transcend disciplines and media (Barthes:1977, 79, Bremond:1973, 12).

The above stance brings forth the question as to, which traits carry the defining narrative within this broader scope<sup>8</sup>. Alternatively, in another contex-

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<sup>7</sup>There is a transmedial sense to narrative and Rossholm's statements cover the investigations taking place in this research, "...narrative" is used in a transmedial sense throughout the essay and thus includes narrative films, theatre plays, etc.; most of the time my use of the term 'reading' should be understood in an accordingly wide and variable sense" (Rossholm:2017, 207).

<sup>8</sup>In term of the broadness of a narrative definition, I would like to supplement, with my comments in my *Organised Sound* article (Giannoukakis:2016, 261).

tualisation , the imposed constraints for a text<sup>9</sup> to be classified as a narrative text must be defined. The answer may partly be given in absolute terms, for instance, that in order to be considered narrative a text needs to be communicated, and partly in relative terms, claiming a number of distinguishable features in a text for it to be identified as narrative. The latter, suggests recognising graduality in the text's capacity to display degrees of narrativity<sup>10</sup> (Greimas:1979) under specific operations (transformations). Considering the cognitive character of narrative may result in a more inclusive definition, a synthesis, which accounts for the cognitive operations involved, as well as for the transmission media and their inherited capacity and competence to convey narrative. In turn, the investigations under the scope of a wider narrative description allows for a deeper comprehension of the possible ways through which narrative meaning is formulated in general.

Amongst the several other dispositions towards identifying universal employment of narrative as a fundamental cognitive process Jerome Bruner (Bruner:1990, 1991) identifies narrative as one of the two fundamental modes of thinking, its counterpart being the paradigmatic mode. The latter operates as a verifiable referential grounding of experience. The former deals with the anthropocentric view of experience, modalities, and actions.

The above remarks point to the involvement of fundamental cognitive routines evoking classifications, mental representations, and sequencing operations as constituents of a primary, almost intuitive narrative act. This is one of the fundamental dispositions for inquiring into narrative in a research project focusing on artwork poetics.

To the question "*what is narrative?*" Anne-Marie Soderberg (Soderberg:2003,

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<sup>9</sup>Since I am referring to cognitive narrative acts, by text I include any type of representation, regardless the medium and semiotic channel, that could trigger the narrative act on a recipient and not just language-based text.

<sup>10</sup>Narrativity is a primary subject to Greima's analyses, and one of the main traits in studying the meaning effects of language and sign systems in general.



8), similarly to Ryan's remarks, refers to the act of narrating as a "fundamental human activity, a mode of thinking and being" (*ibid.*), further claiming that is a form of organisation of our experience and memories. By telling narratives, we understand not only our own but also other people's experience (*ibid.*). She draws on Bruner's narrative descriptions (Bruner:1991), as does Ryan, to outline the five essential narrative characteristics, from the ten distinct narrative features Bruner identifies. Considering each characteristic separately, she describes them as essential yet insufficient on their own as defining narrative criteria. The five more significant characteristics for Soderberg are:

- Narratives have a chronological component, accounting for events<sup>11</sup> occurring in time;
- Narratives are interpretations of event sequences from a particular *point of view*;<sup>12</sup>
- Narratives are anthropocentric, meaning that they focus on human actions (narrator or other narrative agents)
- Narrating is part of identity-construction processes, and
- finally, narratives are co-authored by audiences, identifying narrative tellings as *social acts*.

Challenging the notion that narrative research should primary be concerned with how the narrative text is formed, Bruner (Bruner:1991, 5) defines as the critical question the investigation of its function as an instrument of the human mind for constructing reality.

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<sup>11</sup>Soderberg defines events same as Bal as "the transition from one state to another, caused or experienced by actors" (Bal:1985, 13)

<sup>12</sup>This interpretation and point of view is critical for the integration of events to a plot structure, by which the events are given meaning.

The above aligns narrative inquiries with cognitive interrogations which deal with the form of interactions in associative routines accountable for mapping content with the intangible materiality of semantic structures. The mapping occurs through a continuous trajectory constituted by symbolic (ultimately) transformations brought forth by syntactical morphisms (operations and relations). In cognitive semantics, there is a consensus that semantic units are mental constructs (Clausner and Croft:1999, 1) and constitute *symbolic meaning* – including *habitus*, by which humans constrain their primary capacity of understanding to concrete manifestations of reality. A view as such elaborates the relations between semantics and meaning with cognitive functions.

In pursuing this approach, one should "[d]escribe some of the properties of a world of 'reality' constructed according to narrative principles" (Bruner:1991). This inquiry oscillates between "[d]escribing narrative 'mental' powers and the symbolic systems of narrative discourse that make the expression of these narratives possible" (*ibid.*). Then remains the aim to show "how 'life' comes to imitate 'art' and *vice versa.*" (*ibid.*).

Bruner aspires to lay out the processes and the different ways a human being acquires "the power of narrative", meaning (according to Bruner(1990)) the ability to mark what is "culturally canonical", but also, of equal significance, to be able to "account for deviations that can be incorporated in narrative" (Bruner:1990, 68).

Notions such as Bruner's, resonate with Jakobson's *poetic function* and Langacker's *imagery*, amongst others. Views as such within the structuralist tradition and its lineage appear very similar (or, rather, homologous) in their descriptions, in that they validate the observations that evoked them (they also originate in diverse fields, e.g., narratology, phonology, and psychology amongst others).

While this part briefly builds an initial argument for narrative's primary function in the workings of human mind, a function also primary in art conceptualisation and appreciation, it appears to be a deeply complex affair. The present approach has not been formal as it does not focus on single school of thought nor following a specific 'algorithm'; rather, it is a heuristic, directed it towards the investigation of those operations mainly involved in the transpositional aspects of story amongst different media settings and retellings. The local analysis that dynamical models offer, appears an efficient set of tools for this type of heuristic approach. The author has concentrated on deep narrative elements since their abstract nature allows for different materialisations, textualisations and actualisations, and has tried to define how, after displacements and projections, these elements situate narrative content on the surface level of semiosis.

The practice of using sonic and visual material to produce meaningful performed artworks in many cases involves these transpositions as a basic tool of the composer. In addition during reception decoding these operations—from their effect on surface structures—in terms of their *meaning effects*, constitutes a determinant process for interpretation from the recipient.

### 3.1 Transmedial Transposition of Narrative

As has been implied, narrative is a structural and cognitive, a semiotic and semantic phenomenon. The fundamental reasoning behind taking up a cognitive narrative stance in the scope of this research, is to ponder a particular operation, along with its extensions, performed on narratives; it relates to their transmedial *transposability*<sup>13</sup>. Shedding light on a narrative attribute as such may facilitate

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<sup>13</sup>See *restituted notion of transposability* of semantic units in the following text. It implies the notions of constraint and *appropriated performance*, two vital *determinators* of some level operations. Since semes are constitutes of narrative units these notions seem also to dictate meaningful narrative structures. The notion of constraint refers mostly to external, historical, diachronic effects on language meaning, while the notion of appropriation involves mostly the

the investigation of the narrative components that are transferable between sign systems and media. The inquiry may be approached by studying the structural aspects of narrative, particularly in a way that allows a non static, dynamical interpretation of it as a structural phenomenon.

The adoption of a cognitive understanding of manifested narrative structural phenomena, may give the listener or reader a perspective concerning the significant perceptive shifts towards figurative and abstract forms and the symbolic references with which these shifts modulate. This predicates in some ways the translation of the structural phenomena manifested during artwork experience in terms of a narratological perspective. It seemed almost natural to treat experiencing new-media artwork in a way that allows the phenomenology of artwork interpretation<sup>14</sup> or conceptualisation appear analogous to comprehending narrative phenomena and their phenomenology. The strategy concentrated on pursuing an analysis of their structure in terms of narrative grammars: the projection of narrative form on content, manifested in narrative formations expressing tension and release, assemblages revealing important elements of a plot, deictics focalising , temporalised reciprocations, and other operational schemas. Analysing the dynamics and classifying these operations – as happens in narrative analysis – allowed for a deeper level of meaningful appreciation of a given artwork to develop and evolve during interpretation (Peircean Thirdness [Andrews:1990]).

In other words, virtual structures (enunciations) may be set in an artwork, and allow narrative to take place, and reference – on the surface level of signification – reality, to acquire its meaning (Figure 1). It may therefore be observed that in such a case, linguistic grammatical meaning operates as a ‘glue’ between

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individual.

<sup>14</sup>It is acknowledged that, as a primary trait in the act of interpreting a work of art, the establishment of intentionality from the composer is assumed. This is considered to be a determinant force, during interpretation, since the recipient is found to perform a process of modalising the content, initiating and fulfilling a fundamental narrative act.

IMMANENCE	MANIFESTATION	SEMANTIC SIGNIFICATION
<i>seme</i>	<i>lexeme</i>	<i>sememe</i>
minimal content unit	lexical manifestation	meaning signifier
(deep level)	(surface)	(polysemous)

Figure 1: Types of semantic analysis and their levels

deep level semic categories, and surface level semantically charged structures.

The transmedial transposition of narrative is of importance for all activities in the fields of the humanities and social sciences, including art appreciation. The following<sup>15</sup> describes a scape of vital concepts involved in transference operations then considers these in terms of their semiotic and semantic implications. These concepts mainly concern narrative structure and its deeper elements. The procedures that establish equivalences between fundamental syntax and surface anthropocentric narrative syntax are summarised in Appendix 2 in the notion of semiotic square by Greimas and are considered primary semiotics as described in structuralism. Yet they are the foundation for any cognitive interrogation into structures and their meaning effect.

Starting from the surface narrative level, syntactic doing<sup>16</sup> which is distilled from syntactic operations, themselves extracted from taxic (deep level) relations, provides the necessary mediation of narrative utterances, a major component

<sup>15</sup>Additional analysis of related concepts may be found in the material included in Appendix 2.

<sup>16</sup>The surface correspondence of deep level syntactic operations. If there is a disjunction, for instance, between two semes at the deep level, a narrative statement is going to be found at the surface level concerning the correspondent surface level actants manifestations of the deep semes, and describing their relationship in terms of a disjunction.

of narrative grammar. In other words, in the practical aspects of this thesis equivalences are drawn between syntactic operation and syntactic doing on the one hand, and establish correspondence between syntactic doing and a primary utterance of actantial doing, on the other.

Referring to terms such as “actant”, “object of value”, “narrative program”, “generative trajectory”, and “semio-narratives” allows for an investigation of the abstract and deep narrative components which appear to be the basic elements transferred and exchanged between different semiotic systems and signification levels. The resultant structures eventually emerge as manifestations of their content and in reference to our understanding of the real world.

Part III presents, furthermore, these basic narrative structuralisms and especially the concept of the semiotic square (Appendix 2) and its complex character as a structure of signification, under the prism of a dynamical analysis using the framework of *Catastrophe Theory* (CT), delineating their dynamical character (which, in more traditional structuralist approaches than these presented in this part, are often overlooked or omitted as a subject of analysis). Part IV demonstrates several interpretations of equivalences of these concepts, and delineates the methods applied practically in order to shape the materiality of the new-media artworks of the portfolio.

### **3.2 The Semantics of Mediality and Pragmatics of Discourse**

The two most prominent models of deep structures are those of Levi-Strauss’s and Greimas’ (Appendix 2). Their formal descriptions are different, yet both structures are based on binary oppositions. Levi-Strauss did not use the term ‘deep structure’, while Greimas recognised the common ground between these two models and states that the distinction between an ”apparent signification

of the myth, revealed in the textual narrative, and its deep meaning, paradigmatic and achronic, implies the same assumptions” (Greimas:1971, 796). For Greimas, Levi-Strauss’ model is one of deep structure capable ”in the process of syntagmatisation , of generating a surface structure corresponding roughly to the syntagmatic chain of Propp” (*ibid.*)

Uttered enunciation is the actualised counterpart formulated during the discourse. It is marked by linguistic types such as spatial deictics<sup>17</sup>, verbal forms, and evaluative qualifiers, in addition to the organisation of discourse at the level of the form of content (Greimas *et al.*:1976, 435). The critical function of uttered enunciation modalises the discourse, and outlines the narrative act (or doing); it also facilitates transformations such as actorial shifting and change of point of view. This operation is analogous to the *poetic function* (Jakobson) or the notion of *imagery* (Langacker), as will be discussed.

Greimas’ syllogisms superficially appear in such a way that steers the cynical mind to distinguish fundamental differences between the cognitive, self-generative, and self-regulatory nature of structure as found in Piaget’s descriptions and the cognitive approach of Greimas with the tendency to abstract and segregate. The imaginative mind nevertheless can acknowledge the common references and admit that Greimas,

[U]nlike the cognitive scientists, defines cognitive activity rather formally, in what he calls the abstract ”actants” of narrative discourse. These actants are defined, more or less, in terms of ”logical implication.” Yet Greimas is able to situate their meaning within the

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<sup>17</sup>1. The semiotic activity makes use of two fields: the Zeigefeld (deictic field) and the Symbolfeld (field of symbols). A third candidate, the Malfeld (field of pictorial representation) is not considered to be fundamentally relevant to natural languages (Bühler 1965: 153–4).

2. The symbolic field may be considered in isolation; *Feldmomente* (field moments), which allow the reconstruction of a whole (a sentence for example) from the set of its constituents. Bühler distinguishes two major types: Stoffhilfen (material field moments), and Wortklassen (word classes). The former open a material domain and a system of interrelations with other elements of the same domain. Thus the term ‘salad’ opens a field either of garden plants and garden activities or one of kitchens and eating (*ibid.*, 171).

complications of the semiotic square, and by so doing he is able to include within his analysis "external" (or "contiguous") cultural criteria affecting their signification. (Schleifer *et al.*:1992, 65).

Furthermore:

Greimas' semantics attempts to inscribe "content-substance" within language. Such an aim is the cognitive project of genres altogether, which attempt to articulate and classify thematic-formal aspects of literary discourse. That is, genre categories attempt what semiotics and cognitive science attempt, to articulate structures of signification, of apprehended meaning. (*ibid.*)

The counter-conviction to the arguments supporting the invariance of narrative substance during transmedial shifting operations such as those mentioned above is the advocacy – in the words of Rimmon-Kenan – that "[stories] 'lose something' in paraphrase or 'translation.'" (Rimmon-Kenan:1983, 9), and identifies the presence of subtle ways in which stories are "style-, language-, and medium-dependent." (*ibid.*). This stance reflects the core of what Herman names as antithesis the complete submission of story to the transmission medium, and its roots can be traced to Russian formalism and Todorov stating early in his research,

Meaning does not exist before being articulated and perceived . . . ; there to not exist two utterances of identical meaning if their articulation has followed a different course. (Translation from Rimmon-Kenan:1983, 9)

Herman (2004, 53) points to Rimmon-Kenan's shift of view and her assertion of the influence of medium affordances on the substance of the narrative message. In that sense,



[D]ance affords possibilities for creating iconic relations between sequences of physical movements and sequences of events in a story-world; written narrative, possibilities for creating conventional relations via utterances and gestures. (*ibid.*)

A narrative-determining force of sign-systems is described as being not only expression media but also "resources of (inter)acting." (*ibid.*)

Indeed, this is altogether a counter-movement to the structuralist assertions, viewing narratives as acts, socio-symbolic doings<sup>18</sup> in flux, due to *ecological* transactions which ultimately create as many stories as there are tellings of them.

It makes sense for the synthesis to recognise a threshold where a shift of context will be so swift that the "gist of story can be lost in a retelling, which then shades off into the telling of another narrative" (Herman:2004, 54). Further to this is the point made by Rimmon-Kenan (Rimmon-Kenan:1983, 9): that even in the situation where the story is lost, or is instead transformed into a different entity, it would still require the recipient to exhibit some competence on narrative structure, story-logic, and narrativity, in order to follow this transformation. The hypothesis for an abstract story-form seems to persist even in the most counter-intuitive environment for this argument. The synthesis view on transmediality, as an operation, is one that shapes but does not determine the story. It, rather, affects the story according to the degree of intertranslatability amongst the exchanged media. In extreme instances (for instance, the translation of a literary work into an abstract painting or its being executed as a musical composition by a symphonic orchestra) it is evident that the story's substance may be concealed by the diverse media affordances and the capacity of the medium to portray the story. Further analysis of the phenomenon

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<sup>18</sup>See *habitus*.

on content requires the identification of pointers to distinctive (and ultimately significant) features of a (not only literary) text. Certain features could signify content-related importance, while others indicate involvement-related importance<sup>19</sup>. The premise that involvement-related or content-related features may be distributed in an actualised narrative calls for an investigation into each of the media's capacity to appropriate each feature type, then make a determination on the translatability of the dominant distributions in the different media. A strategy for extending the synthesis argument according to Herman is "to examine in more detail some of the principles governing story logic, together with the parameter for their use across media" (Herman:2004, 56). Moreover, concerning story logic, he wishes:

[To] suggest that stories do not merely have but also constitute a logic, narrative being not just semiotic structures but also strategies for structuring and thereby making sense of experience—for problem solving in the broadest sense. (*ibid.*).

David Herman (Herman:2004) breaks down *story logic* into two dimensions. One represents *the logic that stories are* and the other *the logic that stories have*. It is evident from his descriptions that the former, "stories are", deals with the form of the message (elements of which are the media constraints), while the latter, "stories have", describes the form of the content conveyed in the message. These categories may describe the form of the responding communicative strategies in narrative practices, and the form of the substance contained in the narrative message – the way story is codified in a narrative.

It is useful for, "stories have" to refer once more to a notion of narrative grammar, while for "stories are" the modalisations resulting from the distribu-

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<sup>19</sup>In the field of electroacoustic music for instance this can be observed in the distinction between texture-oriented and gesture-oriented sound, and where the recipients attention is focused on the presence of either one or the other.

tion of semantically charged structures on syntactical ones (modal analysis<sup>20</sup>) need to be addressed.

Although story is transverbal, it is often claimed to be homologous (i.e., parallel in structure) to natural language and hence amenable to the type of analysis practised in linguistics. Such analysis frequently takes the form of the construction of narrative ‘grammars’, I shall borrow from such grammars the concepts of deep and surface structure, using them as organising principles... (Rimmon-Kenan:1983, 10)

Ryan (2004) investigates narrative from the point of view of a media semiotician. Although the role of media is for them to be immersive and invisible, she points out that they are not hollow containers for transmitting messages. Ryan refers to the media as encoded materiality supporting the projection of information. Furthermore, she recognises a strong dependency between the essence/substance of the transmitted information and the materiality of the media that seems to convey the projected meaning of the message. In that sense, she identifies degrees of efficiency for the medium’s ability to express the substance of the meaning conveyed in a message. Referring to the double articulation of language (and meaning) in the studies of structuralism, why the investigation of the media’s facilitating the message transmission is as crucial as the content of the message becomes apparent. It is because the media are virtually constituents of the meaning conveyed in the message, by constraining the form of the message that contains that meaning.

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<sup>20</sup>Kress presents ‘writing’ and, even more, ‘speech’ as necessarily organised by the logic of time and sequence, and ‘image’ by the logic of space and simultaneity. This is important and always needs to be considered when discussing and distinguishing modes, i.e., what are the affordances of those modes? However, we can now also be more discriminating in teasing apart rather different contributions, each of which may have different consequences not only for literacy but for analyses in general. This teasing apart will turn out to be essential for developing more incisive methodologies for analysis.

Ryan's intentions concerning the media's capacity for carrying narrativity and narrative form are from a cognitive stance quite clear. She wishes to explicate and determine narrativity across modern media and correlate the new communicative (socio-psychological) practices, with cognitive routines. She identifies that the "mental representation of a story involves various types of images (the term is taken here in the broadest possible sense, as an informational pattern stored in the mind)" (Ryan:2004, 12). She further explains that "certain aspects of narrative could be stored as words (for instance, the memorable replies of characters) [...]or as visual images (the setting, the appearance of characters, the map of the narrative world, and some striking actions and situations" (*ibid.*).

Additionally, "it is not inconceivable that moods and emotions will be associated with rhythms and melodies [...]pictures can be remembered either in visual terms or as propositions" (*ibid.*).

To conclude this part of the discussion, Ryan has made the remarkable statement that:

The cognitive representation that I call narrative could thus be the mental equivalent of a "multimedia" construct. While its logical structure is probably stored as propositions, which in turn can only be translated through language, other types of images, and consequently other "mental media", enrich the total representation in ways that remain inaccessible to language. (Ryan:2004, 12)

Once more, deductions similar to those of Ryan can be seen to emerge from earlier observations by Greimas. Describing the semantics of discourse (narrativity) he appointed meaning creation to what he named 'generative trajectory' which allows "for the weaving together of heterogeneous semiotic threads to account for meaning" (Schleifer:1987, xiii).

Given that these threads materialise in media, Greimas' and Ryan's observa-

tions appear to refer to similar mechanisms viewed from a different perspective.

Taken together, Greimas' extension of the cognitive narrative act (formally in the form of abstract actants) to include the discursive mode of narrative – the act of narration, Piaget's and Greimas' claims (Appendix 2) of primacy of the cognitive over the linguistic object, and Rimmon-Kennan's descriptions of a pre-structured story (substance) – preceding its linguistic materiality, and acquiring narrative form (story-form) while perceived or retold, constitute a convincing testimony that cognitive constructions not only precede (and support) but also extend (transform) and communicate narrative, while at the same time are arranged in syntagms by it.

In that cognitive acts are constituents of narrative acts (and mental structures constituent of narrative ones), recent approaches to narrative, by researchers such as Ryan and Herman (who in many ways continue the structuralist tradition) appear to be quite fluid and ultimately competent in expanding narratological views; they situate narrative in a promising manner in the communicative and expressive landscape of the times, which involve new media.

As mentioned, Ryan describes the cognitive narrative act as "identifying reportable stories distinguishable from a background." This is an interesting description, due to its similarity to that of mathematician Rene Thom<sup>21</sup> on distinguishing forms from a background. It could be assumed that Ryan adopts similar vantage point as Thom, concerning this act of differentiation. She considers the literary disposition of narrative as a very particular artefact of specific level and type of signification. Moreover, given the spatial nature of many of Thom's mathematical models concerning the explication of form, the same tendency for spatial models in linguistic and narratological views of researchers

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<sup>21</sup>My intuitions on the capacity of *Catastrophe Theory* to offer mathematical models for contemporary narrative theories were strong even from my primary readings of both Thom's and Ryan's work. Extensive research into Petitot's workings over the last four decades clarified for the most part the significance, extent, complexity, and potential of this process of mathematisation .

such as Ryan may be identified. It is in that sense that the process could also be mathematised. The lack of motivation in cognitive narratological investigations to prioritise the aesthetic over the mental narrative construct – which is more abstract and a semantic artefact of construed structures<sup>22</sup> projected on and differentiating, pre-structured content (story according to Rimmon-Kenan, above), should render the notion of a cognitive narrative grammar as a term that does not, at this point, conflict with existing views. Extending it further to account for Ryan’s analogy of cognitive narrative constructs as mental multimedia, would make a cognitive narrative grammars homologous to a grammar of mediality.

Besides, the understanding of semantic units being parts of narrative units<sup>23</sup> through cognitive routines, and the establishment of values for truth conditionals [\*see veridictory modalities<sup>24</sup>], enables a restituted notion of *transposability*<sup>25</sup>

<sup>22</sup>“A construal is a cognitive operation whereby structure is imposed on conceptual content. Also, the ability to conceive and portray the same situation in alternate ways. Some aspects of construal are *specificity, direction of mental scanning, viewing arrangement, background, metaphor* and *prominence*. The four major classes of construal operations are **attention, judgement, situatedness** and **constitution**.” (Albertazzi:2000, 254)

In general these construed structures are not trivial, but are rather complex and multimodal.  
<sup>23</sup>Once more this realisation is not a ‘new’ one as has been demonstrated above. For further implications refer to Greimas’ semiotic square and Canonical Narrative Schema described in detail in Appendix 2. The bond between narrative and semiosis is too tight to isolate one from the other.

<sup>24</sup>“As an utterance\* governing another utterance (either of doing or of state), modality\* defines an isotopic plane which frames hierarchically inferior elements on which it bears (*cf.* the phenomenon of integration pointed out by R. Barthes). Thus, for example, in the case of the veridictory\* modalities the interplay of being\* and seeming\* as the cognitive positions to which it gives rise, determines an isotopic plane within the discourse. Given the fact that the categories *true, false, secret, and lie* merely constitute a system of relations, the “truth values” are relative to the universe that they modalise (the world of “common sense” and the world of the “marvelous,” both of which play upon veridiction,\* are very different with respect to their determination of what is “true”). Here we come to the “logic of possible worlds” (the same text may be read on different isotopies), like the problem of the “fantastic” or of “utopias,” with the whole question of the impossibility of deciding between two or more possible readings.” (Greimas and Courtes:1979, 165) [*asterisk \**, found in the original].

<sup>25</sup>The *spontaneous* transposable disposition of classified semantic elements to their linguistic and narrative counterparts, can also be interrogated under the scope of habitus. A set of dispositions that control our production and performance — our creative capacity. An individual’s habitus “contains stable forms of sensitivity and generativity that have been laboriously manufactured through repeated performance” (Medina:2005, 113). According to the theory of habitus – an expansion of the formal, abstract models of structuralism, our linguistic (and hence cognitive) competence is heavily constrained, since it is “socially and historically situated.” (*ibid.*).

that accounts for *appropriated performance*. Dismissing formal, dogmatic, and abstract generativity, *appropriated performance* for Bourdieu is not "a generative competence of infinite productivity" (Medina:2005, 113); rather, it is, the capacity of the individual to "produce expressions apropos" (*ibid.*). In other words, the ability to pick one appropriate cognitive constitution as a response to a concrete situation, out of the infinite generative capacity (compositionality and systematicity) of mental structures<sup>26</sup>, as acknowledged in formal abstract models. This is admirably displayed in our "ability to come up with appropriate utterances for concrete speech situations we have never encountered before" (Medina:2005, 113). Although the cognitive project embraces aspects of the structuralist view,

[I]f we were to limit ourselves to relying on the conceptions inherited from structuralism, we would not understand how it could be founded that a feature or a seme, constitutively dependent upon a determined class of interdefinition, could appertain to a class or transpose itself from one class to another, or even belong to no class in particular. Now, it seems essential to make intelligible this possibility, without losing differentiability. (Piotrowski and Visetti :2017, 23).

*Transposability*, *appropriated performance*, and *habitus* are not only notions connected to the facilitation of narrative form and narrativity, but are also concepts associated with primary meaning-making routines of experiencing reality. They were conceived as such even in traditional structuralist interrogations<sup>27</sup> and that is possibly the reason for the active connection, as has already emerged from

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The notion of habitus does seem to appear partly as a result of repeated reflexive abstractions during the early developmental states of children.

See Pierre Bourdieu on habitus and Jean Piaget on reflexive abstraction.

<sup>26</sup>I abstract the linguistic structure that Medina references, to its mental dimension.

<sup>27</sup>Bibliography concerning structuralist investigations found in Appendix ??.

the medium-independence thesis, to cognitive views (see the notion of *imagery* from Langacker and *imagistic* approaches further down, for instance).

The frequently encountered mapping operations, which result in pairings of semantic units as the most fundamental classification of their elementary surface differentiation<sup>28</sup>, has been established as being based on the dichotomy which provides context to semiosis<sup>29</sup> in the structuralist tradition: the syntagm/paradigm dichotomy<sup>30</sup>. The projections of one onto the other are the fundamental methods used in the context of this research in order to regress to deeper cases of meaning formation, and ultimately transcend this impasse between the form of the content and the form of the message conveying it. It is a transformation continuum, a mapping, of (self-regulated) organised substance to semic categories, as Petitot (Petitot:1992) suggests in his analysis of the ways phonological categorical discrimination is attributed to phonetic content. In the field of phonology, it was Roman Jakobson who,

[S]uggested that the projection of the paradigmatic axis onto the syntagmatic axis is what gives poetical depth to symbolic meaning. He called this process of (communication, art, language) the poetic function. (Mazzola et al.:2016, 74)

Furthermore,

[T]he poetic function of communicative symbols is based in intentionality, and focuses on the importance of choosing signs carefully. (*ibid.*)

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<sup>28</sup>These structures are classified later as new complex semantic units forming new pairs, manifesting as the phenomenological complexity of concepts.

<sup>29</sup>Once more I note that semiotics is based on the difference between concepts and terms. Marked/Unmarked in Peircean theory of the Sign, Trajectory/Landmark in Langacker's model of grammar (Langacker:1988).

<sup>30</sup>I refer to this dichotomy several times throughout this thesis since it takes into account the two dimensions of forms of meaning, paradigmatic (positional) and syntagmatic (relational and operational).



The above is once more a reminder of the quote of Marshall McLuhan "Medium is the message", and directs attention to the inclusion of the appropriated performance and theory of practice in meaning formation routines – including those activated during artwork creation. An *appropriation* of the notion of poetic function is assumed, as it accounts for our fundamental creative competency<sup>31</sup> as constrained by *habitus*. Doing so, also allows for the introduction of improvisatory operations, based on practical sense and not on "prior conscious thought" (Teyssot:2013, 9). The *habitated poetic function*, facilitates and enriches through constraining, the creative process of composition (accounting for improvisation), mainly since "the act of habitation consists in grasping routines that help to organise life, and in rethinking and transposing customary modes of action in response to the need to adapt to unfamiliar circumstances" (*ibid.*, 8).

Grounding the poetic functionality of language (or any semiotic system) in *habitus* not only fuels the cognitive operations by which structure is imposed on content, but also

[T]he ability of the mind to conceive and represent the same situation from different perspectives, or different directions of thought, while shading, modalising and differentiating meaning within a 'semantic space'<sup>32</sup>. (Albertazzi:2000, 13)<sup>33</sup>

A more in-depth investigation, reveals the demand to,

[R]eview the notion of difference, constitutive of that of seme, within an explicitly dynamicist (microgenetic) framework, where it could

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<sup>31</sup>Heavily constrained to a *sens pratique* according to Bourdieu. For more on this see Chapter Four of *Language Key Concepts in Philosophy* (Medina:2005).

<sup>32</sup>For a primary description of meaning differentiation within semantic spaces see Osgood, Suci, Tannenbaum:1957, and Anderson:1970. Nevertheless, the actual description I am endorsing in this research is described in La Mantia, Licata *et.al.*:2017, xxii (Introduction)

<sup>33</sup>See also Langacker:1986.

then become a differentiation and be considered in its various phases, thus enabling to relativise the discretisation imposed by the semic analysis grid. (Piotrowski and Visetti.:2017, 23)

This demand calls for the introduction of "the dynamicist dimension, which we would expect to manifest here in terms of (de-)stabilisations, of transformations, of formal metamorphoses within fields" (*ibid.*).

This dimension may be perceived as *Time* in narrative constructs, the quality of narrativity representing the dynamical aspect of narrative structures. It is a conceptual structure, manifesting in the form of dynamics. The third part of the present thesis focuses on the catastrophisation of the semiotic square, an otherwise static construct, and attributes it with its dynamic character.

In comparativist approaches (including the narratological ones), one perceives "the notion of transformation (from one form into the other)" as inherited from structuralism a "token for the systematicity at play". Transformation leads

[T]o the individuation of semantic states in exclusive terms of figure/ground structures (rendered by semic arrangements), in order to attribute them as such to attested forms, taken as sole benchmarks for determination and repetition. (Piotrowski and Visetti:2017, 23.)

In this sense, cognitive narratological investigations formulate cognitive narrative grammars, expanding the structuralism heritage. These investigations regard the activated construal operations "ranging from specificity, direction of mental scanning, through point of view, to metaphor" (Alberazzi:2000:13), and emerge as actualised imagery through "differentiated and interwoven *series of activities*" (*ibid.*), which ultimately describe relations between mental structures. Hence the term *imagery* (in the current author's interpretation, the

attainment of the mental components and interactions in *habitated poetic acts*) is used, in the words of Langacker:

[T]o indicate our ability to mentally construe a conceived situation in alternate ways (hence the term does not refer specifically or exclusively to sensory or visual imagery (see Kosslyn 1980; Block 1981). A pivotal claim of cognitive grammar is that linguistic expressions and grammatical constructions embody conventional imagery, which constitutes an essential part of their semantic value. In choosing a particular expression or construction, a speaker construes the conceived situation in a certain way, i.e. he selects one particular image (from a range of alternatives) to structure its conceptual content for expressive purposes. Despite the objective equivalence of the sentence pairs in [a. This is a triangle; a / . This is a three sided polygon], the members of each are semantically distinct because they impose contrasting images on the conceived situation. (Langacker 1988a: 7)

The above description exposes the relativistic nature of the basis of the semantic unit, the seme, which "is but a moment we believe to be fugitively stabilised in an interpretative trajectory" (Piotrowski and Visetti:2017, 24) and is not an object of absolute value.

The cognitive capacities and construal operations described in this section give a *scenic* structure to the cognitive functions during perceiving, understanding, and transforming.

It is reasoned that the poetic function asserts a sympraxis between composer - recipient (including presence and intentions), and their mutual (although most times asynchronous) interaction with both content and transmission me-

dia<sup>34</sup> (message), in a socio-historical placement that adds a pragmatic axis. This sympraxis in turn modulates real-world representations and common knowledge to fictive world-making acts establishing newly formed constrained representations.<sup>35</sup> It is an informal agreement perceived as *Agency* in narrative structures, and like *Time* (and *Space*) an important aspect of narrative understanding.

Furthermore, the ordinary – yet not trivial – mental capacity (imagery) is expressed even in our daily understanding of reality, a creative force available to be skillfully awakened by the performance<sup>36</sup> of the ‘storyteller’<sup>37</sup>, the competence<sup>38</sup> of the metalanguage<sup>39</sup>, and the facilitation (in the representations) of ‘natural’ displacement of agents amongst events and situations as an affirmation of the spatial, the temporal and the causal (purpose)<sup>40</sup>.

*Space*, *Time* and *Agency* in artwork creation and communication, may function as pillars of narrativity attributed (by *sympraxis*) to the foregrounded semantic structures. Equally active formative roles, through imagery and systems of habitation, could be ascribed to composer and recipient alike in the narrative interaction with these mental structures.

The three components (temporalisation , spatialisation , and actorialisation

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<sup>34</sup>The interaction ofcourse with content/media pair is of different degree and type for each active role-type agent. There are common elements along those interactions, and this is why in some cases it is possible for the agents to alternate views and positions.

<sup>35</sup>The importance of this *modulation* is outlined in the following quote, which almost reveals the *alchemic* character of these cognitive acts. By *alchemic* this thesis is advocating for the depth of influence of symbolic transformations (which are intangible), on our conception of reality, transcending phenomenologies and materialities.

”Language and spatial representation are qualitatively different, and hence are functionally specialised for different tasks. Where language and spatial cognition overlap, we can ask whether and how language modulates our spatial understanding. Recently, several different lines of research have proposed a strong role for language in permanently modulating and changing our spatial representations.” (Landau *et.al.*:2010, 59)

<sup>36</sup>An extended notion of the primary Hjelmslevian sense, which relates not only to the action of (transmitting) but also the ability to transmit the message.

<sup>37</sup>Not necessarily a person, or one storyteller. It may be any system capable of conveying modalised meaning in transmitting information about story events.

<sup>38</sup>The depth of knowledge about the message, the virtual ability to describe it in its wholeness

<sup>39</sup>The language of communication ‘chosen’ between the sender and recipient of the message (even if the message is ‘no message’ at all).

<sup>40</sup>All three are forces of constraint.

) are, according to Greimas, mechanisms of disengagement, a generic procedure by which an observer actant is revealed through a system of aspectual<sup>41</sup> categories established during the temporal programming of discourse (the process of actualisation) (Greimas and Courtes:1979, 18). Two kinds of new investments emerge in temporalised structures of discourse producing two meaning effects in relation to temporality and aspectuality. Temporality is linked to the process of establishing temporal categories which "project a temporal organisation of topological nature onto the utterance" (*ibid.*). Aspectualisation comes forth from investments which convert the function of utterances into a process. In this way the static logical nature of narrative utterances transforms to the temporal dynamic properties of processual utterances – a general explication to the relation between diachronic transformations and their temporal or historical manifestations (*ibid.*) .

The elements described, considering narrativity to be a semiological phenomenon of ecological nature, dependent upon *focalisation*<sup>42</sup> (attributing constructive, and poetic operations of narrativity upon the recipient), are based on associative, conceptual and proprioceptive as well as diegetic, spatial and

<sup>41</sup>"Aspect structures and category structures. Located at the deep semiotic level, narrative grammar uses a categorial logic, based on the discrete\* character of units\* and on the discontinuous character of states\* (an object of the world is either "black" or "not black," without transition). When narrative structures are thus formulated, they are temporalised during discoursivisation \* and consequently receive complementary aspectual investments; therefore, to logical transformations\* at the deep\* level correspond, at the discourse level, diachronic "changes" which we can account for with the help of aspectual categories (articulating semes of punctuality,\* durativity,\* inchoativity,\* perfectivity,\* etc.). Such a conception of aspectual structures consequently allows us to reconcile "story" and "structure" and to conceive of conversion\* mechanisms of category structures as aspectual (temporal) structures, and vice versa." (Greimas and Courtes:1979, 316) [asterisk \*, found in the original].

<sup>42</sup>Narrativisation may be perceived as an imposition of narrativity upon an object by a receptor. This makes determining narrativity rest significantly upon the receptors competence (through experientiality and reflexive abstraction) to construct, impose it upon content and interpret it. Therefore focalisation is the process through which the receptor is able to place themselves at the central axis of a subject's experientiality. A description of focalisation from the book *Handbook of Narrative Analysis*, describes it as the term which, "refers to the relation between that which is focalised – the characters, actions, and objects offered to the reader – and the focaliser, the agent who perceives and who therefore determines what is presented to the reader. So, we are talking here about the relation between the object and the subject of perception" (Herman and Vervaeck:2001, 70)

pictorial processes. It is an empirical process based on reflexive abstraction (Piaget), and "as abstraction processes, they include gestural./spatial semiotics, time semiotics [...] and embodied semiotics" (Marty:2015, 97)

The world-making narrative act of perceiving and understanding the world should principally involve acquiring and retaining spatial awareness of it. In turn, this process is almost indistinguishable and notably reliant upon interpretation and, on formulated, stable, elementary linguistics conceptualisations. Cognitive grammars use intensively spatial metaphors, and paradigms from dynamics to acquire meaning from language and have developed a diverse view on the mind's meaning acquisition mechanisms. Their assumptions even in their most elementary expression challenge<sup>43</sup> several fundamental assumptions of formal semantics.<sup>44</sup> Thus language is seen as a cognitive system facilitating conceptualisation and expression, and can not be reduced to an algorithmic system.

Furthermore, it reflects the complexities of conceptualisation, and can not as a system exist independently of other cognitive systems. Lexicon, morphology and syntax<sup>45</sup> are thus comprehended as a continuum containing symbolic structures. As a result grammar is a constitution of a reserve of symbolic resources upon which the individual may draw, rather than being constructive<sup>46</sup> or generative<sup>47</sup>. Meaning then appears to be a subjective experience not directly linked to 'world truths,' it is dynamic and contextual. Semantics depend on modalities, and the contents of the mind's workings, therefore, are conceptual. Truth, the semantic reference, in the context of cognitive grammars, appears as not truth-functional (Albertazzi:2000, 13). It is not embedded in

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<sup>43</sup>One of the reasons why cognitive grammars are adequate and relevant in artwork poetics both as analysis and synthesis frameworks.

<sup>44</sup>'New' narrative models and descriptions are widely based on cognitive semantics or hybrid views.

<sup>45</sup>The syntax-lexicon continuum and construction grammars

<sup>46</sup>Construction grammars

<sup>47</sup>Generative grammars

syntax structures and is not formed solely by its functions. It is metaphorical and closely connected to world knowledge, perception, and interpretation, phenomena of linguistic conceptualisation <sup>48</sup>. The contraposition to formal semantics as summarised here rests upon different methods and objectives, and consequently upon different conceptions of construal operations. Meaning in cognitive grammars is conceived as the result of mental activity, and not as a series of formal operations between variables and quantifiers as in formal semantics. It is grounded in the socio-cultural domain, physically embodied, and represents conceptualisations of non-linguistic experience (Langacker:2000, 25). Truth-conditionals in the cognitive hypothesis, are not truth-inclusive and do not depend upon absolute value systems – as in formal semantics where they are considered embedded in the semantics of the sentence; rather, they emerge as individual choices made during construal operations.

The current investigations are concerned with establishing a theory of semantics for the formation of symbolic meaning, and the delineation of the cognitive routines involved.

The dynamicist conception proposed in this research as an adept modelling approach to these mental narrative representations, is seen as "scientific imagination [...] fuelled by mathematics" (Piotrowski and Visetti:2017, 24) and "today constitutes the best scientific locus for a philosophy of becoming, such as evoked by the few following keywords: flux, spatiality, temporality, instability, stabilisation, phase, emergence, graduality, differentiation, coupling, continuous/discontinuous dialectic" (*ibid.*).

Ganderfors (Ganderfors:1995), in giving a general answer to the question what constitutes semantics, describes it as the specificities that define "a relation between linguistic expressions and the referents of the expressions." (*ibid.*,1). According to him this is as far as the agreements on the question advances, and

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<sup>48</sup>A mental construct.

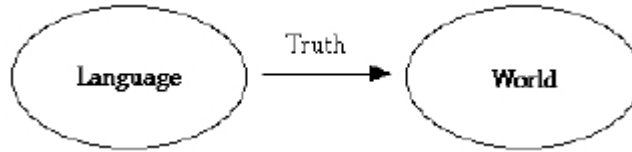


Figure 2: The ontology of extensional semantics

the divergence of opinions begins. The subject of value here is the answer to the question on "what kind of entities the meaning of various words are" (*ibid.*). The two main trends oscillate between *realistic* and *cognitivist* views. The realistic approach attributes the meaning of the word<sup>49</sup> to an external reference world<sup>50</sup>, and is distinguished to extensional and intensional.

The extensional starts from the sign system (in this case, language) and maps its elements onto a "world". The *compositions* of these mappings map truth values to sentences of the language, and through this process truth conditions are determined (*ibid.*).

In its failure to account for the interpretations of the individual, this approach was found to have its shortcomings, thus it was supported by intensional semantics. In the case of the intensional semantics the sign system was mapped onto *possible worlds*, and "the meaning of a sentence is taken to be a *proposition*, which is identified with a set of possible worlds – the set of worlds where the sentence is true." (*ibid.*).

Ganderfors focuses on the cognitivist paradigm in which the meanings of expressions are considered *mental entities*. In this circumstance, the process is understood as a mapping from the sign system (linguistic expressions for instance) to cognitive structures. This suggests that the system itself (language)

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<sup>49</sup>It could be any complex sign capable of evoking semantic processes, such as imagery. Mappings on objects of value on possible worlds scenarios are represented through truth conditionals.

<sup>50</sup>Habitus is based on references as such, situated historically and socially.



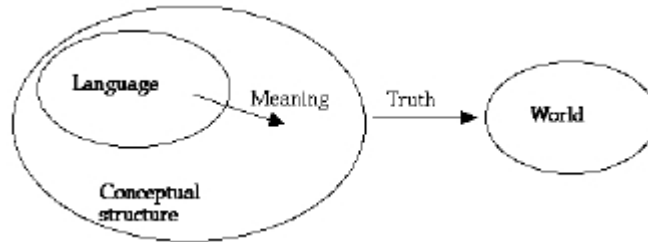


Figure 3: The ontology of intensional semantics

is part of the structure and is not an independent entity. Semantics, then, describe relations between mental constructs. Now the focus of the investigation is placed on lexical meaning rather than on sentential meaning; truth conditionals are not absolute but are subject to *acceptance* or *belief* (Ganderfors:2009). The relation between the external world and truth conditions are considered only when the interaction between the cognitive structure and the world takes place. The idea that spoken words are symbols for mental constructs and experience dates back to Aristotle, who recognises that the mental experiences which are directly symbolised by words are the only common human condition. Aristotle distinguishes between the experience and the external ‘things’ of which experiences are images. Accordingly, spoken or written words refer to experiences (Greimas’ *meaning effect*) and not to the external reality.

Even the use of the word ‘world’ in these inquiries creates a predisposition for the strong spatial metaphors used in language and narrative analysis under the cognitive prism. It stems out of the strong semantic connection to world truths, and spatiality in a fundamental one. Frequent reference has been made to the world-making trait of meaning-making routines. There are cognitive acts (as narrative) and based on knowledge of this world including of literature and the arts. This knowledge is represented and made available in our experience with the form of image-schemas.

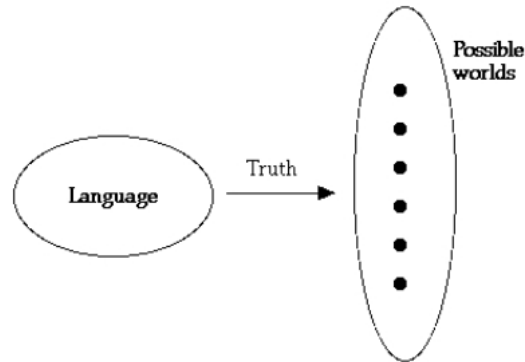


Figure 4: The components of cognitive semantics

It is now probably easier to understand Ryan’s surpassing the expectation of narrative appearing as an aesthetic object (Ryan: 2004), and supporting Turner’s dismissal of a literary mind as distinguished from the human mind. Doing so allows her a playful venture in a new territory of narrative, since narrative could be described as playful interaction with make-belief truth-conditionals. Narrative complexity is, in some ways, intensified this way under the cognitive prism. New possibilities of creating narrative relations may present themselves in the narrative text if to a broader narrative scope exists. It is a stance that allows further and broader narrative investigations, attuned to the advancements and up-to-date understandings of how the mind works outside the literary scope.

In order to understand the relation between art and narrative, it is necessary to identify the connections and the mechanisms that are involved when, meaning is contextualised and attributed to artistic and narrative semiosis. It could be assumed that in order for this function to take place such attributions would be rooted in a domain of common reference grounding them to its knowledge base. This common domain is the real-world and our shared experience in it. The question then arises as to what the plane of reality has ‘taught’ us concerning form, function, and composition (complex structures characterised by discrete

relations between parts).

Meaning in narratives as portrayed in Ryan's narratological views is complexified and bound by its internal mediality. This immanence could be seen as a valid presupposition for media to be able to carry meaning in certain ways. The speculation is, for her, based on the cognitive project's suggestions, and reflected in her deductions that:

[T]he cognitive representation that i call narrative could thus be the mental equivalent of a "multimedia" construct. While its logical structure is propably stored as propositions, wich in turn can only be translated through language, other types of images, and consequently other "mental media", enrich the total representation in ways that remain inaccessible to language. (Ryan:2004,12)

*Scenic* views emerging from actantial analysis and the notion of narrativity as primary organiser of discursive acts are, as in the grammars of case proposed by Charles Fillmore, in correspondence with a 'multimedia' view on narrative structure and understanding, and include *spatiality* in the form of knowledge and knowledge representation (as narratives may be).

In fact this is an investigation that began with Hjelmslev and his introduction to the notions of content-form and expression-form. After reaching a historical perspective on the subject of grammatical case in terms of the localist hypothesis, and in the effort of providing its structural principles, he initiated an interpretation of case-relations in terms of spatial movement and arrangement. This led to a description of the sentential micro-universe in the context of a theatrical arrangement. In this scenic (and dramatic) arrangement the predicate is the central representative of actions and processes, while the elements dependent upon the predicate are the principal elements of this action. The dependent elements designate the anthropomorphic (actant) and spatio-temporal

(circumstant) attributes and create the ‘little drama’ of the sentence structure.

Hjelmslev’s conceptions of grammatical case involved treating the noun as central sentential element, its functional unity established in terms of its fundamental signification of spatial relations. Both conceptions were not adopted by catastrophist views, since they attribute sentential centrality to the verb, and admit to a schematisation where the actantial places are viewed as a localised arrangement around the verb, with explicit local configurations subject to constraints imposed by the space-time dimension on morphologies.

The above language ‘set-ups’ suggest an interactive function of language and thus meaning, not just one of serving the pairings between forms and meanings. The communicative function of language has been emphasised above.

The process of transmission, decoding and interpretation by a receiver involves conceptualisations. Through communication language and narratives fulfil several *social contracts*. Language and narrative convey such information by creating scenic structures of experience (frames), which index and construct concepts (Fillmore:1982). The frames invoked by language mobilise knowledge structures, which fill in background knowledge of and around a concept.

Language’s systematicity reflects the systematic structure of our conceptual system, an explored hypothesis of both structural and cognitive linguists. Moreover, the structured mind may be seen in part as a reflection of the structured and organised world it references. In that sense the idea of a scenic comprehension of meaning, indicates a reality understood through conceptual domains.

These domains are bodies of knowledge within our conceptual system, organising, relating and filtering concepts and experience. These are the domains drawn upon during the discursive act. An additional suggestion concerns the way modalisations take place (given the chosen modalisation where certain content manifestations are more likely to happen, as discussed in the description

of Greimas' model in Appendix 2, since cognitive views admit that figuration and grounding are based on this conceptual body of knowledge. In turn, it affects the way modalisations take place. Hence figurative elements tend to be more energetic in relation to a background, which may explain why meaning is conveyed in narrative (and language) in a certain way. Both the symbolic and interactive functions of language reflect the pairing, through meaning, of the symbolic to its mental representation (the conceptual).

Concepts are derived from percepts, the range of perceived information imprinted and integrated into mental images. All of the wealth of information and knowledge that may be evoked from language may be conceived as communicated experiential frames.

Both case grammars (Fillmore) and its supplementary cognitive grammars (Langacker), provide an encyclopaedic understanding of knowledge. They are based on actantial understanding of structures of meaning, which only through their modalisation by the evocation of mental images may reflect figurative (and ground) surface elements. The argument Langacker makes is that basic domains deriving from perceptual experience (pre-conceptual), constitute the basis of more complex assemblages the abstract domains which essentially correspond to Fillmore's semantic frames.

According to both views any grammatical constructions are relative to semantic frames and domains, in such a way that the meaning of that construction cannot be understood independently of the frames with which it is associated. In general, assuming a cognitive stance towards language and narrative also addresses explicitly the semantic and pragmatic implications of meaning formation in linguistic and narrative structures. Adding to the theory of semantic frames is the idea of conceptual domains proposed by Langacker. Similar to the frame theory, domains structure and provide necessary background knowl-

edge to lexical meaning. The concepts represented are structured in terms of complex domain arrangements, the domain matrix of a concept. Two basic domain types, basic and abstract, are used to represent either the nature of our embodied experience (domains such as SPACE or TIME), or derived from more complex structures of experiences such as those derived from social contracts, for instance, MARRIAGE or RELIGION.

In addition to the theory of frames, domains appear in a hierarchical order (e.g., the concept EAR is understood with respect to the concept HEAD which in turn is understood with respect to the concept BODY). While frame semantics emphasise the development of a theory for grammaticalisation, as in valence relations, the theory of domains is mostly focused on the organisation and structure of knowledge and the ways concepts are understood in relation to other concepts. Nevertheless, basic domains are based on knowledge that is not dependent upon other forms of conceptual organisation, and are not understood in terms of other domains but from pre-conceptual directly embodied experience.

Basic domains are similar to image-schemas<sup>51</sup>. Emergent, pre-conceptual and inherently meaningful, deriving from experiencing the world and the embodied cognition of it. They give rise to more complex conceptualisations, and internally may be non-trivial. They are dynamic and able to undergo transformations.

Both image-schematic and domain-based approaches are related to the actual understanding of meaning. Essentially, the structural meaning of language, i.e., its schematic structurations, relates to structural properties of referents (what language references) and to scenes, the situations in which referents are found. This schematic meaning reflecting conceptual representations

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<sup>51</sup> Abstract representations deriving from our everyday observation of and interaction with the world, that produce embodied analogue representations of experience that in turn establish conceptual structures.

in language is considered as being directly related to fundamental aspects of embodiment. Nevertheless, the idea of domains adds to concepts deriving from internal processes and not necessary imagistic, sensory ones: image schemas suggest image content. To summarise: cognitive semantics suggest the grounding of human thought in basic domains and image schemas while also admitting to mediation by chains of intermediate concepts, the abstract domains.

This explains the 'narrative as strategy' approach, applied by this author<sup>52</sup> in the context of this research, expressed by two crucial, current trends in narratology: the cognitive investigation of narrative functions which admittedly entails its medial constrained manifestations, and the investigation of the trans-medial nature of narrative. Both trends relate to the deep structural identity of narrative composites in terms of the embodied understanding involved during interpretation of their meaning and function. While the former trend investigates the exact cognitive mechanisms activated during narrative acts, as well as the process set in place in order to enable narrative manifestation; the latter traces functionally and pragmatically these fundamental routines in different manifested forms within explicit media arrangements. The contents of this research refer to an expanded narratology that allow diverse ways of evoking narrative scripts to be investigated.

The next section proceeds from the surface level cognitive descriptions of narrative and narrativity to a deep level, where the morphology and the schematisation of the processes resulting in an observable surface level syntax are described by appropriate mathematical models. This has historically resulted in the mathematisation of case grammars and founded the basis upon which cognitive grammars developed. A dynamical model for describing narrative is based on Thom's Catastrophe Theory and the classification he proposed of the

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<sup>52</sup>Narrative as the primary meaning-making function and basis of any analytical methodology.

Elementary Catastrophe archetypes.

Relating to the practical aspects of this research, the heuristic approach starts with a structural conceptualisation based on semic categorisation according to the semiotic square. It incorporates, too, the terms of the domain-based hierarchies of the composed audiovisual narratives. Actantial analysis provides the constituents and the primary relations, grounded in basic and abstract conceptual domains with each relation generating a new semiotic square. Finally, these structures are mathematised using catastrophe theoretic interpretations of these relations, in the context of paths on elementary and complex catastrophes, and showing how through conversions they acquire their surface status (figure-ground). In some cases, this process is also applied in its reverse direction: it starts from surface forms in order to acquire the deep narrative elements and their structure. The cognitive approach in this research was employed in order to conceptualise the composed narratives and narrative elements in terms of multimedia scenic structures<sup>53</sup>, enclosing meaning, i.e., the representation of primary knowledge, and manifested in terms of the syntactical relations of and operations on the manifested content.

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<sup>53</sup>This was found from the initial conceptions of this research project to be a 'convenient' and probably one of the most direct approach of using basic traits of available media (sound spatiality as found in acousmatic music both in its spectral and also in its projected manifestations, simulation of space in terms of mathematical relations as found in game engines, and imagistic representations as found in the visual medium). The characteristics of the chosen media here considered able to facilitate narrative concepts in diverse ways and combinatories.



Part III

A Dynamical Approach to

Narrative

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## 4 Catastrophic Schematisation of Narrative Structure

During the current research, it was recognised at the outset that there existed the need to account for the invariants in narrative structures, those elements that seem to remain stable under the generative trajectory. These would be required in order to serve as anchoring points between the conceptualisation of a composition, on the one hand, and its transformation into syntactically arranged content, on the other. The first expressions of the author’s syllogisms then revolved around a notion I developed and described as *transconsistent composition*. The main concern here was not the invariants themselves, but rather the elements that maintained some behavioural consistency, and symmetry while crossing different levels of semiosis during the generative process. The first formations of a method involved the following steps:

- To identify causatives and operatives in relations between system components, i.e., “X-event present, increases the likelihood of a Y-event present”. Describing the system using system thinking (causal loops diagrams). And identify levels and rates of change in the system using system dynamics methodology, i.e., manipulation by feedback loops, accumulation, delays, and simulation;
- To single out<sup>54</sup> intensive-extensive properties: intensive properties are invariant to the size or amount of material such as its speed, density, or concentration; extensive properties may be spatially divided, such as size and length and then determine the intensive differences, i.e., the rates of change;

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<sup>54</sup>I am using the exact wording used at the end of 2013 when I wrote this methodology. “Single out” is precisely the term that is causing the gap many times in structuralism.

- To determine critical thresholds in intensive differences where morphogenetic events occur;
- To plot first-order phase-spaces for the systems components bound by causality and in this respect identify those that are not bound by causality;
- To determine each component's behaviour and identify subspaces in the phase-space where similarities in behaviour are found;
- To identify causal relationships between first-order phase spaces components;
- To plot (second-order) phase-spaces (or 3d volumetric flow animated renderings) of the first-order components (this is where invariance and dynamics are introduced to replace the notion of distinct object and events), and;
- Once more to use sub-spaces, and force fields to control systems behaviour and narrative.

Even these initially naive<sup>55</sup> intuitions identify certain significant realisations that the investigation was facing in the optimum direction of focus, despite their being intuitive and partly unconscious. For instance, an early intuition arose, that an element of causality, and especially some of its identifiable features, would be significant. There was then no clear sense of the nature of the causalities that would be tracked, a study that would later come to be an exercise in complexity, self-adaptation and emergent phenomena. Nevertheless, the need to pursue qualitative differences and to operate on the basis of rates and dynamics was abundantly clear.

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<sup>55</sup>Naive in the sense that many assumptions did not account for different levels of semiosis (deep, surface and intermediaries during the generative process); this was an approach mostly influenced by the biological strands of structuralism, and biological and natural morphogenetic processes (such as organisms and landscape formation). The relevance of the work of Thom had yet occurred to me at that point in the research.

It seemed even at the early research stages that some kind of morphogenesis must be involved, although the author's understanding of the process at the time derived mostly from the field of biology and the link to different type of substrate, e.g. visual, aural, conceptual, was not yet distinguished.

Still the most important implication in the transconsistent composition framework suggested above was to treat the audiovisual compositional object as a dissipative formation.

An element overlooked, until later was that while 'in the hunt' for 'components' and separate elements; these would make themselves 'known' only in oppositions, in their relations to other components. They would form categories. In the case of narrative, basic units are discussed as constituting semic categories, with the elements constituting them appearing in pairs or in negated statements.

In sum, the aim differs little from proposed morphodynamical models such as those of Thom (1975), Petitot (2011), or Wildgen (1994) amongst others from diverse fields of research. The field of dynamical structuralism and the use of the morphodynamical models provided the necessary mathematical space for semio-narrative structures as core constituents of the canonical narrative schema to be properly and in full development mathematised while not deflecting from the author's initial intuitions.

The following, summarise the descriptions of semio-narrative structures and their components in terms of the morphodynamical paradigm as developed through the works of Thom, Petitot and Wildgen.

#### **4.1 A Topological Study of the Semiotic Square**

This section specifies the topology of the semiotic square, interpreting it in terms of its form as archetypal categorical (paradigmatic) articulation. In that sense,

the semiotic square acquires the status of an elementary, universal morphology, able to develop a semic category. The development is based on the following assumptions:

1. the internal states of the system are the local minima of a potential function characteristic of the system, and is defined on a phase space which is considered its *internal* state;
2. an instance exists, that selects and actualises one of all the potential internal states while virtualizing the others;
3. the potential function (and the internal states) are dependent upon a multi-parameter variant in an *external* space, that operates as a control space for the internal system states .

As a consequence of the above catastrophic models may be seen as models of structural paradigms and their articulation may correspond both to substitution and taxonomy. Passing through a domain actualises a determination while virtualizing the rest, and the activated state is substituted by another in the passing to another domain. At the same time the co-location of the actualised and virtual determinations defines the dimension of taxonomy for the model.

The *catastrophe ensemble* – the closed set of point for which the potential function becomes unstable, is thus determined and in its crossing the system's state rapidly shifts its internal state in terms of the selection mechanism – its convention<sup>56</sup> as per Thom (1975).

#### 4.1.1 Schematisation of the Paradigm a Catastrophic Explanation

Since the catastrophe ensemble as defined by the internal states is non chaotic possesses a proper geometry (partitions of the set) subject to prediction. Figure

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<sup>56</sup>The Maxwell convention (system seeks minimal potential through catastrophes of conflict), and the convention of perfect delay (system occupies local minimum as long as it exists, shifting states through catastrophes of bifurcation).

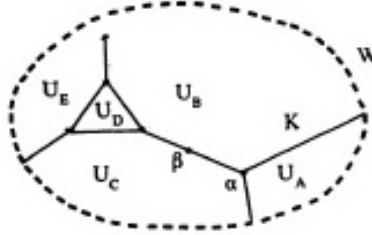


Figure 5: Space stratified by boundaries

5 displays the boundaries that separate the domains corresponding to internal system states while the catastrophe points are stratified. The boundaries correspond to the *glued* subspaces of decreasing dimensions that have instabilities of increasing degree with the internal potential. This geometric explanation describing the stratification of the domain may serve as the schematisation of the categorical nature of the paradigm.

It is clear that Elementary Catastrophe Theory (ECT), opens up the idea of a geometry of stratifications in the theory of singularities and structural stratification. The development of the potential function in a family of potentials in the external space (in Figure 5 the dotted space  $(W, O)$ ), is consider its unfolding, while the stratification  $(W, K)$  is the local model organised around the potential of minimal complexity. Each stable local model  $(W, K)$  may be explicitly associated with each instability of the manifested potential function. Each singularity responsible for the generation of an instability stabilises in a family of potentials and brings about a local model that privileges one of these unfoldings as the organising center. These unfoldings have been classified in the EC classification; to produce a stable global geometrical model, the local universal models may be combined.

The fundamental postulation for the use of ECT onto semio-narrative struc-

tures, is that the determinations of the semio-narratives, a seme, a semic category or an actant, when positioned in a structure occupies a place of minimal complexity, a domain of minimum potential. Thus, is possible to convert literal identities into positional ones, and formal logical relations translated into connections, while retaining the same elementary level, and finally symbolic assemblages of formal logic presented as a dynamic topology of unfoldings. Since Morse's theorem states that there are only two types of EC, catastrophes of conflict and catastrophes of bifurcation, translating the unfoldings into structural terms corresponds to the qualitative and privative<sup>57</sup> oppositions similar to those detected by Jakobson in phonology. These are minimal structures of opposition, and the basis for every elementary structure, including the semiotic square.

#### **4.1.2 The Catastrophe of Conflict seen as Qualitative Opposition, covering the Contraries of the Semiotic Square**

Considering the catastrophe of conflict of minimal complexity, its potential seen in Figure 6, is the corresponding schema of the qualitative opposition in catastrophe theoretic terms. This catastrophe reflects in its topology the primary concepts and all the constituent categories that may be found in the morphology of a qualitative opposition, thus enabling the topological translation of those.

In that sense the identities may not be described as discrete, but defined by their internal positioning. The positioning (defined by the potential function and its local minima), is reciprocally meaningful while the description is simultaneously relational and topological. The reciprocal dominance of one state-place over the other schematises the relation of reciprocal logical presupposition, while the differentiated space as categorised by the catastrophic set either an

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<sup>57</sup>Privative opposition refers to the presence or absence of a distinctive feature found on an element. The term where the feature is present is called marked term, while its opposition as neutral term.

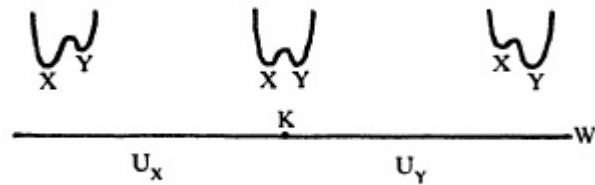


Figure 6: The schema of qualitative opposition found in the catastrophic set of a system as the above potential between two minima.

ideal space of junction (conjunction/disjunction) or the structural space of the paradigm as defined by qualitative oppositions.

#### 4.1.3 The Catastrophe of Bifurcation and Privative Opposition, the Contradictories of the Semiotic Square

The catastrophe of bifurcation of minimal complexity as found in CT is the fold catastrophe. It's potential may be seen in Figure 7. It is the schematisation of the appearance and disappearance of a determination. This describes a process of the dynamic genesis in structural synchronisations. The interface  $K$ , which differentiates the external control space into domains, is now asymmetrical, corresponding to the appearance and disappearance of the determination. This modelisation provides a viable description for a vital and longstanding subject of inquiry in semiotics, the (non-logical) status of negation. In fact, within the basis of the dynamic positional topology presented in the case appearing here, negation seems to acquire no status unless interpreted as illocutionary. That means that is not an absolute state or position but rather accounts for the absence of a position from the operations on discrete components. This negativity is constitutive of the topological invariance of structures and depends



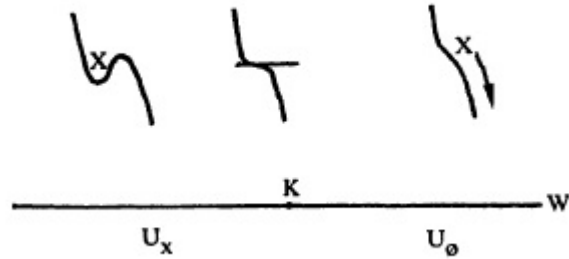


Figure 7: The Fold catastrophe is the schematisation of privative opposition upon form rather than on substance.

#### 4.1.4 The Dialectical Conflict as the Topology of the Cusp Catastrophe

As a local system of paradigms, a model of taxonomies, the semiotic square articulates a qualitative opposition  $X/Y$  in relation to two privative entities  $X/\emptyset, Y/\emptyset$ . This indicates as far as dynamic topology is concerned, a schema of contraries (relation of contrarities in the Semiotic Square), covering the interdiction, the reciprocal presuppositions, and also the genesis of the involved terms. This, in catastrophic theoretic terms, is far from simple combinatorics; rather it is an exclusive elementary structure around an exclusive organising center.

Figure 8, displays the cusp, a catastrophe with a two-dimensional external control space. It is the most simple schema that can be proposed able to represent the dialectisation of a conflict  $X/Y$ . In recognising the qualitative opposition  $X/Y$  as a sub-schema in the model, may be observed that this oppositional relation is being developed as a morphogenetic process, developing the nature of the relationship while the opposition is being developed. The

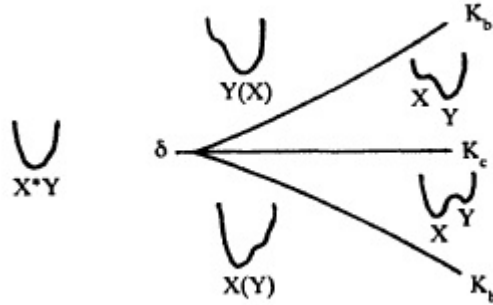


Figure 8: The potential and projections of the cusp as the schema of dialectic conflict.  $X(Y)$  signifies the *capture* of the term  $Y$  by  $X$  and  $X * Y$  symbolises the synthesis between them

true and absolute expression of opposition between the determinations is never fully developed apart from the threshold  $K_c$  ; This threshold, is a union of the disjunctive-conjunctive relationship between the expressions, a domain of fragile balance. This is a schematisation of how the  $X * Y$  determination is dynamically differentiated and stratified within an explicit domain, while in the schema outlines the static fusion of the terms.

In the schema there is a point  $\delta$  where  $K_x$  disappears similarly to critical points in phase transitions. There, bi-modality is abandoned, an elementary schema of signification. The crossing of  $\delta$  and depending on the direction of the path into the domain of static fusion  $X * Y$  (as Thom describes it) defines the status of the components as either neutral or complex. While the crossing of the side boundaries  $K_a$  or  $K_b$  , schematises a sudden shift of state (Figure 9) described by Thom as metabolic fussion.

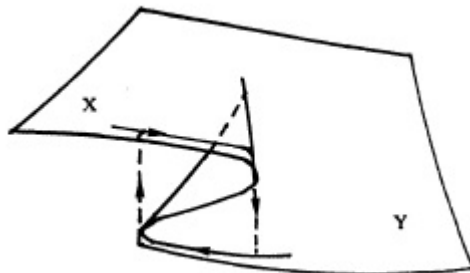


Figure 9: Metabolic fusion corresponds to the cycle of hysteresis, where alternate exchanges between the determinations occur

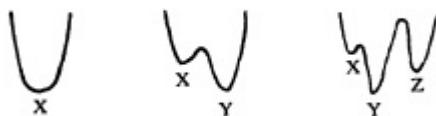


Figure 10: The potentials of compact catastrophes are wells confining the determinations within their sides

#### 4.1.5 Schematicism of Deixis as the Topology of Swallowtail Catastrophe

The cusp is a compact catastrophe (Figure 10), where during the bifurcation of a determination, another necessarily captures it, as shown in Figure 6. In order to be able to schematise the privative oppositions  $X/\emptyset, Y/\emptyset$ , it is necessary to complexify the cusp and not treat it as a closed, bounded set. In privative oppositions, it is necessary to progress towards a place where there are no distinct determinations. -

Allowing one of the cusp's potentials to bifurcate to  $\emptyset$  (decompactification),

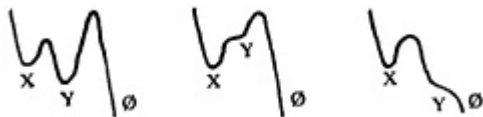


Figure 11: Decompactification of the cusp.  $Y$  is allowed to bifurcate also towards  $\emptyset$

suggests the introduction of a new threshold separating the distinct determinations ( $X$  or  $Y$ ) from an ‘empty space’ where determinations are undefinable. The corresponding minimum then is allowed not only to bifurcate towards  $X$  (or  $Y$  respectively), but also towards a descending branch that falls ‘out of frame’ (Figure 11).

$EC$  indicates the Swallowtail (Figure 12) catastrophe as the fundamental type that organises the potential similar to those displayed in Figure 11.

The Swallowtail entails sub-schemata representing the relations  $X/\emptyset, Y/\emptyset, X/Y$  (Figure 13). It is an irreducible structural archetype that gives a model for the unity of the opposites, the static fusion  $X * Y$ , and the double potentiality of neutral/complex term.

In the model the stratification for the genesis of the determination  $Y$  from  $\emptyset$  in the presence of  $X$  is included, but not the other way round. This is a dissymmetry characteristic of the Swallowtail corresponding to the phenomenon of markedness.

Since the notations  $\bar{X}$  and  $\bar{Y}$  do not symbolise terms (as was explained above), but illocutionary statements, may be shown how the bifurcation of the position of  $Y$  corresponds to the affirmation of  $X$ , and in turn how the affirmation of  $X$  implies its integration in a reciprocal presupposition and conjunction-disjunction with  $Y$ . This is explained in terms of the factorisation of  $Y \rightarrow X$

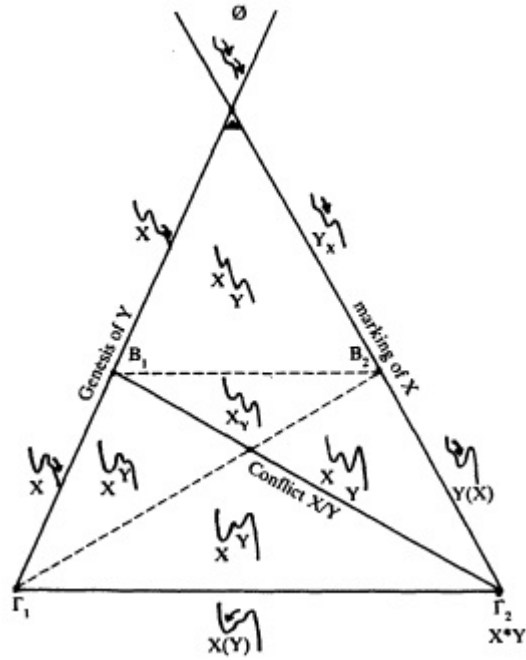


Figure 12: The Swallowtail catastrophe, reflecting schematically the relations between two determinations.  $Y(X)$  and  $X(Y)$  signifies the capture of one determination by another

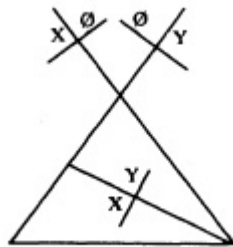


Figure 13: Co-localisation of sub-schemata of Swallowtail (  $X/\emptyset, Y/\emptyset, X/Y$  )

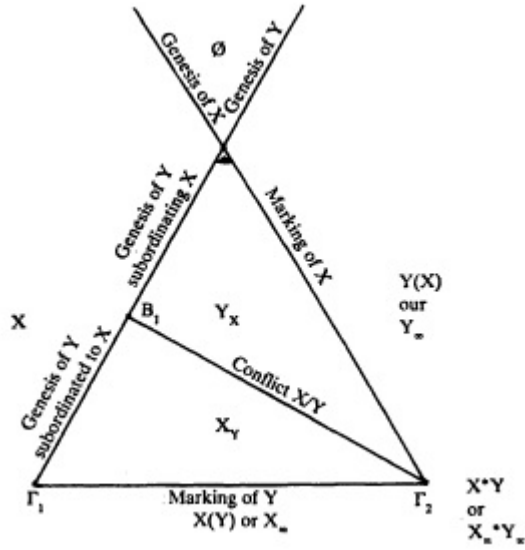
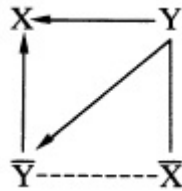
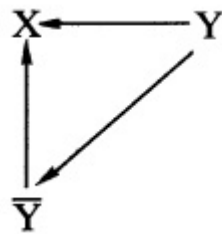


Figure 14: Schemata of relations contained in the Swallowtail

by  $\bar{Y}$  and how it unfolds the presuppositions linking determination  $X$  to determination  $Y$ .



It is possible to describe the factorisation



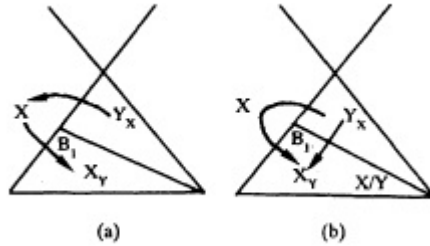


Figure 15: a) First negation  $Y \rightarrow \bar{Y}$  as path  $Y_X \rightarrow X$  and implication  $Y \rightarrow X$  as path  $X \rightarrow X_Y$   
 b) Factorisation  $Y \rightarrow \bar{Y} \rightarrow X$  bypassing the beak point  $B_1$

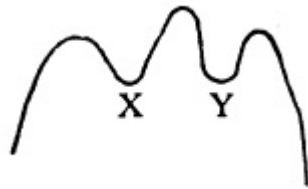
in the following manner (Figure 15).

$Y \rightarrow X$  corresponds to the passage from the domain where  $Y$  is dominant over  $X$  (the domain  $Y_X$ ), to the domain where  $X$  reciprocally dominates  $Y$  (the domain  $X_Y$ ), by traversing through the domain of conflict  $X/Y$ . The succession of states  $Y \rightarrow \bar{Y} \rightarrow X$  describes the passage from the domain  $Y_X$  to  $X_Y$ , bypassing the beak point of the Swallowtail and recrossing the domain of the genesis of  $Y$  from  $\emptyset$ .

The above catastrophic interpretation of the semiotic square includes all of its intricacies, as a morphogenetic development through a continuous and dynamic adjunction of its organising centers (Figure 14). The interpretation includes a dual point where the genesis of the determination  $X$  and  $Y$  are organised independently, a cusp point  $\Gamma_2$  organising the domain of conflict and its neutral/complex character ( $X/Y$ ), and a beak point  $B_1$  organising the implicative relation between determinations  $X$  and  $Y$ . This schematisation shows the progressive development of the square's topology while the semantic axis remains bimodal with two terms.

#### 4.1.6 The Schematisation of the Semiotic Square as the Topology of Dual Butterfly Catastrophe

The Swallowtail schematises, as shown above, half of the semiotic square; its full development needs symmetry. To achieve symmetry, the potentials necessary to consider are of type shown in the figure below, providing not only for the genesis of  $Y$  from  $\emptyset$  in the presence of  $X$  but also for the genesis of  $X$  from  $\emptyset$  in the presence of  $Y$ .



Potentials of the Dual Butterfly.

This type of potentials may be found in the catastrophe of the Dual Butterfly, considered as one of the most complex types recognised by *EC* and express two determinations. The schematisation of the semiotic square, in the case of the Dual Butterfly, is given in a sequence of sections manifesting both synchronic and diachronic<sup>58</sup> traits (its current temporal manifestation and also its history). Its structure exhibits temporality intrinsic to the structure and may be considered synchronic. The structural space of the square in terms of the Dual Butterfly is linked to the dimensionality of the model type and can account for the “figure eight” sequences of the square (Appendix 2). The proposition of an ‘eight shaped path’  $S_1 \longrightarrow \bar{S}_1 \longrightarrow S_2 \longrightarrow \bar{S}_2 \longrightarrow S_1$  from Greimas

<sup>58</sup>This dichotomy was initially introduced by Ferdinand de Saussure, to delineate two distinct approaches to linguistic phenomena. Synchrony in opposition to diachrony designates simultaneity as a criterion for gathering a group of linguistic phenomena and constitutes a state of language. It is an operational concept. As a concept it triggered the idea of a linguistic system. Opposed to the dichotomy is the concept of achrony in linguistics, affirming linguistic structures as logico-semantic structures of atemporal character. In terms of semiosis, Greimas views perceive deep semiosis as achronic, and recognises temporalisation in discursive surface structures.



describes the path from an initial (narrative) state to a final state, and is the result of a detailed analysis of tales and myths. The acts of negation  $S_1 \rightarrow \bar{S}_1$  and  $S_2 \rightarrow \bar{S}_2$  actualise the contradictions (the schemas of the square); the acts of affirmation  $\bar{S}_1 \rightarrow S_2$  and  $\bar{S}_2 \rightarrow S_1$  actualise the implicative relations (the deixes of the square). In the deep semio-narrative level of the square the contraries are not actualised by any operation<sup>59</sup>, nevertheless at the anthropomorphic level they correspond to the conflict between subject/anti-subject, the performance that manifests as the polemical dimension of a story.

In that respect, the objects are assigned values (attributed with axiologies), that are modalised in the external control space of the Dual Butterfly (the anthropomorphic discursive level of manifestations); this modalisation dictates the synchronic temporality of the dual Butterfly structure.

The axiological modalisation (or polarisation if seen in terms of the semic categories of the square) of the external place induces an irreversibility that is characteristic to natural forms since it is intrinsically dynamic, it allows the linking of evenemential (a level of dialectics constituted by functions and actors) syntax to the catastrophically schematised elemental taxonomy. The issue remains of how the semiotic square can be converted into actantial syntax.

## 4.2 The Actantial Model brought forth by Formal Conversion

Formal conversion, where conversion may be considered as a change of level, according to Petitot (Petitot:1989, 197), refers to the development and the translation of a taxonomic and paradigmatic interpretation into an actantial and syntagmatic description. As long as it does not account for the projection of the semantic axis onto the syntactic, or for the deep semes invested in object

<sup>59</sup>An operation is an actualised transformation.

values as manifested through modalisation , it is considered formal. Therefore, it is complemented by two other types of conversion:

- the conversion by duality, which deals with the transformation of semantic values into subject-object conjunctions, in other words the transformation of semantic articulation morphologies into relational actantial structures;
- the meta-psychological conversion dealing with the intentionality of subjects, the modalisations such as desire, the evaluation of the axiologies (truth values), and the thymic investments, amongst others.

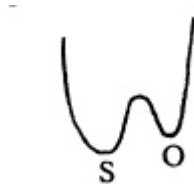
#### 4.2.1 The Syntagmatisation of the Actantial Paradigms

Greimas' anthropomorphic syntax found at the discursive narrative level is an evenemential syntax of operations of 'subjects of doing' to 'subjects of state'. The actants are defined in a relational manner, as positions of deixes (translated into positional values). Thus, they may not be found in an isolated state. Elementary structures of actantial interactions need to be considered as paradigms, schematised as EC's and interpreted as local systems exploring the minima of the potential, and as functions/agents (actants). The conversion by duality interrogates the relations between syntactic paradigms and paradigms of fundamental semantics. EC's as models conveniently allow for their syntagmatisation, as long as paths are traced in their external spaces and the crossings of the strata interpreted as events forcing the actants to interact. Thom's actantial graphs are ways to create scenarios from EC's.

Three types of relations, appear in the actantial level. The first concerns interactions of conjunction-disjunction between subject and objects, that are invested with values, and are narrative predicates of state [  $S \cap O$  conjunction, and  $S \cup O$  disjunction]. The second refers to the polemical nature of story, which syntagmatises the paradigmatic relation of contraries (performance). The third

deals with the fiduciary contract between the subject and a sender; the process initiating and facilitating the quest through a contract with the subject, and the sender-awarder validating the subject's return from the quest with the acquired object. This schematisation produces deep semantic categories by converting linguistic values to axiological values which are invested in the objects, converting taxonomic relations into predications of the system state, and the operations of fundamental syntax, formal and structural, into anthropomorphic doings (event-based syntax of action).

It is opportune to consider an utterance of doing realising an utterance of state of disjunction  $S \cup O$  into an utterance of a state of conjunction  $S \cap O$ . This utterance provides for the syntagmatisation to a certain modality the actual paradigm of subject-object ( $S-O$ ). It is most common to conceive this as a sub-schema in a catastrophic schema (much like the double Butterfly or Swallowtail discussed above). The catastrophic schema would need to display potentials similar to the following:



The transformation of the utterance may thus be schematised in the 'capture' type (Figure 16).

It has been shown that EC's are, by definition, modes for projecting the paradigmatic onto the syntagmatic. The introduction of paths in their external spaces transforms the synchronic taxonomic relations, which are the constituents of those paths to diachronic sequential chains of syntactic events. This exhibits the equivalence between the paradigmatic and syntagmatic, similar to

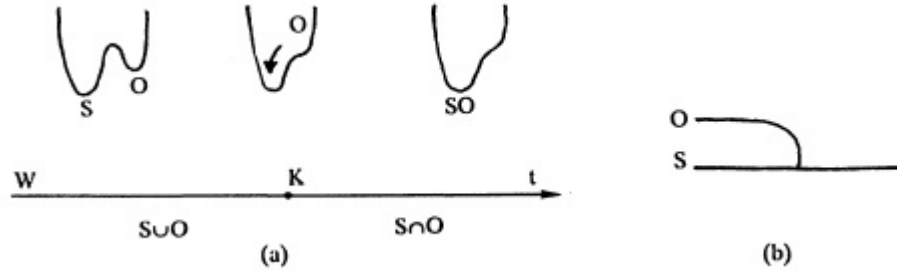


Figure 16: a) The capture event  $S \cap O$  (conjunction) corresponds to an external path in the external space of the cusp (see Figure 8).  
 b) The corresponding actantial graph for capture. The actants correspond to the edges; the syntactic events to the vertices.

the equivalence between the structural space and the paths which need to be traced so as to identify it.

Admitting that the ‘doing’ utterance corresponds to introducing time in a taxonomy, the formal conversion points to the schematisation of syntactic doing in such a way that is feasible to demonstrate the equivalence between syntactic doing and generic doing<sup>60</sup>.

#### 4.2.2 The Schematic Structure of Actantial Interactions

At its base the actantial model is the ternary term  $S/O/\bar{S}$  corresponding for the subject - anti-subject competing for the same object of value. Its schematisation should be described by the complex geometry of the Dual Butterfly. In this part as Figure 17 demonstrates, a typical plane section of the topology is under consideration, in order to describe a part of the Dual Butterfly geometry. Semiotically, this catastrophe is simple to describe, corresponding to the polemical narrative schema, describing the transfer of an object of value  $O$ ,

<sup>60</sup>The formal term that can be substituted for all elemental verbs of action that are responsible for the conversion of the organising centres of taxonomic relations into syntactic events.

from an anti-subject  $\bar{S}$  to a subject  $S$ . Following its synchronic temporality, the relation  $\bar{S}/O$  is organised by a cusp and  $O$  is captured by the anti-subject  $\bar{S}$ . The initiation of the proper group action<sup>61</sup> occurs by the introduction of a Swallowtail in the domain where  $\bar{S}$  is dominant. The newly emerged cusp organises a virtual relation  $S/O$  (a traditional narrative reference of this would be the ‘desire’ of the Hero to free the Princess). This is a virtual relation, which upon actualisation, interacts with the anti-subject  $\bar{S}$  in a ternary structure (Figure 17). In the diagram (Figure 17) may be seen that there are four co-localised domains:

- a central zone where three actants are active (triple point T)  $S/O/\bar{S}$  ;
- two domains of the Cusp topology where two actants are active  $S/O$  and  $\bar{S}/O$  ;
- a domain where two actants  $S/\bar{S}$  are active and conflict between their determination exists.

Following the dominance of  $S$  over  $\bar{S}$  the cusp  $\bar{S}/O$  is progressively virtualised in the domain where  $S$  is dominant and absorbed once more. Finally disappears and totally replaced by the relationship  $S/O$ , this translates to the subject acquiring the object of value. This diachrony is in principle reversible. Its irreversibility is an aftereffect of the polarisation of its structural space, making the relation  $S/O$  a repelling and  $\bar{S}/O$  an attractive one.

In the Butterfly schema as seen in Figure 17, the focalisation of the ternary relationship (  $S/O/\bar{S}$  ) to the relation of conflict (  $S/\bar{S}$  ) is defined by a reciprocal presupposition, where one contrariety (e.g.,  $\bar{S}/O$ ) presupposes the other ( $S/O$ ). The reciprocal presupposition exists not only between the actants, but

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<sup>61</sup>A group action of a group  $G$  on a topological space  $X$  is said to be proper if the mapping  $G \times X \rightarrow X \times X (g, x) \mapsto (gx, x)$  is a proper map, meaning for a compact set in  $G$  the inverses are compact. All points of  $X$  need to have compact isotropy groups.

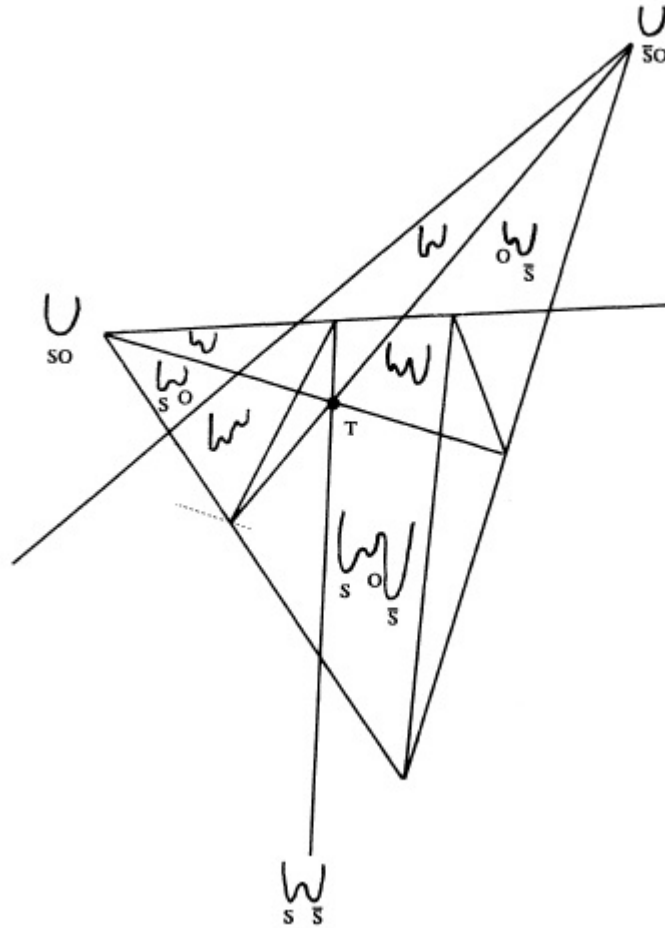
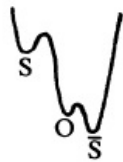


Figure 17: The investment of the double Butterfly by  $\bar{S}, S$  and  $O$ . Only some of the forms of the generative potential are represented

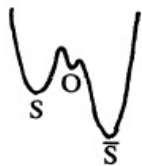
also between the antagonistic narrative programs. This prompts to the admittance of a schematisation of the notion of paradigmatic junction of Greimas and Courtes, precisely described as:

[T]he logical necessary concomitance of two utterances of conjunction and disjunction affecting two distinct subjects which are concerned with the same object. (Greimas and Courtes:1979, 165)

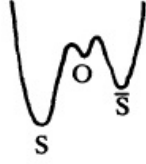
The proposed modelling approach may also account for the equivalence between the domination of  $S$  over  $\bar{S}$ , to the transfer  $\bar{S} \rightarrow O \rightarrow S$ , and explained in the following. Tracing a canonical path between the external space of the Butterfly, starting from the Cusp  $\bar{S}/O$ , and reaching the domain of the Cusp  $S/O$ , while passing through the ternary relation zone falling into the Swallowtail. The dominance of subject over anti-subject  $S$  and  $\bar{S}$ , unfolds gradually by the differences in the degree of disjunction  $S \cup O$  and  $\bar{S} \cup O$  as displayed as follows:



i) Weak disjunction between  $\bar{S}$  and  $O$ , strong disjunction between  $S$  and  $\bar{S}/O$

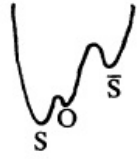


ii) Virtualisation of  $O$



iii)

Performance, domination of  $S$  over  $\bar{S}$



iv)

Reactualisation of  $O$  , weak disjunction between  $S$  and  $O$  , strong disjunction between  $\bar{S}$  and  $S/O$

Figure 18 demonstrates the canonical path  $\gamma$  on the geometry of the Butterfly.

### 4.2.3 The Variants and their Transformations

One of the main aspirations of the catastrophe interpretation of the actantial model is to demonstrate how variants appear during formal conversion, regardless of the invariant and archetypal nature of the catastrophe based interpretation. There are several paths  $\gamma$  that are not homotopic<sup>62</sup>, since the external spaces (  $W, K$  ) are multidimensional. The homotopy groups of the paths may be organised into variants and their transformations. In turn, they may be absorbed and change homotopies type, an indication of the occurrence of crossings of strata of co-dimension 2. The singularities then of co-dimension 2 are the organising centres of the variants' transformations. For example the crossing of the beak point by the Swallowtail would make the narrative passage from the

<sup>62</sup>One can continuously be deformed into the other. Another way of describing homotopy for the paths of the Butterfly (dimension 4) is continuously deforming one to another without crossing strata of co-dimension 2 yet without crossing boundaries between manifolds in a co-dimension 2 stratified space, a plane, for instance.



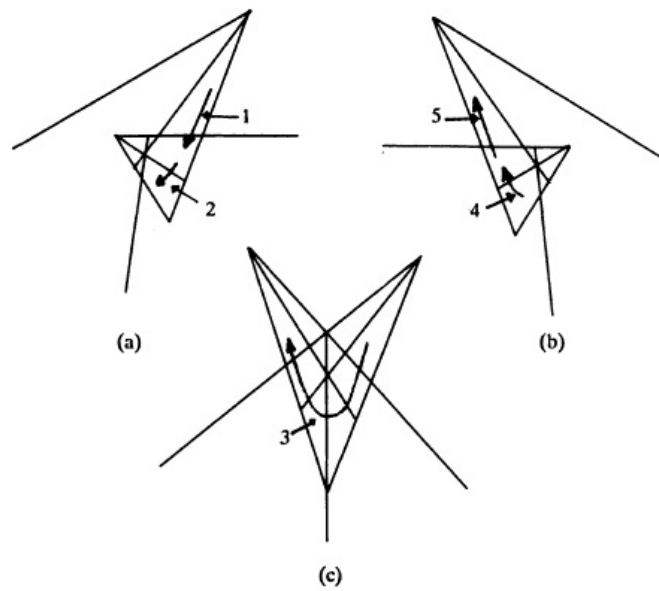


Figure 18: The path of equivalence between conflict and transfer.  
 (a) [1] Crossing from initial disjunction  $S/O$  to double disjunction (i)  
 [2] Virtualisation (ii) of  $O$   
 (b) [4] Reactualisation (iv) of  $O$  after the domination of  $\bar{S}$   
 [5] Crossing from the double disjunction (iv) to the disjunction  $S/O$   
 (c) Path  $\gamma$  projected on the central (ternary relations) domain of the Butterfly  
 [3] Conflict  $S/\bar{S}$

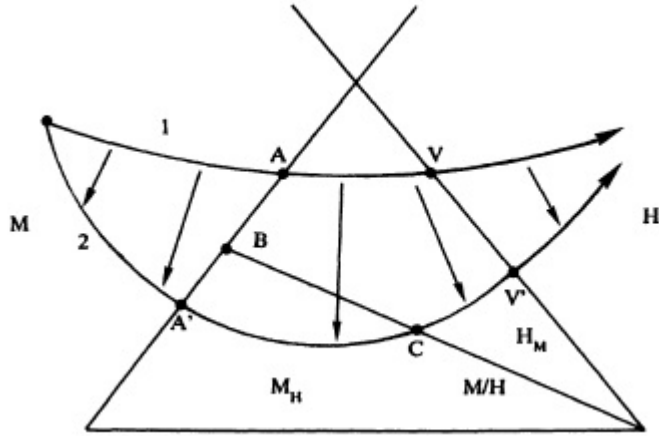


Figure 19: The Swallowtail as domain of the transformations of a hero (H). Path 1, shows the hero appearing as dominant (point A) and captures because of his hero qualities the anti-hero (M) at point V. Path 2 on the contrary shows H as a degraded version of its hero qualities. The path is now, after more complex modalisation s, more complex too. The hero appears dominated by M at A', involved in ternary antagonistic relation at point C, being victorious (is realised) at point (V'). Paths 1 and 2 are homotopic (common endpoints).

“Hero” with all the attributes this subject could expect, to a faulted version of the ‘Hero’, one with self-doubt and fear (See the analysis of *The Saviour* in 7.2.4 ). These semantic transformations are direct effects of a transformation of local contents (Figure 19).

### 4.3 The Conversion by Duality, the Schema of Transmission

Formal conversion offers few insights into the conversion of fundamental semantics (deep narrative levels) into anthropomorphic syntax. Therefore, it adds no information concerning the transformation of a taxonomic (categorical) structure with two semes (a constituted semantic category) into an actantial structure involving three actants (see the description of the actantial model above). To

proceed with an investigation into the framework of catastrophic modelling, the following two observations may be brought forth:

- if through conversion the realisation <sup>63</sup> of a seme  $s$  (a value), corresponds to a conjunction  $S \cap O$ , and its actualisation <sup>64</sup> $S$  to a disjunction  $S \cup O$ , then according to Figure 16,  $s$  identifies with the maximum potential separating the basins of  $S$  and  $O$ ;
- the semiotic square is schematised by the Dual Butterfly catastrophe, the actantial model by the Butterfly; the progression from an  $EC$  to its dual takes place by transforming the minima into maxima and the maxima into minima. (Petitot:1989)

Based on these observation, the hypothesis becomes that the values define thresholds that differentiate the subject-actants from the object-actants; the differentiation taking into account the co-locality admits to a duality of the values and the actants. To summarise, conversion by duality transforms the semiotic square into a paradigmatic actantial model, while formal conversion syntagmatises the actants into a group of variants.

#### 4.4 Meta-Psychological Conversion, the Schematisation of Desire

There is also a non-formal dimension to conversion; it deals with the intentionality determining and regulating the narrative programs of the realisation of

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<sup>63</sup>I would like to emphasise, that realisation according to Greimas and Courtes (1979), is perceived as the transformation which, from previous previous disjunction, a conjunction is affirmed between subject and object. A general notion in semiotics was that concerning states of being the ternary articulation virtual/actual/realised, is replaced by the category virtual/actual. Prior to their junction subjects and objects are virtual. In the framework of utterances of state and with the junctive function two typologies of relations are affirmed. When a disjunction exists between subject-object there is an actualisation, in the case of conjunction a realisation.

<sup>64</sup>As stated earlier this is the passage according to Greimas description “from a system to process”. As an example one can think of language as a virtual system which is actualised in its discursive manifestations.

values by subjects. Semiotically these subjects may be described either as subjects of *deficiency*, subjects of *quest*, and subjects of *desire*. The interrogation in this part concerns the degree to which catastrophic modelling can be developed into *dynamics of intentionality*.

Thom's model of predation and its pregnancy may provide an elegant solution. He describes predation based on the observation that one trait of animal regulation is functioning through actant catastrophes (predation, sexuality), rendering survival dependent upon actants other than the self. In relation to the ego, these actants appear as intentional objects, which are internal and immanent and from which the ego, as a subject of deficiency, is idealistically divided from. Being external objects, these forms (objects of intension) are biologically pregnant and perceptually salient. Their identification, by a predator, for instance, reprograms in turn the identity of the ego (e.g., the predator actant), triggering certain behaviors (attack, flight, seduction, amongst others). Thus, Thom recognised biological regulation as being syntactic and actantial; it externalises the semantic component of metabolism. Therefore, the catastrophes, including the actants of biological regulation, realise (through genetically programmed actantial interactions), the functional signification of the tissues that are differentiated by the catastrophes of embryogenesis, as Thom describes. Assuming this may be so, it is necessary then to establish a parallel connection between biological regulation and imaginary regulation manifested as grasping the meaning in semio-narrative structures.

In that sense the deep semes, primarily being interoceptive, then becoming proprioceptive, and in the next conversion manifest as thymic investments, were non-representable pregnancies or 'drives' so to speak. They could be grasped and subjectivised solely through the intermediation of an actantial localisation and diffusion, regulated by the circulation of objects of value in syntactic dis-

tributions.

The coupling of the deep semes with the figurative semes of the discursive level is analogous to the coupling of biological pregnancies manifested perceptively in salient forms that localise the manifested pregnancies. Hence, it may be said that intentionality is regulated by pregnancies; its realised object though is ‘released’ by figurative localisation . This neutralisation may be perceived as a definition of desire, which is not merely the lack of an object of value. It entails constrained intentionality (intention); these intentions are not pregnancies, but gradually spread figures of pregnancy. Such a factor introduces an irreducible gap between the state of being of an object, and its subjective significance, rendering an object of value as acquiring an axiological status. In myths, the axiologisation of values through a Sender actant, correlates with ontologising desire, i.e., interpreting the significance in terms of objective being, which is by definition an act of veridiction.

#### **4.5 Brief Conclusions**

The above models are by no means exhaustive, but do provide a comprehensive schematisation of the full narrative program as described in a basic structure of signification such as the semiotic square. The descriptions, as demonstrated, surpass several problematic areas met in traditional, formal attempts to an explication of semio-narrative structures. As schematic representation are abstract, but equally may inform computation given that the schematic representation becomes explicit. They are found in the basis of the analyses of the artworks in Part IV, and this type of schematisation was at the core of the conceptualisation and computational models provided for the narratives of the current portfolio. The use of the semiotic square as proposed by Greimas provided for the symbolic representations of the logico-semantic relations in describing a situation,

while these models provided for their transformation into objects of value and informing their possible evolution taking into account the descriptions of their systemic potential.

## 5 The Catastrophisation of the Case: the Construction of a *Case Scene*, Locality and Syntax

In this short section, the author recounts the reasoning behind the scenic arrangement of content as it is presented in the artworks in the accompanying portfolio. Here, the primary concepts underlying the principles of the narratives' scenic and spatial organisation, are coming from the notion of *case scenes* as described in *case grammars*, introduced by Charles Fillmore (1968) and reformed by John Anderson (1971).

The case understanding of grammar, was raised by Fillmore in an effort to overcome problematic situations where the surface grammar arrangements did not capture the deep case relations. With the concept of case scenes, functional information is no longer introduced in a configurational manner in the sentence, but in the sense of a scene, and deep cases are identified with functional categories selecting universal semantic roles. Case grammars admits to an explicit number of case universals (functional categories); some primary categories are:

- the *Agentive (Nominative)*, which is the case of the Agent, its state is typically represented by the verb, it is an animate entity;
- the *Dative*, is the case of the entity where the process is addressed to;
- the *Instrumental*, describes inanimate objects or forces which in a causal fashion participate in the state;

- the *Locative*, identifies the place or spatial orientation/direction where the state or process takes place;
- the *Objective (Acusative)*, is the case of the actant whose role in the process or state, is described by the semantic content of the verb.
- the *Factive*, is the case of the actant resulting from the action or stated identified by the verb, or may be understood as a part of the meaning of the verb.

Case grammars in their introduction by Fillmore (1968) presented several issues, it will be mentioned here, that these regarded ambiguities introduced in reproducing the notional content of the semantic roles, that resulted in a large number of case universals. An initial treatment of the situation was attempted by John Anderson (1971), and his localist proposal suggesting that semantic roles result from the composition of a small number of primitive cases which he named case-features (similar to the structural paradigm of Jakobson). He described these case universals as deeply rooted in the phenomenological experience of the natural world. Thus, proceeded in the deduction of cases in a way that they appear rooted in archetypal spatio-temporal interactions, the principle of locality, and on a second level interpreted them, in actantial terms describing the operation as polarity. Anderson's deductions manage to reduce the number of cases by:

- treating the case contents as complex structures that can be analysed to case features;
- identifying case features, based on a localist interpretation, with an explicit number of case universals;
- assigning to the verb the selection of case features;

- proceeding to elaborate the selections by the verb with a generative potential.

Nevertheless, the concept of a generative case system appears insufficient in understanding the origin and allowing the deduction of case features. The main reason is that the spatial features and local features are in term of the signification and not in terms of a geometry of space. A geometrical configurational resolution allows the isomorphic presentation of the relational structures, the actantial schemas, since the actants are reduced to pure positional values. These type of reduced actants may be called proto-actants.

Fillmore returned to the principle notion of case systems, aspiring to address the ambiguity of the initial proposal, regarding the distinction of deep and surface structures. His supplementary deductions revolved around the notion of *scenes*, as a capacity in order to formulate representations in language and decode them in novel situations, including the lexical and syntactic caliber of the forms of meaning. In his own words “I believe now that there might be a solution. It involves what I said earlier about meanings being relativised to scenes.” (Fillmore:1977, 72). The meaning of this phrase is that the human mind chooses to understand expressions by acquiring or activating scenes, or images, or memories of experiences; the words and the linguistic expressions have a classifying function in that setting. Therefore, in choosing a word or phrase, a larger context or framework in which the chosen expression has an interpretation is activated. Furthermore, the meaning of elements appears to identify in a simultaneous fashion ‘figure’ and ‘ground’, in the words of Fillmore (1977). In the act of interpreting an expression, a sense of a background scene and a perspective on that scene emerge. The ensemble of the potential expressions describe a wholistic sense of the scene, but particular aspects are brought to the foreground through explicit perspectives.



## 5.1 The Scenic Conception of Case and the Distribution of Actantial Roles

Case grammars deal with semantic structures that operate as filters in the transformational trajectory of thoughts into language. Hence, they account for the organisation of human knowledge about reality in terms of fundamental concepts such as causation, time, and space, among others. A unification, thus, is required between the semantico-cognitive representations serving as inputs to the transformational trajectory, and the syntactic relational structures that are the schemas of the transformational process.

## 5.2 The Locality Principal in Narrative Semantics

The morphodynamical schematicity of deep actantial interactions gives a rigid support to one of the primary hypothesis found in linguistics, the *localist hypothesis* (LH). This hypothesis claims that the grammatical relations signifying abstract actantial relations grammaticise the spatio-temporal interactions of spatio-temporal actants, meaning actants that may be reduced to their local positional values. In that sense, cases appear as grammatical and local determinations. This allows for the substitution of a the logical and formal descriptions of syntactic relations, into schematic and iconic spatial descriptions. LH suggestions appear as a hypothesis for natural language. They concern the topological dynamics of actantial structures and the cognitive nature of structural syntax.

## 5.3 The Mathematisation of the Scene, Catastrophes and the case of Case

It has been demonstrated mainly by Wildgen (1982) and Petitot (1992), that the morphodynamical models can adequately mathematise *case scenes*. Their efficacy in reducing actantial interactions to geometrical configurations of de-

terminated positional values is demonstrated in sections three and four of the current part. In general, CT proposes a morphodynamical schematisation of actantial interactions. The Thomian views outline the association of an abstract structure that is objective and syntactic, to spatio-temporal processes involving actants. By reducing actants to their locations i.e. the actantial graph, CT interpretations exhibit both objective and syntactic valence. The actantial graphs described in sub-section 4.1, are considered archetypal. By interpreting the stable local regimes as actants, a semantic interpretation is attainable, expressed in normal language and reflecting the qualitative notion of the archetypes. When the external parameters are purely spatial, then the catastrophes are taken as substantives, while with the introduction of temporality they are interpreted as verbs.

These archetypal syntactic morphologies converge with case grammars and offer a general theory of regulation and stability in structural terms. The archetypal catastrophic graphs define a common generating potential in relation to the actants, facilitating their reciprocal determinations, meaning their structural order and their interdependency is defined as positional values. The morphodynamical models are paradigmatic, but their conversion, by introducing a temporal dimension in terms of paths and directions, is feasible and can be considered a formal approach to converting the syntagmatic dimension to a paradigmatic dimension.

These traits, are according to Petitot (1992, 2011) the reason that morphodynamics provide “[...]a natural mathematisation of the theory of cognitive scenes” (Petitot:2011, 241). Fillmore’s deductions of a case scene, leads to a division in two components. One is that of the context entail in a semantic field associated with a scene, and the other entails the actantial profile and relations entailed in the case frames. Thus, the topological interpretation of case gram-

marks situates the semantic roles (actants) in a localist fashion and their content is no longer semantic but schematic. In that sense a scene  $\Sigma$  bears the following components:

- an isotopic semantic field, that contextualises the content of the scene and is irreducible to a localist interpretation;
- a global scheme  $G$ , i.e. the archetypal actantial graphs, defining the interactions between the deduced positional actants; the actants  $P_i$  correspond to the positional translation of case roles (e.g. source, object, agent, instrumental, goal), and are situated in an abstract, topological external space  $\Lambda$  basal to the scene;
- and specialisations of the positional actants  $P_i$ , transforming them either to places or to effective actants (actors, forces, objects, etc.).

Hence, a scene semantically and conceptually attributes determinations to the semantic roles, and at the same time determines them configurationally.

Topologically the scene  $\Sigma$  is spatio-temporally localised in space-time  $R^4$  through the embedding  $j : \Lambda \hookrightarrow R^4$  of its external space  $\Lambda$  in  $R^4$ . The embedding  $j$  defines the specialisations of the actants in places, thus becoming purely spatio-temporal actants, while the effective actants are defined in terms of locality. The localisation, relating to the effective actants that correspond to verbs and actions, is linguistically expressed through adverbials complementing the verb.

An explicit, small number of archetypic schemes determine the case universals. The universal scheme  $G$  is a composite of such local archetypes. In that sense, Fillmore's description of a perspectival structuring of scenes, consists in constructing the global scheme by combining these local archetypes. The archetypes are selected through the verb's valence and the case schematic de-

scription, while the semantic context of the verb modulates the scene in whole. There is a minimal part of the global scheme  $G$  that needs to be covered in order for a scene to be described effectively, and the determinant aspect of this is labeled by Fillmore the “saliency hierarchy”. The saliency hierarchy of a case determines the way in which the actants of an archetypal locality selected, is situated at the surface level by grammatical relations. These nuclear surface descriptions are the input for transformational processes.

## 5.4 Methods and Tools

The morphodynamical models to be implemented belong to the general category of complex dynamical systems. Complex systems display global emergent characteristics, resulting from the underlying collective interactions between their components (Petitot:2011). The relations between the components of the system are either competitive or cooperative (*ibid.*).

The mathematical tools to analyse systems as such and their componential interactions are: non-linear dynamical analysis in terms of attractors, structural stability, and bifurcations, self-organising criticality (*SOC*), cellular automata, genetic algorithms, and sub-symbolic algorithms among others. These algorithms provide tools for the understanding of the statistical and computational properties of complex systems.

The analysis of complex dynamical systems is enabled, as the opening statement of the current document outlines, by the mathematical, theoretical and technological progress of the last few decades, rendering the simulation attainable, and providing a type of experimental data, for phenomena that can not be measured or reproduced in a lab, using virtual simulation and computation.

A variety of tools, in order to allow for assessments of scenic content (of different media type), has been developed according to dynamical mathematical

models throughout the research period. These tools detect, analyse and regulate objects, relations, and processes of the deep components of the presented narratives, and in terms of a systemic approach, correspond to the internal and external space regulations in a particular narrative system.

The general strategy for determining a morphological content assessment is based on the cognitive grammars' perspective that concepts are construed as 'fillings' of extensive forms with intensive qualities. This is according to Petitot an "exact definition of morphology" (Petitot:2011), in his own words a "morphological approach to concepts" (*ibid.*). Morphological assessment is brought forth through cognitive scanning that detects qualitative discontinuities in qualitative spaces.

Langacker offers morpho-cognitive explanations to meaning appearing in natural languages in terms of *Things*, *Relations*, and *Processes*. He admits to a profile/base distinction on the salient referents of a scene, similar to the gestaltic figure/ground opposition; the base is a cognitive structure from which the referent of a semantic structure is detached forming a figure on a background. The figure possesses a profile that functions as the focal point, and it is identified as the contour separating a thing from its background. Based on these descriptions a thing is a region in a domain. Cognitive scanning then, tracks the spatial and qualitative differences between two positions in the domain, and in the process boundaries are defined. The relational profile describes the asymmetrical association between the salient figures, the *trajectors*, and the rest of the elements that belong to the background and are referred to as *landmarks*. According to Langacker, all static relations may be reduced to four basic conceptual relations: identity, inclusion, separation, and association. Finally processes, are considered the temporal sequences of the profiled relations and correspond to what has been referred in this thesis as the schematisation of processes and action. It

may be understood that the descriptions here, in terms of the cognitive process of scanning, refer to a spatio-temporal morphological assessment of perceived content. The cognitive views may be considered as the subsequent postulations to case grammars proposed by Fillmore and discussed in Part II and III.

To this issue of spatial segmentation, once more the description of morphology as a system of boundaries, attributed to Thom, offers a satisfactory mathematisation. His topological formalisation of morphology has been described by the author in an article for *Organised Sound* (Giannoukakis:2016), and suggests that:

Given a material system  $S$  occupying a spatial domain  $W$ , the form of  $S$  manifests through a set of detectable qualities  $\{q_1(w), \dots, q_n(w)\}$ . These are characteristics of the internal states  $A_W$  of  $S$  at every point  $w \in W$ , and acquire their values from associated quality spaces  $Q_1, \dots, Q_n$ . The spaces refer to a quality such as color, texture, etc. When  $w$  varies smoothly in  $W$ ,  $A_W$  exhibits smooth changes also; As long as,  $A_W$  is the actual state, then the functions  $q_i$  vary smoothly, but in the case that  $A_W$  bifurcates towards another state  $B_W$  and  $w$  crosses a critical value, then some of the  $q_i$  functions present discontinuity. Thom names as *regular* the points  $w \in W$  where locally all quality functions  $q_i$  vary smoothly, and *singular* the points where locally the quality functions present discontinuity. The set of regular points  $R$  is an open set of  $W$  and  $K$  is its complementary ( $K = W - R$ ), a close set constituted by all the singularities. The set  $K$  is considered the morphology produced by the internal dynamical behaviour of  $S$ , and segments  $W$  into regions.

All the feature-tracking and analysis tools implemented to classify content presented below, possess a primary design principle attributed to the above general topological description of morphology.

For Thom, the qualitative discontinuities are phemenologically dominant,

and since the system  $S$  exhibits critical behaviour at the singularities, which are also critical values of the control parameters of the system, a general mathematical description of morphology manifested in general systems may be extended to a general theory of critical phenomena and symmetry breaking. Hence, the admission of the geometrical description of the structure  $(W, K)$  may be also a geometrical description of phenomenological segmentation and *eidetic reduction*<sup>65</sup>, as they are proposed by cognitive grammars and the Husserlian “experimental phenomenology” (Petitot *et al.*:1999, Albertazzi:2013) before them.

To delimit the segmentation of a space from its underlying mechanisms, a scale of observation must be chosen and determine an internal dynamical function  $X$  defining its internal states. The phase space  $M$  of  $S$ , is a differentiable manifold whose points  $x$  represent the instantaneous transient states of the system. The phase space is also called the *internal space* of the system and  $X$  appears as a flow on  $M$ , i.e., a system of ordinary differential equations  $\dot{x} = X(x)$ . The smooth vector field  $X$  is considered the *internal dynamics* of the system, and its internal states can be modelled in terms of the attractors of  $X$ . An attractor can be considered a neighbourhood that asymptotically attracts every point  $x$  of the flow  $X$  belonging to that, or a sufficiently close, neighbourhood. Since only one state of the system can be actualised at a time, there necessarily exists a selection function  $I$  that selects one internal state  $A$  from the potential internal states of the system.

The control parameters of the spatial domain  $W$  that also control the system  $S$  is the *external space* of  $S$ . The flow  $X$  on the internal space of  $S$  is parameterised by the external points  $w \in W$  and varies smoothly in relation to them.

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<sup>65</sup>The examination of a mental object in terms of primary and invariable components that define it. A relevant process is that of *eidetic variation*(Petitot *et al.*:1999), described by Husserl, and involves the imagistic mental reconstruction of the object and imagining its varying features under transformational operations. The process results to the reduction of phenomena to their essential attributes.

Since the above morphodynamical model can be easily translated to a physical description, the process of transcending to surface level phenomena from deep level descriptions, is determined by:

- choosing an appropriate scale of observation that provides a smooth approximation of the local dynamics;
- qualitatively assessing the internal dynamics and interactions;
- finding observable features (qualities) that describe the internal space of the system;
- transforming the morphological assessments, that are geometrical, to phenomenological states; this process is brought forth by the explicit correspondence between the reduced morphological form, result of feature detections and tracking, and the mental, schematic forms resulting from the cognitive process of eidetic reduction.

Revisiting the steps for *transconsistent composition* of artistic, narrative forms as proposed at the beginning of this part by the author, they may be reformed to align with the general morphodynamical model (Petitot:2011) as follows,

- Identifying internal dynamics and internal states of a system;
- setting the selection criterion of properties;
- defining the external control space;
- outlining the field of dynamics;
- identifying qualitative discontinuities and specifying morphologies;
- detecting critical singular points;



- determining the system's structural stability;
- categorising the morphologies retrieved;
- considering temporal paths in the control space and identifying fast and slow dynamics;
- determining the Lyapunov and identifying dissipative dynamical behaviours;
- reducing the description to gradient systems (attractors and gradient-like dynamics).

CT proposes that for a non-linear system of four control parameters, or less, there are only seven different types of qualitative changes (EC's) that the solutions can undergo. Since, these systems can describe not only natural, but also cognitive and narrative systems (Petitot:1992, Petitot:2011), as proposed in this part, then the design of a non-linear multimedia network with four control parameters, or less, is adequate to model a plethora of narrative phenomena and content, using a limited number of classes. Particularly here, it has been demonstrated that the topology of the Double Butterfly is sufficient to capture the full development of the semiotic square and the intricacies of a complete narrative program.

It is indeed considered difficult, since *X Short Stories* was conceptualised as a system of relations primarily, to dissociate the tools used for the modelling and regulation of the environment from the regulated employed content. Consequently they are mentioned in this part, since the *imprint* of the regulation functions may be distinguished on the communicative form of their content. These tools regulate content in two levels, the first level of analysis refers to qualitative regulations of content, and the second of the parameter space. One can think of the first and second derivatives of a tracked feature in a time series for instance, the first tracks stability of the time-series describing a content

value, the second tracks the quality of the changes and provides information on the ‘energy’ the qualitative changes of content require. The tools used to represent and communicate the relationships between the media content and in general the information constituting a differentiated (*narrativised*) conceptual domain (or more) regulating a narrative, are of three basic types:

- tools relevant to detect and measure observable features on the material, they are related with segmentation, integration and eidetic reduction; examples are: filter decomposition, Laplacian operators, and Gaussians providing a low level analysis, which results to contour extractions, skeletonisations, distance fields as descriptions of space, triangulations etc.;
- containers for storing, transferring, and processing content; these are frames, volume containers, vector fields, and particle systems among others (relevant videos found in Appendix 5);
- and operators that are statistical, propose some type of dynamical mapping, or alter the temporal dynamics of a tracked time series.

The first type of tools, deals with outlining, following, and manipulating detectable, i.e., measurable content features and creating trajectories, such as those found in Figures 20 and 21, from the dynamics and their temporal evolution; these form the flows of the internal system space. The implementations of the second type act as containers; these are able to enclose the content representations, and allow numerical operations to take place. They are either frames of different dimensionality, for instance one-dimensional audio frames, two-dimensional or three-dimensional, and even higher dimensionality textures containing in the extra dimensions feature-tracking meta-data, and all the additional scenic information retrieved by the morphological analysis. The containers have a spatial component, aural or visual, and may be directly translated to

areas where content manifestations occur. Then the analysis frames refer to volumes, vector fields, particle systems and in general abstractions of salient surface forms. These objects contain all the explicit information concerning a (usually significantly small) ‘chunk’ of the tracked material. Operations on the content enclosed in the containers, manifest as transformations on the perceived visual and sonic material, or as regulations of the narrative components whatever they may be in terms of their medial identity. In terms of their topological stature these containers represent the phase space of the system, while their content values the flows in that phase space. And while these individual complex components are conceived as the partial phase spaces of the system corresponding to each narrative component, the final screen-space or the performance-space as manifested, may be considered as the all-inclusive phase space of the communicated narrative system and its salient forms as attractor areas in that space regulating the flows.

It may be observed that the morphology of the algorithms that make these local representational operations possible, for instance, algorithms operating on the principle of difference between ‘frames’, could be particularly efficient in detecting differences in states on the surface level material given that a suitable interpretation of the local changes to global morphological estimations takes place. One approach to global assessments, used frequently in this research portfolio, is polynomial fitting of the time-series of tracked features. Depending on the degree of the polynomial curves, different observations can be reached that reflect the overall energy dissipation or accumulation of larger narrative sections and not just the small chunks of content where the analysis takes place. These energetic estimations provide, in turn, valid predictions of changes of states that correspond to larger narrative segments. Transformative operations as that just described may be considered as an example of a statistical operator.

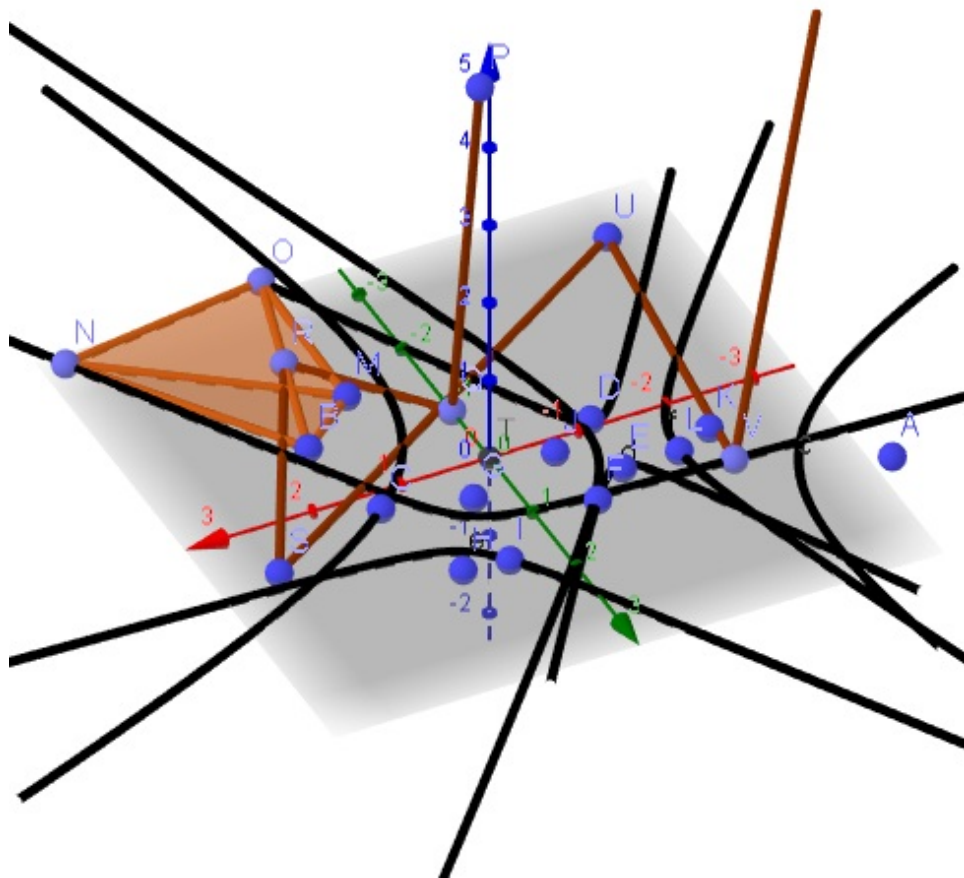


Figure 20: Isolines and elevation values from the two dimensional projections of extracted trajectories from content analysis; The contours are used as boundaries defining stage topology.

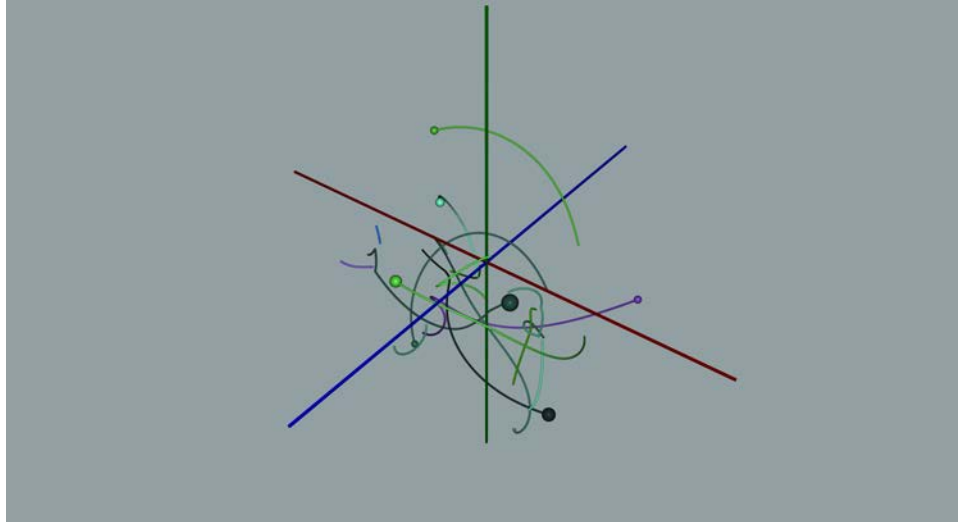


Figure 21: Paths and trajectories in three dimensional space, defining the performance stage topology (see Figure 20)

It must be stated that many of the suggested processes below (part of the morphodynamical routines), eliminate the details while creating new compressed<sup>66</sup> (in terms of the information entailing) temporal forms. In that sense provide extra information for a complex scene and bring singularities<sup>67</sup> to the foreground. The new information enriching an initial scene ultimately reveals meaning that is conveyed in it.

#### 5.4.1 Space Segmentation

The initiatory comment in this sub-section is that space segmentation is a process mainly based on the Laplacian differential operator, while space integration is primary based on propagation (diffusion) of space through fields of oscillator networks, i.e., periodic, semi-periodic, or chaotic attractor networks. The tools developed to bring forth these operations are described below, starting with the

<sup>66</sup>Binary images or spectral representations of amplitude and phase for instance.

<sup>67</sup>Zones of influence, boundaries, skeletons, critical points, force and velocity fields etc.

space differentiation tools.

The tools presented underneath are multi-scale shape processing routines that normally smooth a signal at different scales while retain and outline sharp variation points attained from their first and second order derivatives.

The multiscale processes proposed underneath are basic structuring schemata corresponding to scale-invariant space partitioning as carried through by grammatical elements such as deictics (Petitot:2011). The characteristic of these elements is that they are able to handle relations regardless of the scale reference (magnitude and volume invariance), as well as choose specific morphological features by geometrical data reductions decisive for scenic placement and categorisation. In addition their function is to trigger transformational routines on the objects and their composition in a scene such as expansion processes.

**Edge Detection (Magnitude invariance)** is a basic low level process based on zero crossing detection<sup>68</sup>, capable of extracting the singularities in a signal through Gaussian smoothing and edge tracking<sup>69</sup>. The singularities are sharp variations that represent discontinuities found around the ‘zero-crossings’ of the processed signal. The detection of the ‘zero-crossings’, is a natural way according to Marr (1982: 67) of transforming a continuous, analogue stream of content into a discrete, abstracted, and symbolic representation. This type of transformations reduce an image or a sound into a compressed version based on their intrinsic characteristics. Edge detection enables the reconstruction of the whole signal from the detection of its edges in an objective manner, since it is relying on the signal’s morphological profile. The sharp aspects are singled out,

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<sup>68</sup>The detection is based on wavelet integral analysis which measures the variation of a signal smoothed at scale in a neighbourhood proportional to a scale coefficient. A common smoothing operator is the Gaussian and when the variation of the convoluted signal is sharp the first derivative describes an inflection point, while the second derivative (the Laplacian of the Gaussian convolved signal) at that point presents wavelets in the form of zero-crossings surrounded by two peaks of opposite signs.

<sup>69</sup>Usually performed in one step by convolving the signal with the Laplacian of the Gaussian function.



Figure 22: Edge detection

while other qualities are smoothed or eliminated. The detected edges define the boundaries of external objects, the limits where qualitative discontinuities appear.

**Extraction of Global Contours** is the step following the edge detection, and is based on the integration of the local qualitative differences detected by edge detection techniques. These contours are essential for the topological classification of the scenic content and for the space propagation techniques described below.

**Contour Diffusion (Expansion routines)** is a process based on scale-space analysis deeply influenced by the biological mechanisms as found in the biological visual system functionality, and the physical aspects of the signal.

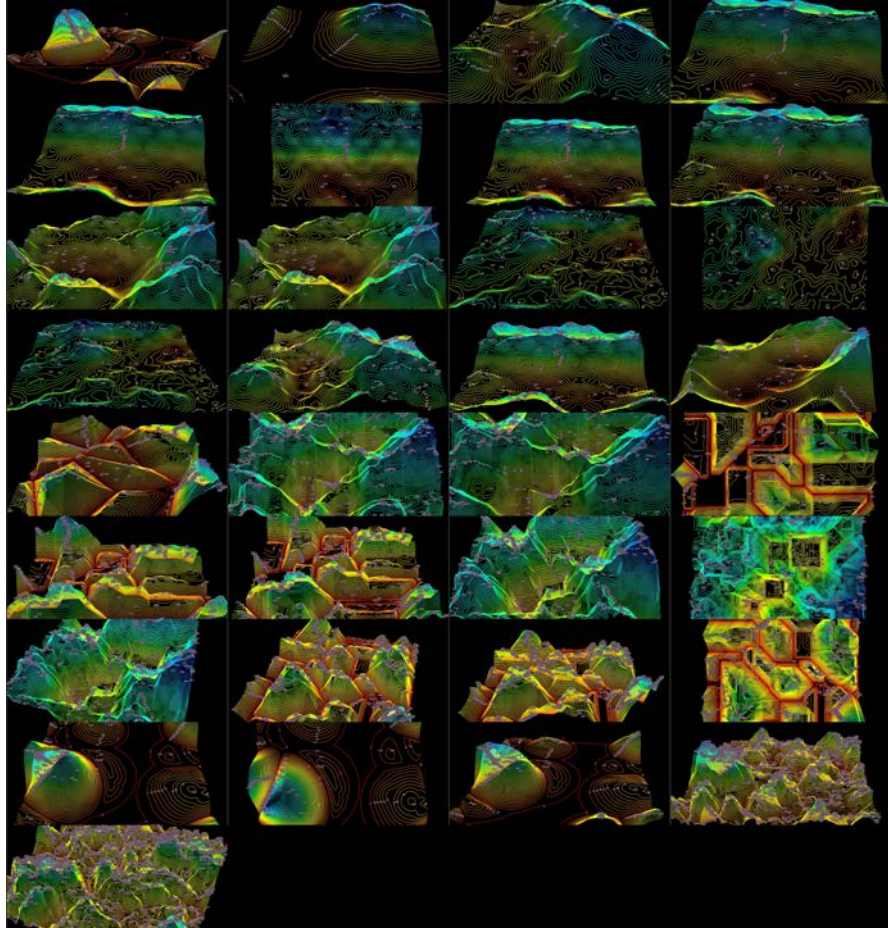


Figure 23: Global contours extracted with positional values. These extractions are used as stage-topology. The values are results of feature extractions.





Figure 24: Contour extraction and Skeletonisation facilitates the dynamical projection on a performer's body (*the Fallen*)



Figure 25: Edge aware contour diffusion

The scale-space representation of the signal produces a scalar representation of smoothed signals versions that is parameterised by the smoothing kernel (usually a Gaussian) used for the suppression of the information. Anisotropic techniques are preferred in order to retain the information of the contour edges.

**Skeletonisation (Volume invariance)** is an extremely useful transformation for constituent analysis as it simplifies the form into a one-dimensional projection rendering the analysis of it easy. Skeletonisation is a process resulting from the diffusion of the contour inwards, resulting into an intensity function. The crests and ridges that are the results of the diffusion, are extracted by an anisotropic diffusion equation retaining the and enhancing the sharp variations. This process is a natural approach in providing for a form's parthood irrespectively of the form's complexity. It is considered a basic mereological algorithm.



Figure 26: Laplacian blur diffusing the extracted contours



Figure 27: Anisotropic blur the contour edges are retained

Skeletons schematise a form while conserve important structural features of it.

**Triangulation Techniques (Morphological Invariance)** are fundamental algorithms in computational geometry used for the tessellation of curved geometries, as are described by splines. They provide a horizontal decomposition of space, and also inform on the convex hull differences (relevant video found in Appendix 6).

**The Audio Processes** that serve similar purposes as the low level extractions outlined above, are similarly low level features extracted from the audio signal either from its spectrum or from its time-based representation. The developed modules operate in sample rate ( $sr$ ) and are: zero crossings detection, running average of frame, frame minimum, frame maximum, spectral brightness, spectral roll-off, spectral centroid, spectral variance, inflection points detection, formant extraction, spectral partial selectors, and several types of spectral smoothing modules. These modules correspond to low level features for the visual domain.

Rarely are these modules used on their own, the usual practice is to use a combination of them in order to provide a more complete description for the analysed signal (video demonstration of audio feature extraction modules are found in Appendix 7).

#### 5.4.2 Space Integration

Integrative mechanisms are employed in order to generate global structures using the results of the local procedures described above. They are triggered by the space segmentation processes, and solve the problem of space integration by expansion and diffusion-propagation processes originating from the salient

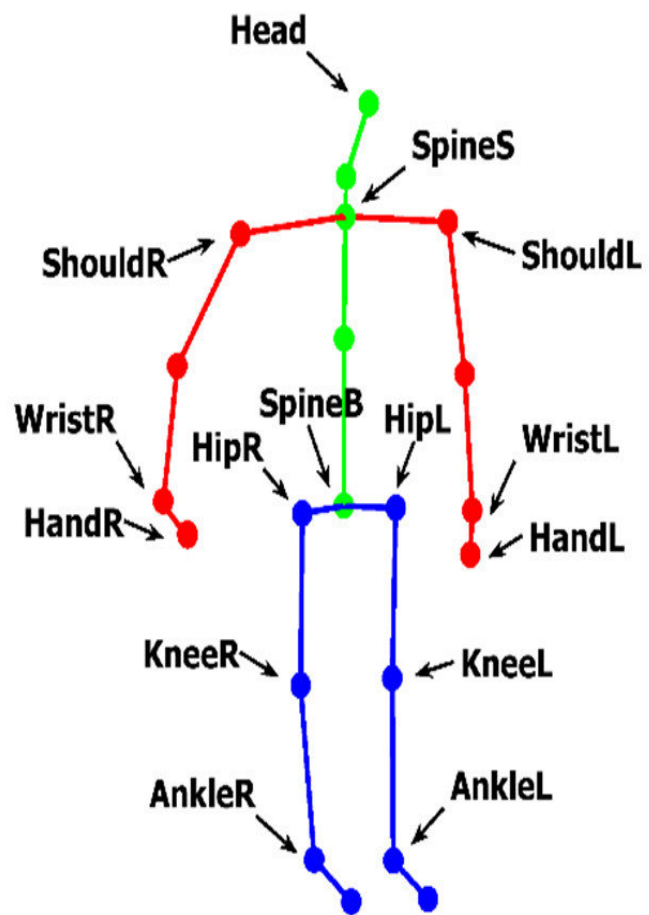


Figure 28: Skeletonization of a human body (stick figure). Only the medial axis of the form is taken into account

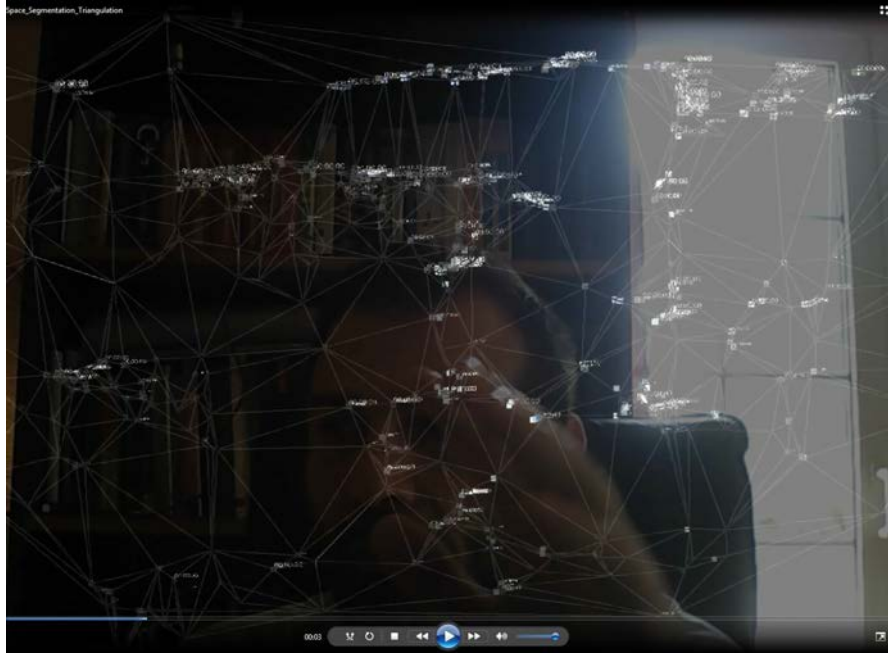


Figure 29: Real-time space triangulation

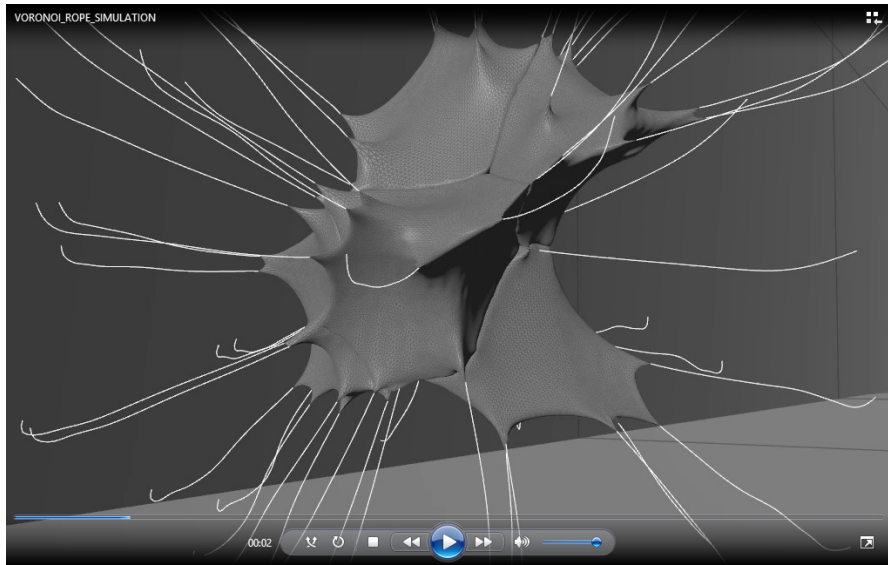


Figure 30: 3d space triangulation with Voronoi

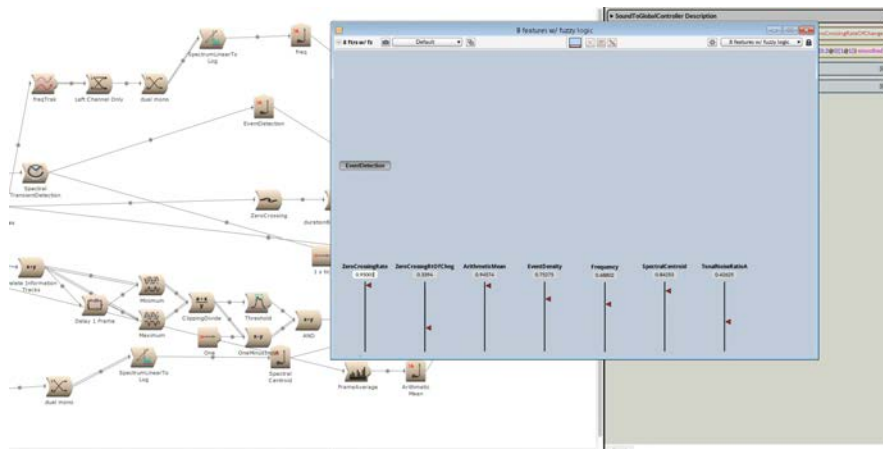


Figure 31: A combination of real-time low level features extraction in Kyma

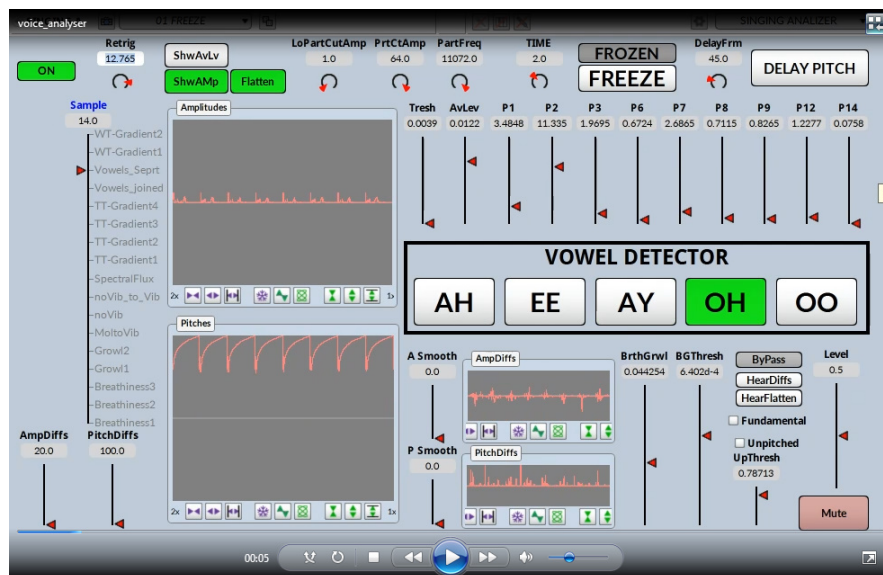


Figure 32: A vocal feature extraction tool in Kyma, extracts values for the vocal quality (vibrato, breathiness, growliness, etc.) as well as vowel detection



features of a form, e.g., its contours. The contours, for instance, can either be excited and extend or intend in a inhibitory fashion, and through waves create wave front singularities and wave front collisions. In that sense, contours are considered active elements that either trigger diffusion-propagation processes, or inhibit the effect of those coming from other sources. The results of the diffusion-propagation are new geometrical forms, mainly singularities and are carried through concealed in the perceptual information of a scene.

Below some of these processes are described as implemented either for framing conceptualisations within geometrical, topological description, or implementing the actual surface forms, or aspects of them as they appear in the manifested artworks.

**Diffusion Processes** represent the movement from high energy or concentration zones to regions of lower concentration, driven by the gradient descent of the energy, concentration or any other parameter determinant of the process in most cases in terms of the distance travelled. In terms of spatial distribution, diffusion processes point from confined, small domains to larger domains, thus may be a qualifier for space topology. In cognitive terms diffusion may inform on the locality of a domain. (relevant videos found in Appendix 8)

**Cellular Automata** are discrete, abstract computational systems that are useful as general models of complexity, and as explicit representation of non-linear dynamics. They are spatially and temporally composed of a finite set of simple units, the *cells*. They provide insights on how simple local rules and simple units can display emergent, complex behaviour. (relevant videos found in Appendix 9).

**Distance Fields** or *distance maps*, are a very efficient approach to an integrated approach of space including explicit information of each point to its

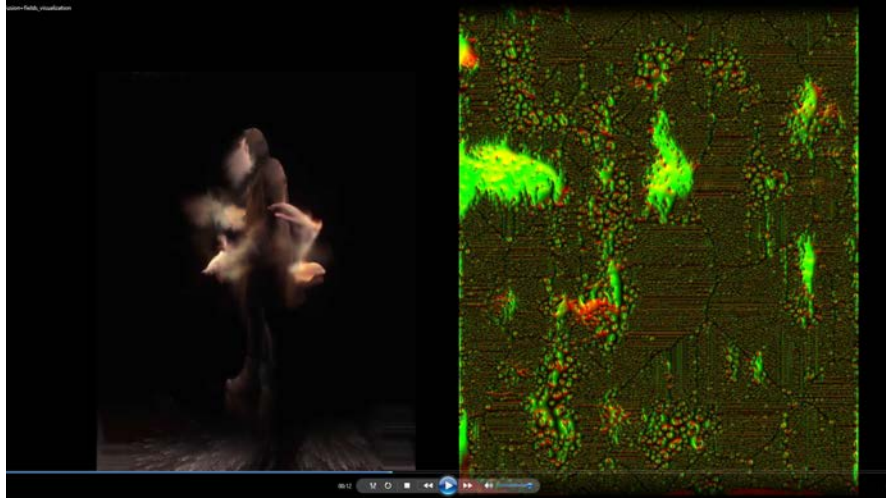


Figure 33: Diffusion propagating space (left), visualisation of the diffusion field (right)

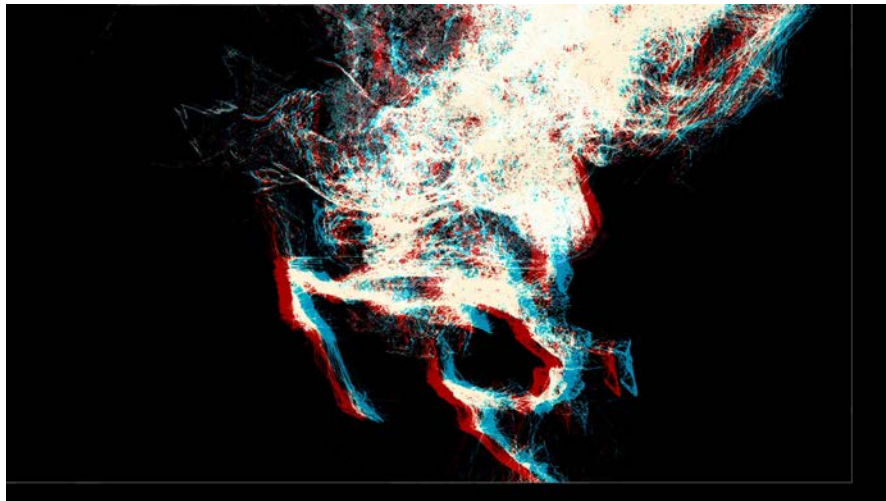


Figure 34: 3d diffusion from the artwork *Dolores*

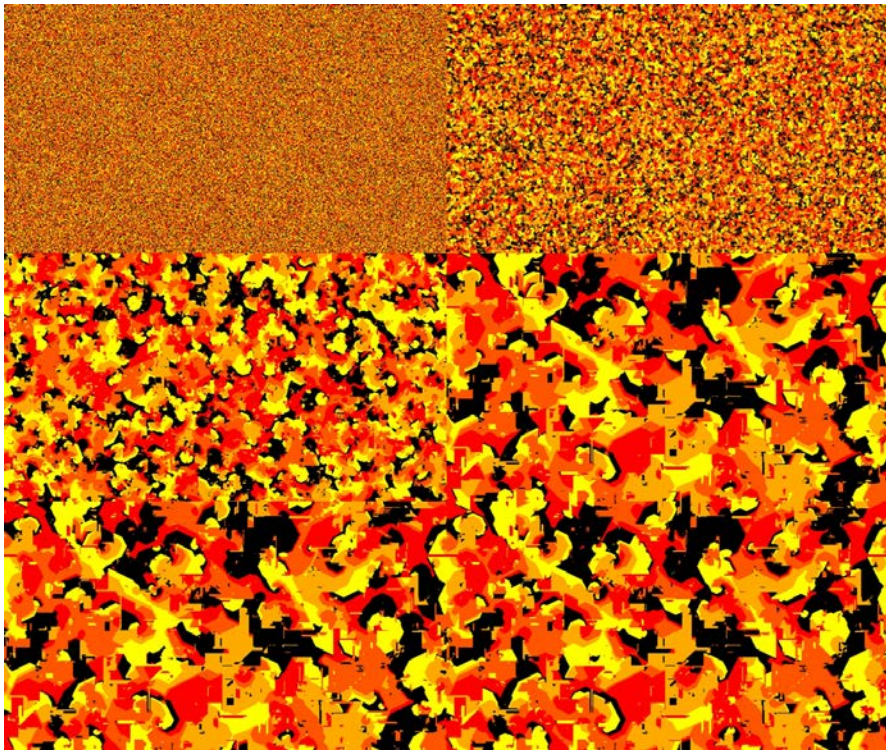


Figure 35: Cyclic cellular automata 300 generations

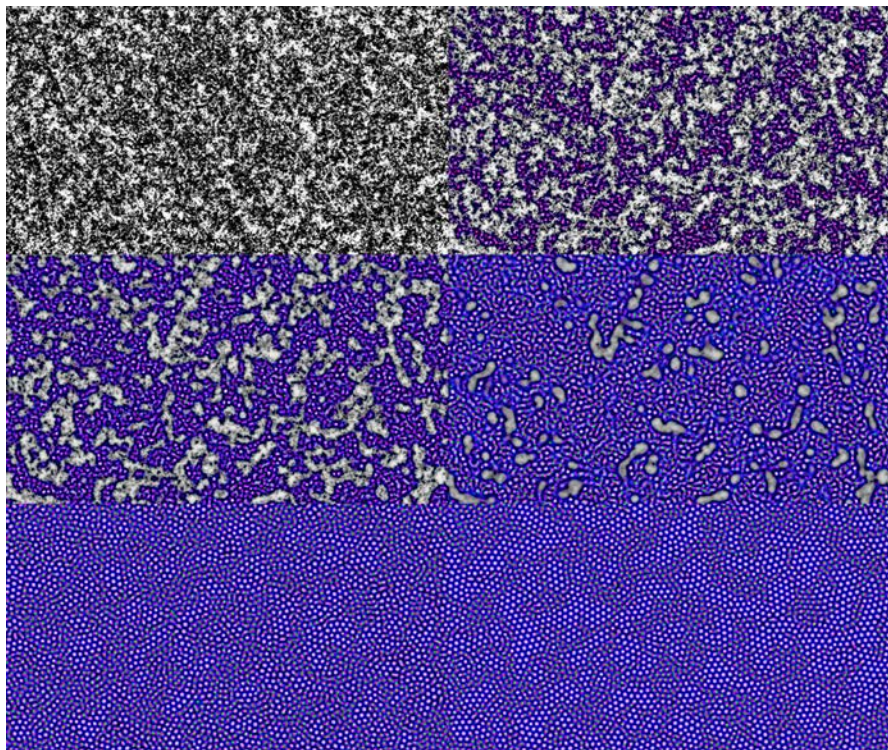


Figure 36: Multiple Neighborhood Cellular Automata 1200 generations

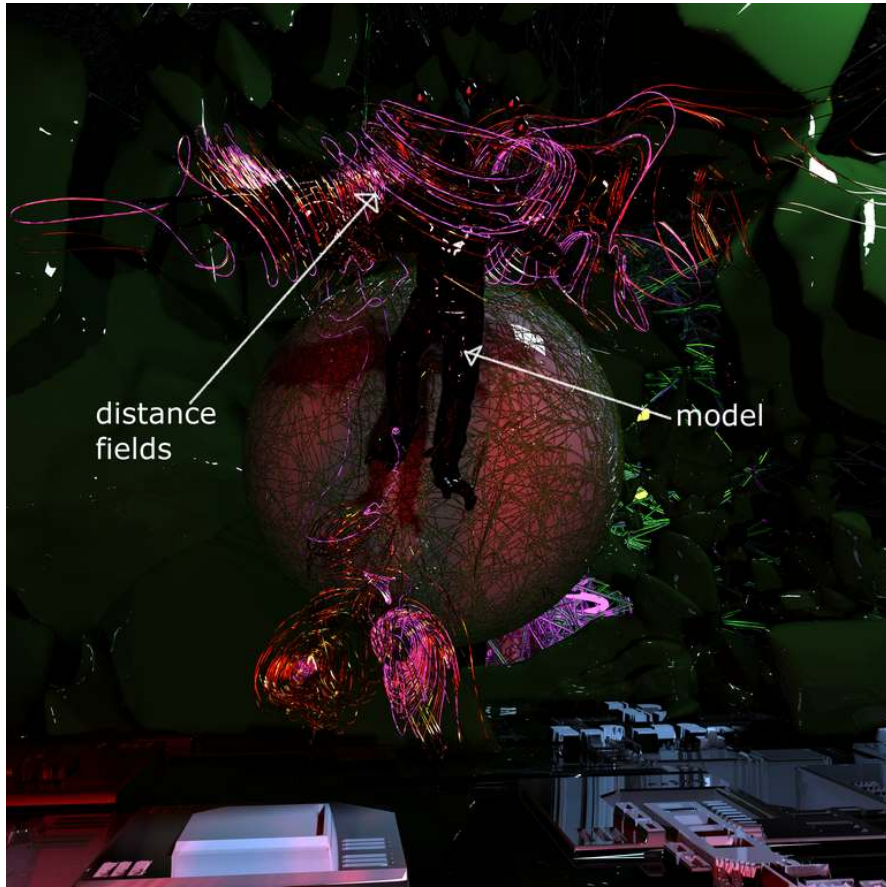


Figure 37: Distance fields generated from a 3d model. The model and the resulting distance fields are displayed by white arrows

distance from boundaries and contours in that space. Distance fields, provide information enabling and enabled by skeletonisation, and may even perform path-finding operations in a space. Distance fields, are extremely flexible in that they can provide a basic topological arrangement for individual objects, the field around an attractor area, or for the whole space an object is entailed, the vector field this attractor belongs to. Hence, distance fields inform on the structure of space in relation to the objects entailed in it.



Figure 38: The 3d model was analysed and transformed into a distance fields representation. Ribbon particles using the distance fields representing the model form were introduced.



Figure 39: To the above model an additional vector space was superimposed modulating the final form of the structure.

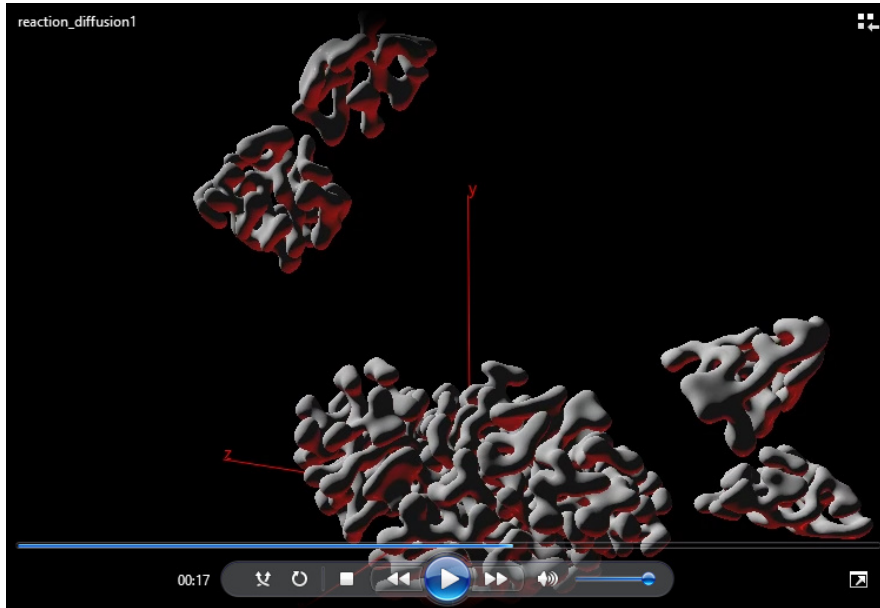


Figure 40: 3d reaction diffusion

**Reaction Diffusion** models pattern formation phenomena in systems consisting of many interacting components, and they are used to describe a variety of biological, chemical, and physical systems. (relevant videos found in Appendix 10)

**Agent Based Propagation** uses a computational model based on actions and interactions between autonomous agents. As such, is the agents' systemic structure, that creates the explicit models of the space. (relevant videos found in Appendix 11)

**Differential Line Growth, Diffusion Limited Aggregation** works by differentiating and expanding in space a continuous line or curve without intersecting itself. The expansion is based on explicit forces between the points differentiating the curve. (relevant videos of simulation tools found in Appendix

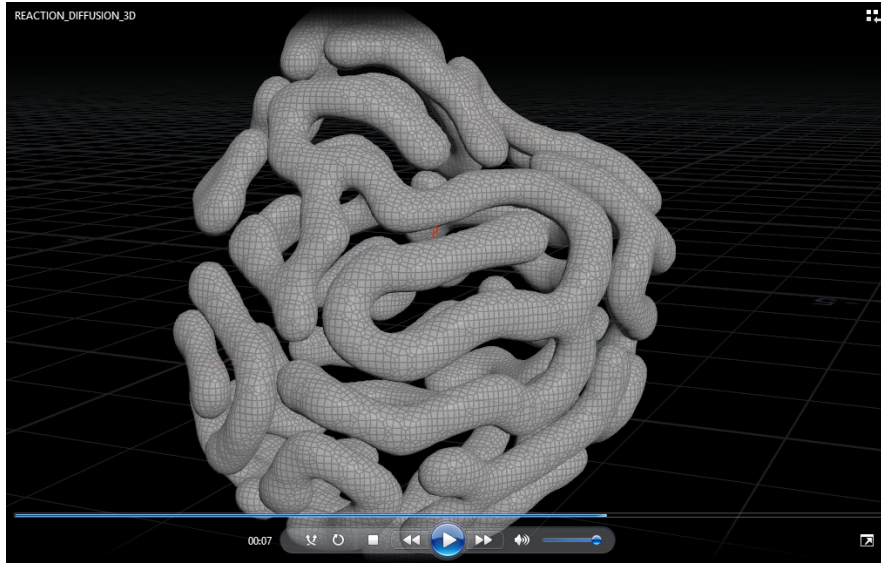


Figure 41: 3d reaction diffusion with different spatial constraints

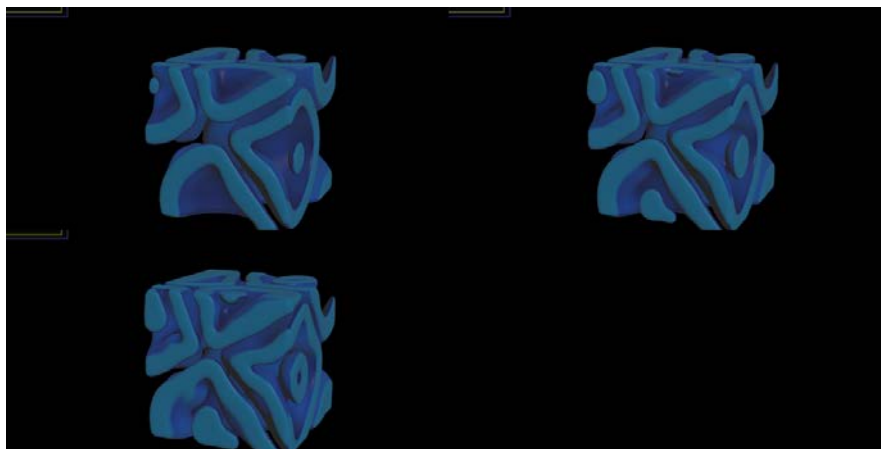


Figure 42: Gray Scott diffusion



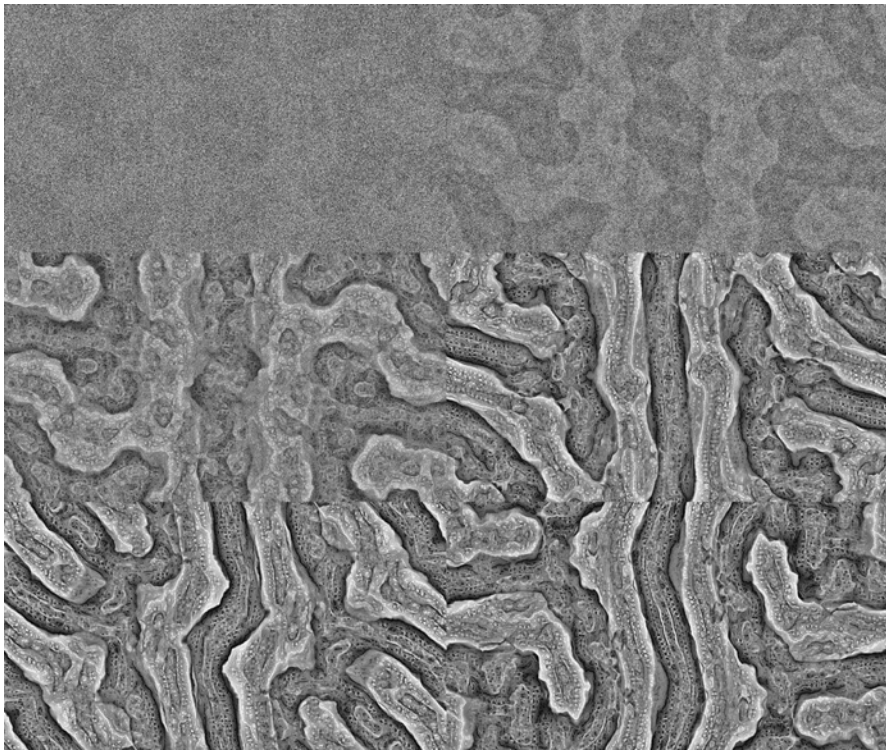


Figure 43: Multi-scale Turing diffusion



Figure 44: Reaction Diffusion with spatial constraints

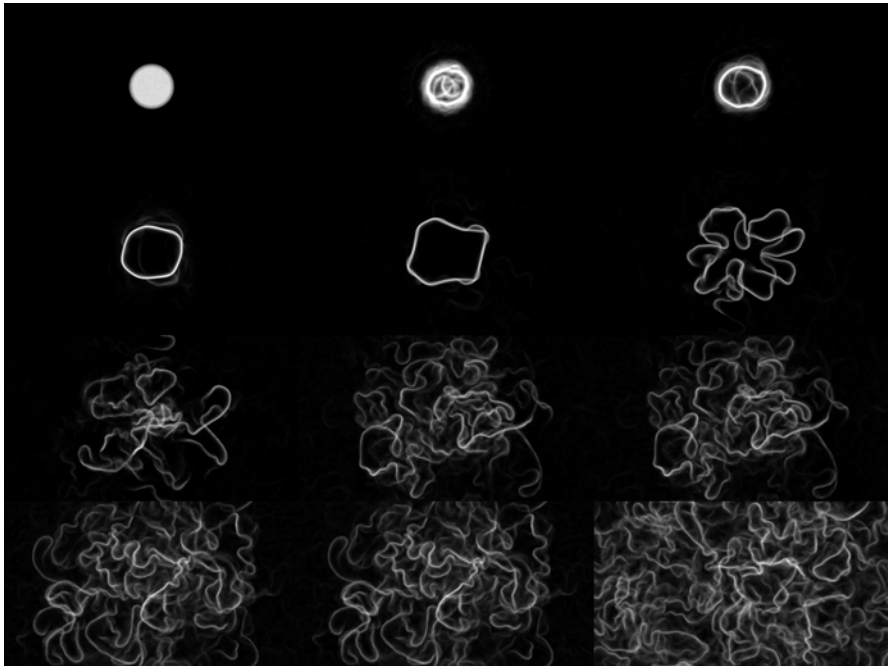


Figure 45: Physarum networks 1200 generations

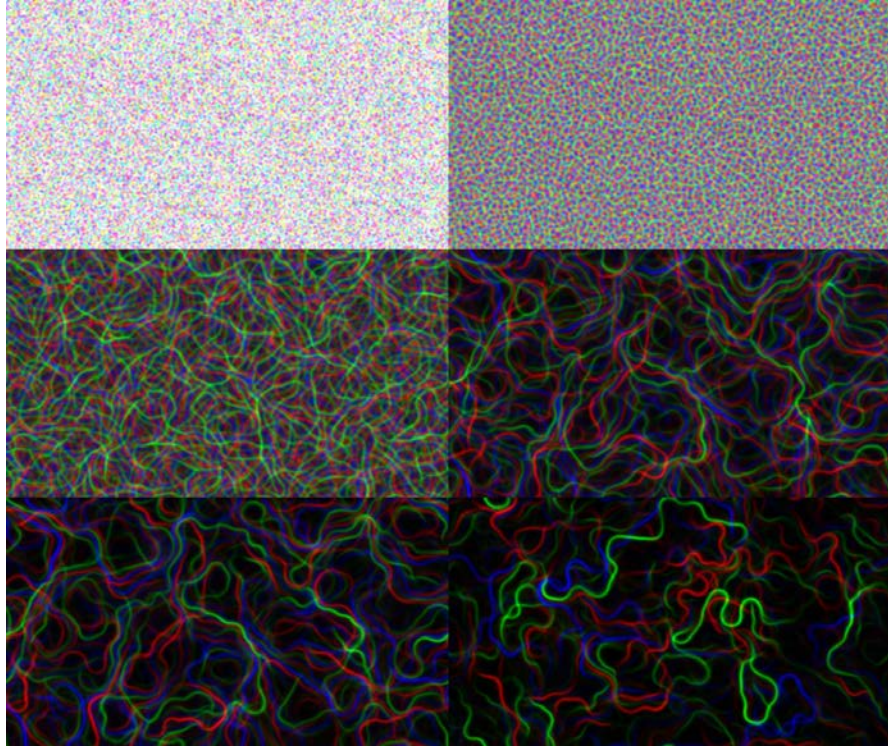


Figure 46: Physarum networks 1200 generations

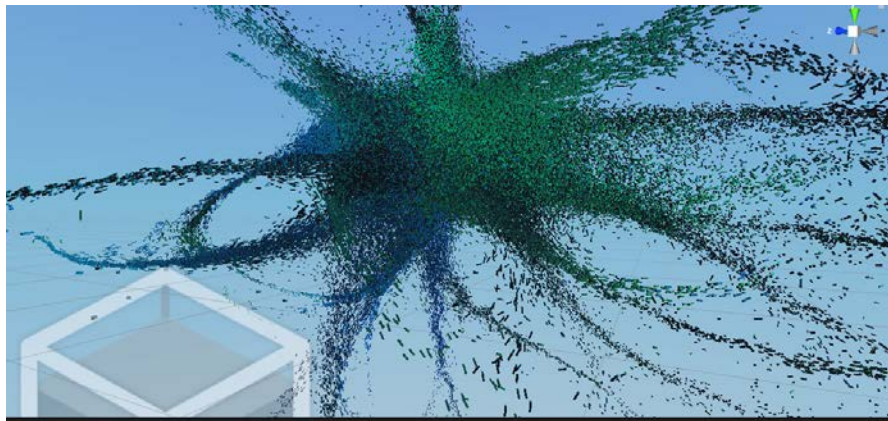


Figure 47: 3d physarum networks

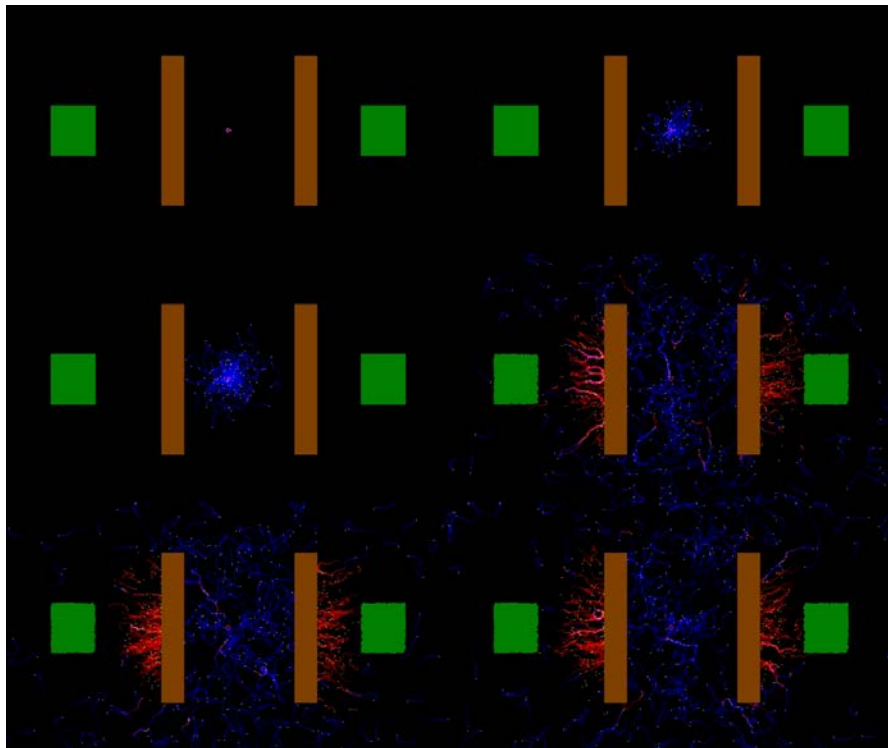


Figure 48: Agent colonisation, the blocks are the 'food', the blue agents search for 'food', the red agents return and store the 'food'

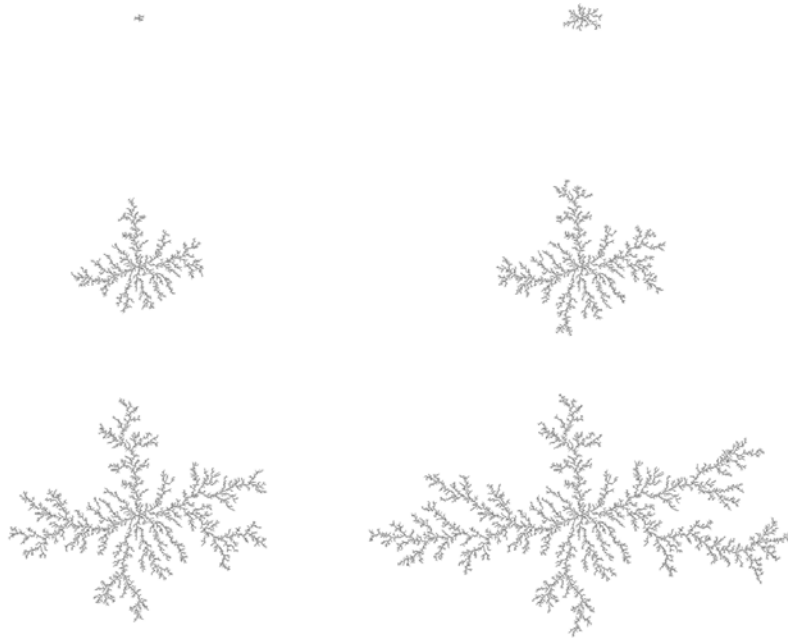


Figure 49: Differential Line Aggregation

12)

### 5.4.3 *Attractor Syntax*, Regulation by Dynamical Controllers

In order to regulate content in accordance with the morphodynamical paradigms, a series of content regulator tools were implemented. These tools define the attractor<sup>70</sup> interactions and regulate what is described by Petitot (2011) as *attractor syntax*. Some of those are described below (relevant videos of controller tools are found in Appendix 13).

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<sup>70</sup>Should be reminded that the attractors of a system (the basins in the potential function describing it), model the actants of a narrative process.

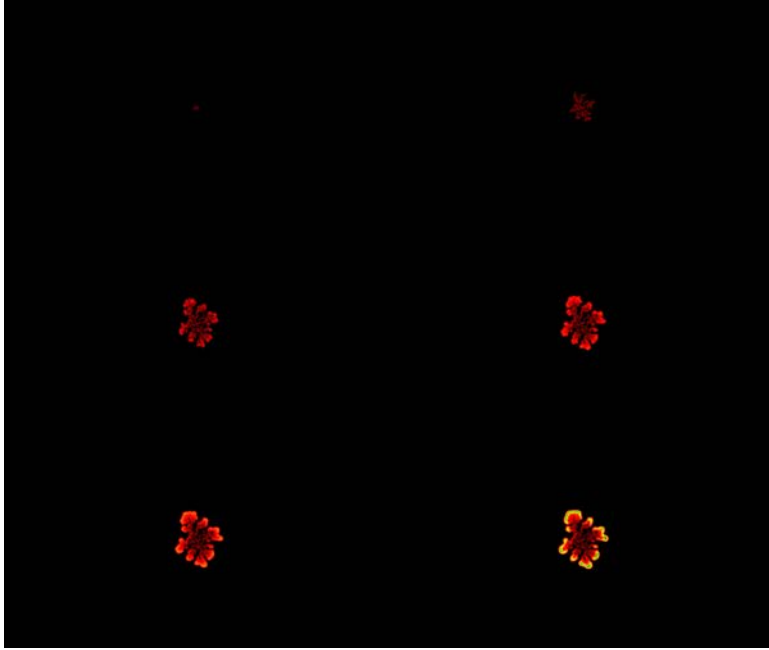


Figure 50: Differential Line Aggregation

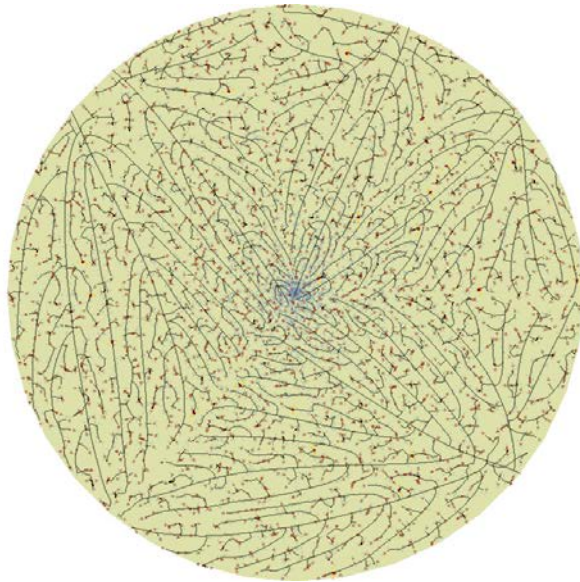


Figure 51: Phyllotaxis

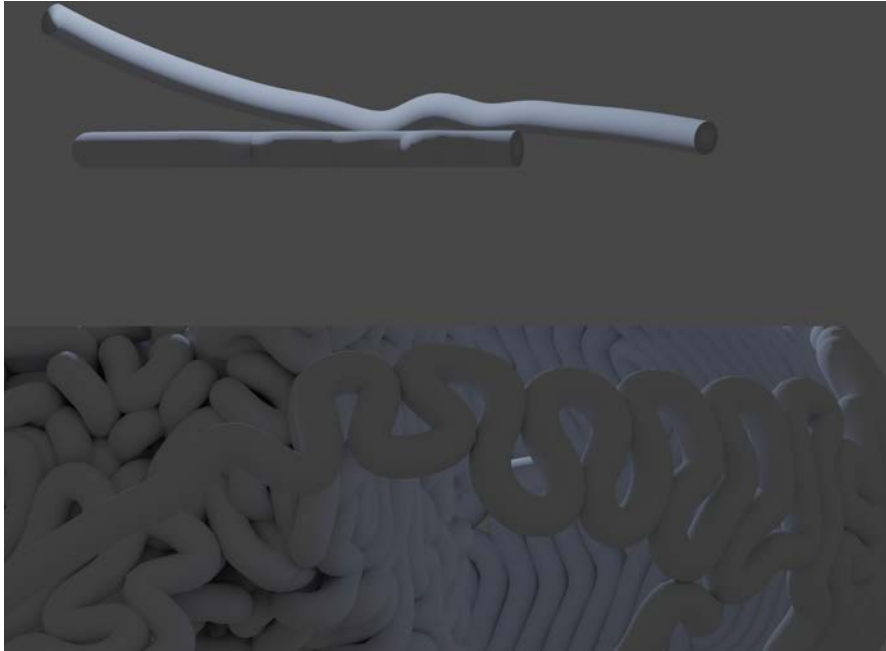


Figure 52: Differential line growth 3d simulation, the line is constraint of a 3d surface

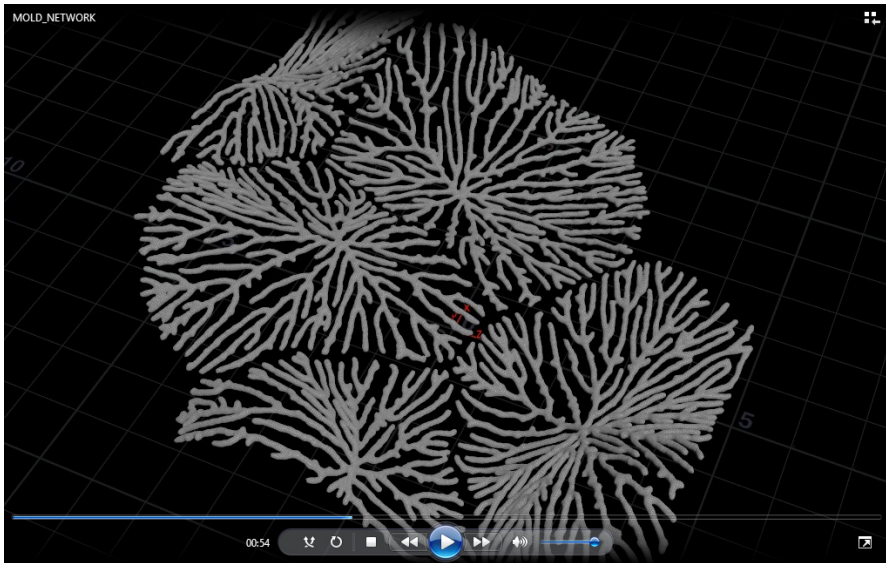


Figure 53: Mold growth simulation



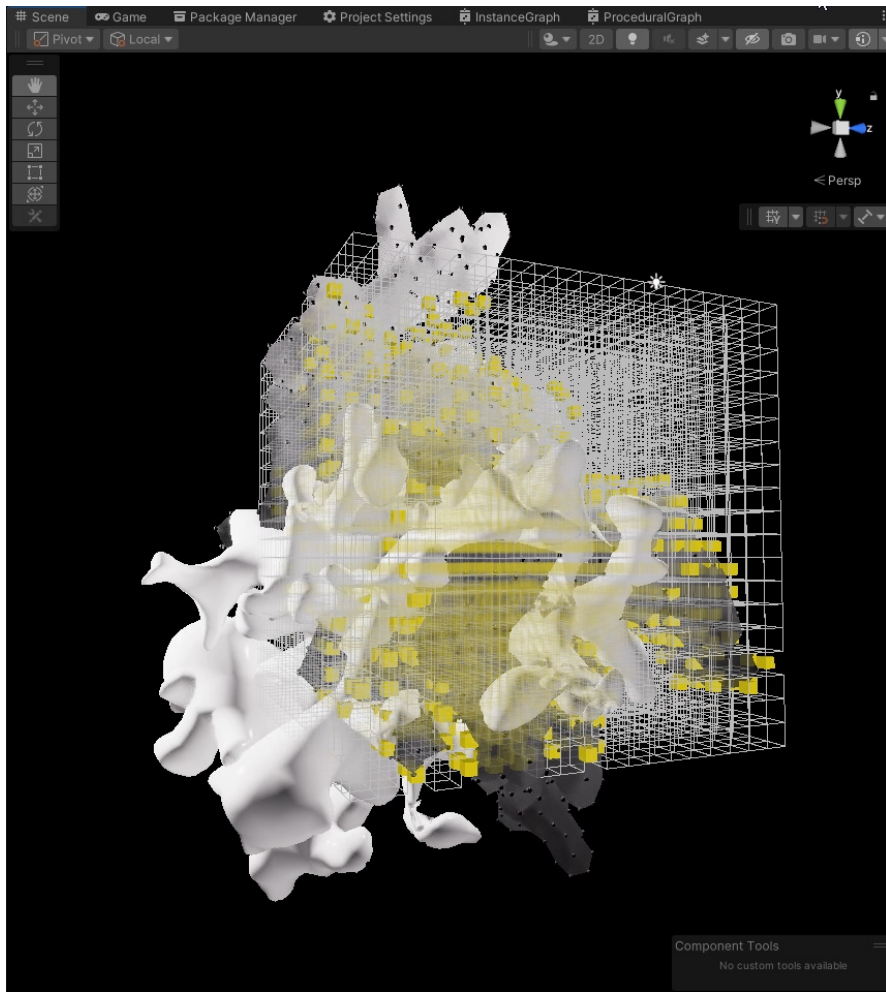


Figure 54: Organic growth spatial propagation the shape is emerging from surface triangulation, each point on the differentiated surface is subject and subjected to the sum of forces. The points repel each other for the extension to take place

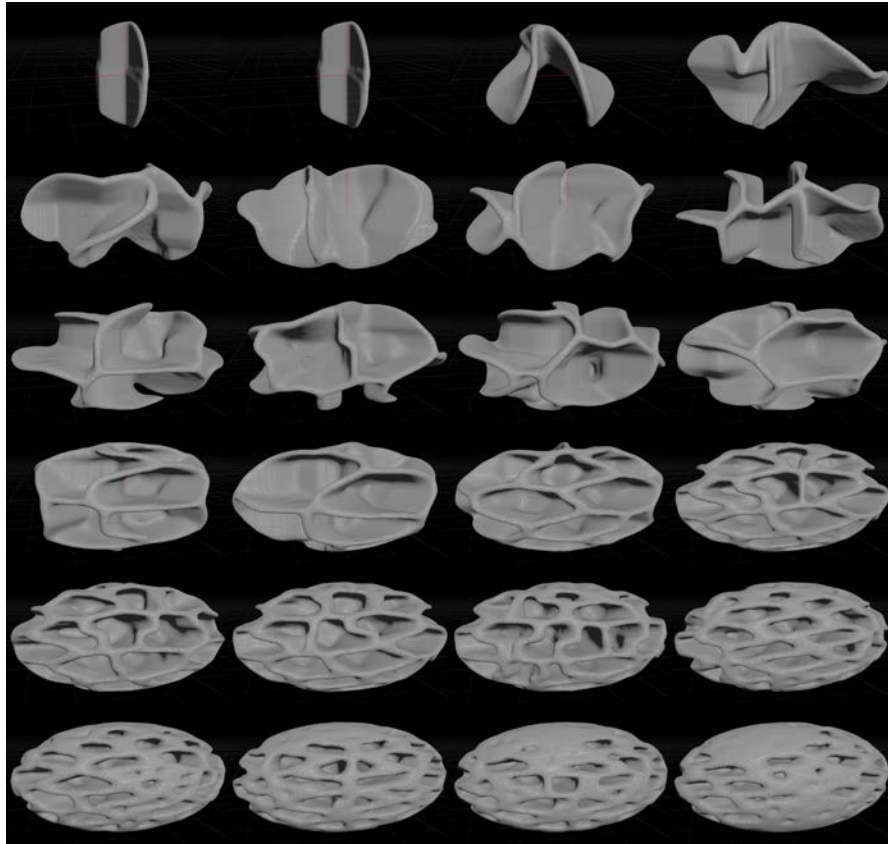


Figure 55: Space propagation through organic growth, mushroom simulation

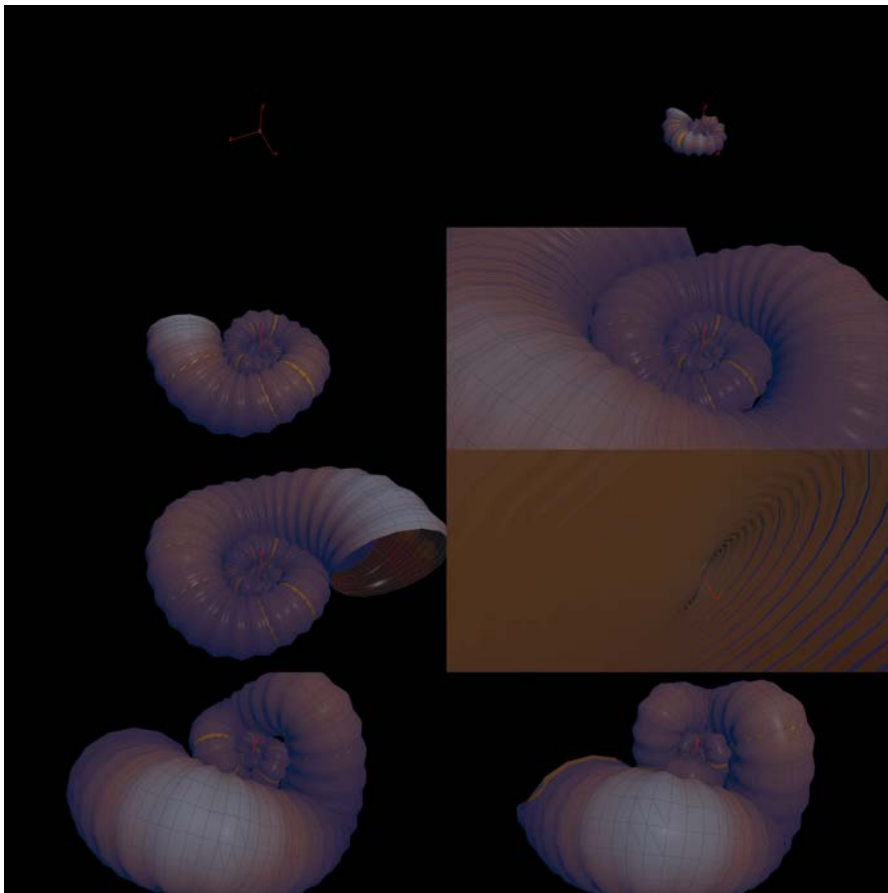


Figure 56: Shell (ammonite) growth

**Memory Machine** is one of the tools developed for the regulation of the complex dynamics as appear from the several low level feature detections on content. This dynamical regulator, is based on Thom's proposed model for memory<sup>71</sup>, referred to as the *Memory Machine* by the author .

A simplified implementation of Thom's proposal, is represented by the interactions of four attractors in a combined field of complex dynamics in entanglement with different types of swarm dynamics between those attractors, the two systems are weakly coupled (These tools were modelled in the Kyma audio environment in audio sample rates). Here is an overview of the proposed model as described by Thom (Thom:1975, 325):

We (Thom) propose the following structure for memory:

1. A relatively slow dynamic  $(P, \psi)$  representing consciousness and mental activity.
2. A rapid auxiliary dynamic  $(M, X)$  .
3. A weak coupling between these two dynamics by a third system  $(Q, X)$  , of a type product of  $N$  linear oscillators, each with the same period.

Thom then explains how the configuration space  $Q$  results in an  $N$  -dimensional torus  $T^N$ , an unstable structure (originated in the differing degrees of weak coupling between the systems), resonating its way to a structurally stable form thus simpler in structure. An underlying structure as such, regulating the narrative dynamics and events, operates as a rhizome. It is in turn further complexified through integration with other rhizomes regulating surface manifestations.

The tool design utilises the analysis and feature detection of content representing the slow dynamics of mental activities. The rapid dynamics are rep-

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<sup>71</sup>See Thom:1975, p. 130-138, 140-149 and 325-327, for explication and proposals on weak couplings of form, spectrum, natural memory, canalisation , and a model of memory (structure, dynamics).

resented by a network of four attractors modelled as interacting autonomous agents. The interactions are defined by a set of rules determining the ‘physics’ of the interactions. The environmental attractor points for each agents are defined in terms of their number and their position, these are global attractions and their intensity can be regulated. Each agent moves to a position constraint by acceleration, velocity and friction. Each agent behaviour is determined in terms of attracting or repelling the other agents. In addition, in the case of attracting other agents three determinations can be made, attracting based on a spring model (increasing with distance), attractor based on a magnetic model (attractor decreasing with distance), and constant attraction. The range and scale of an agent’s attraction is also determined by the user. The reaction time of the agents is also controlled, as well as the time of reaction of cohesion and evasion. The change from cohesion to evasion can also be instant (boolean) or smooth transition between the evasion and cohesion states can be adopted. The distance to be travelled and the ‘escape’ direction and speed is also controlled by the user’s choices. Finally in terms of overall manifested behaviour a parameter determining the stability of the system is provided.

The Memory Machine is an explicit, four attractor model from a general tool for handling swarm dynamics in frames of audio. The general tool is used both for audio spectral synthesis, processing, but also for audio spatialisation, since its outputs (positions of agents) can be exported in real time and control other parameters.

**Other Dynamical Controllers** In accordance to the Memory Machine described above, further dynamical controllers were designed and implemented. The main strategy was to model a dynamical process in its simplest representation possible (one-dimensional or two-dimensional), and then regulate the user’s parameterisation choices with the one-dimensional models of dynamical



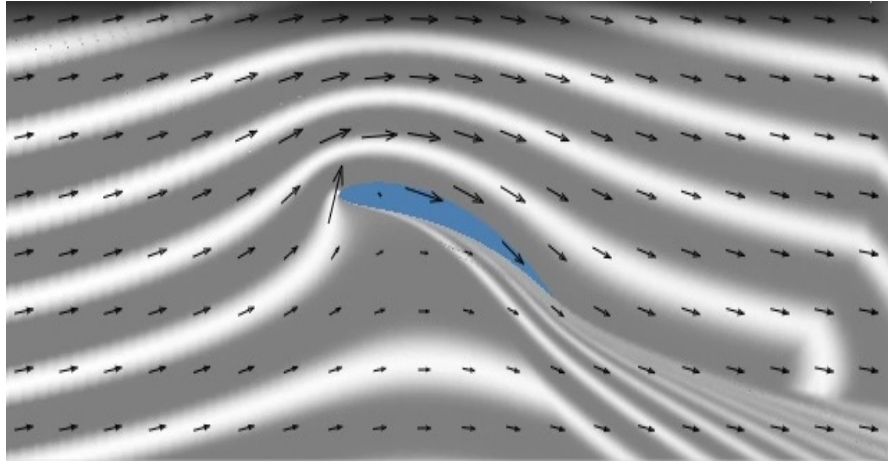


Figure 58: Dynamical Controller for regulation of content functions as a real-time phase space, user can input system's dynamics

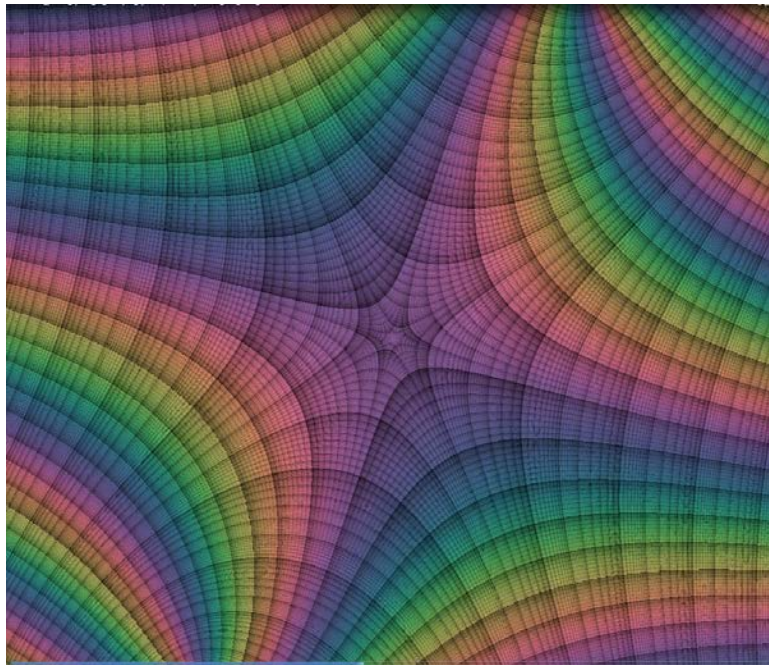


Figure 59: Dynamical phase space, simulates a process and exports phases and magnitudes

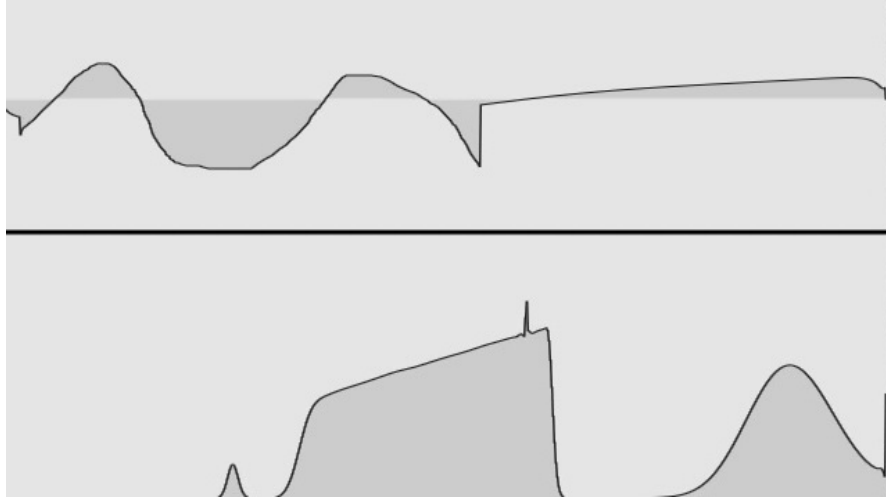


Figure 60: Dynamical fluid dynamics controller, upper part controls the speed of the simulation, lower part is where input values are inserted. The controller maps the values to the simulation's dynamics

order to structure audiovisual scenes in a Gestaltist approach based on things, relations and events as defined in cognitive linguistics, associating them to domains, singularities and bifurcations proposed in morphodynamical analysis.

The spatial component entailed both in these abstract morphological algorithms and in grammatical linguistic forms, e.g. prepositions, constitutes the core meaning inducing element providing a bidirectional link between them.

The space segmentation and integration algorithms may provide for a coherent morphological semantic interpretation when used in relation to each other. Contours may be understood as active components that trigger diffusion-propagation processes (or inhibit such processes from different sources) and in turn generate new geometrical structures (by expansion or compression) acting as virtual elements of a scene that entail its categorisation and singularities.

More complex, richer in geometrical information, modelling processes may be generated from primary morphological algorithms by introducing additional



operators. For example, introducing a feedback component and a multi-step blurring process in contour linear diffusion expansion implements a semi-linear reaction-diffusion propagation system capable of corresponding to a wide range of phenomena such as the formation of travelling waves and patterns of self-organisation.

The epistemological objectivity of this approach has been shown by Petitot (2011) using low level vision processes as a case study.

The conclusive attainment of the extended approach found here is to receive perceptual input and output schematic narrative semantics. This is achieved by the enrichments of scenic content with virtual structures, products of the morphodynamical routines, that entail additional information concerning the scene's structure and temporal evolution.

The use of morphodynamics for modelling narrative composites results in a naturalised model able to provide for natural morphologies be it linguistic, conceptual, acousmatic or visual, and provide as output Gestaltic schematic representation of structure not neglecting their dynamical character.

Furthermore in morphodynamics the Gestaltic apprehension of form no longer relates to symbols but to dynamical processes, allowing for embodied, image schematic meaning to be modelled utilising the topology of complex attractors and their sequenced bifurcations. Symbolic structures are then conceived as emergent macro-formations underlying the micro level dynamics.

A last remark concerns the use of sub-symbolic computational routines in order to model processes similar to those described here. Sub-symbolic networks may be considered as a sub-domain of the systems described in this research. Though not the focus of the venture these algorithms were tested during the research for their effectiveness, but at a later stage not involving their use in any of the artworks presented. The experiments conducted were at an early stage at

the time of completion and the research with these models is still undergoing. Thus some early results and some initial conclusive observations are exposed in Appendix 3 and not further developed in the main thesis body.

The next part (Part IV) of this thesis exposes the processes described as they were employed for the creation of the multimedia art portfolio accompanying this document.

Part IV

## Practical Implementation

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## 7 Analysis of the *X Short Stories* Portfolio

**The previous chapters** have described the abstract nature of meaning formation routines and accounted for a number of processes and operations performed on abstract semic categorial elements. This occurred in order to attain a conceptualisation of the link between those abstract terms and stable forms manifested and invested semantically during interpretative processes. The current chapter outlines possible practical applications<sup>72</sup> of such frameworks for the creation of new-media works of art.

In Part III the term ‘abstract’ was displaced towards the spectrum of the term ‘complex’. It is the complexity of the nature of these routines that makes them difficult to be defined, and for that purpose new models inspired by complexity, bifurcation and systems theory were introduced. In doing so one is equipped with new mathematical concepts that allow objective epistemological observations to take place, and at the same time introduce mathematical models that respond better to the complex nature of the described phenomena.

Petitot (2011) explains that the introduction of dynamical models attains to explain how these phenomenological morphologies emerge from the underlying laws governing their formative processes, and proposed that a topological basis of an attractor syntax may be introduced. He explained that the core idea is to represent the Gestaltic relations found during the understanding of phenomena by singularities of diffusion-propagation processes triggered by the detection of boundaries defining a detectable form (regardless its material nature), which leads to the construction of actantial graphs that describe the cognitive routines regulating this act.

The last section of Part III then introduces methods and tools that en-

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<sup>72</sup>An initial proposition of the analytical capacity of morphodynamical models was first presented in an article in *Organised Sound* (Giannoukakis: 2016). Complementary for the analysis presented in the article (Patah:2010 by Diego Garro) are given in Appendix 4.

able the practical implementation of these models and allowed for the desired Gestaltic construction of a perceptual scene to take place in a bottom-up approach starting from low level dynamical routines such as boundary detection, that further inform the perceptual input and enrich it in such a way that enables the referential mapping process and renders *things* meaningful.

In order to demonstrate the functional and generative potential of an analytical framework inspired by the dynamical character of cognitive processes for diverse applications in composition of new-media art, the presented portfolio contains a variety of artwork typologies involving different media and material. This results in a ‘stretched’ narrative notion that facilitates the practical realisations and includes a spectrum of possible conceptualisations defining the explicit compositions, but also the narrative subject as may be found in the field in general.

As was described in the previous chapters, over the course of this research, a number of different approaches were considered in terms of modelling narrative (and modelling artwork in narrative terms), leading gradually to the elementary understanding of narrative as a meaning formation, and primary conceptualisation process. Given this, the most suitable method for approaching a broad narrative understanding was through dynamical systems analysis, and particularly the methods Catastrophe Theory and the morphodynamical framework proposes. The catastrophe theoretical deductions in the cognitive sciences, since their appearance, have had the goal to relate forms (and their structural profiles) with content (addressing at the same time the connection to its concrete real-world references), and in the process provide for the ways this cognitive routine takes place in order to appear meaningful to the mind of a human observer during interpretation. Aligning with cognitive methods, they allow for a Gestaltic structural formation of a scene and at the same time are based on

epistemologically objective elemental processes and irreducible components.

To develop this understanding the relations were addressed between deep level mental representations (abstract, schematic, scenic forms regulated by an elementary understanding of the world, in their primary expression corporeal) and figurative forms, while explaining how the former regulate content into surface level semantically invested (the figurative) components – which reference concrete structures found in the real world.

The proposed concept required attributing to these deep level structures their dynamical character and admitting that they do not remain static; rather, they self-regulate and continuously transform when subjected to the projective processes such as those involved in discursive and communicative acts. In that sense the deep forms become activated, modalised, and invested, regulating their surface manifestations and allowing them to be represented meaningfully through symbolic associations.

The dynamical approaches, particularly the catastrophic modelling considered in this research venture, have been shown to exhibit great degree of flexibility in transcending to surface or regressing to deep level interpretations of morphologies. This occurs through conversions retaining the formal aspect of classical approaches, ones that usually operate on symbolic content.

In art composition, the process of tracing back the deep level components of a surface meaningful manifestation affords the syntactical rearranging of the deep level structures in a controlled, finite, and non-chaotic way. Upon re-projection, regulated by the new deep arrangement, new surface manifestations form. This process may be thought of as a fundamental act in creating artistically meaningful evolutions of content organisation, even in non sensical ways accounted for in Greimas' semiosis model.

It seemed feasible to extend this projective process that appears fundamental

for the evolution of linguistic forms and language, and consider it primary in the evolution of form in other semiotic systems such as musical, or visual. The dynamical descriptions in the proposed catastrophic narrative framework, which does not diverge to any great extent from the dynamical descriptions adopted for the interpretation of natural phenomena and their manifestations, detaches the morphodynamical approach from its linguistic determinations, and renders it available to other domains of interest on account of its universal naturalised character.

**The process** followed for the completion of the artworks was a combination of real-time performance and off-line estimation (using the tools presented in the last section of Part III) of the different narrative content, as was generated in the different performances, concerning a narrative subject. This was an ongoing and continuous studio process switching between real-time performance and off-line estimation that reformed the structure of the final content projections, and brought to the foreground particular aspects and explicit characteristics for each artwork. These final estimations concerned the representation of the narrative theme and the diverse ways that compositional choices may be reflected in a satisfying and meaningful aesthetic fashion.

More specifically the process would start from an initial abstract idea that would later be presented in the form of an elementary semic category (using the semiotic square), and through the explosion of the initial square other main narrative terms would develop. Having an established enunciative structure, an elementary form of meaning, consisting of four (or less) elemental actants<sup>73</sup>, the operations amongst those would then be determined.

The basic operations available in the semiotic square between primary terms would be translated in a dynamical language through the container and opera-

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<sup>73</sup>These could be figurative visual or aural forms, explicit spatial arrangements etc.

tor tools and thus the relations between those terms would be determined in a non-deterministic fashion. Furthermore the components in the container tools and the products of the different operations performed on that material would be assessed with extractor tools tracking detectable features, and statistical operators. The complete set of these material formalisations and their representations would form the core component of the narrative structure regulating the performance. The conclusion of the process would be the formulation of the syntagmatic structure of the real-time arrangements through the ‘tuning’ of the parameter space; a process dealing with changing and experimenting with the thresholds and determinations of the feature tracking and operator tools. This procedure would shape the topology, the stratification, and the path flows in the narrative environment, not arbitrarily, but in terms of the morphological profile of its constituents.

The final structures would then be evaluated in terms of their narrative competence by using the statistical analytics tools<sup>74</sup> developed allowing for the extraction of the potential functions of the narrative. The evaluation of the narrative potential functions in terms of their catastrophic topological translation would give indications for the arrangement and distribution of the semantic components to surface representations through the manifested forms of content.

To enable the above described studio process the critical assumption of treating each stable (or at least observable) compositional form as a dissipative structure and the relative compositional space enveloping these forms as a phase space describing the states of the systems that brought forth these forms was adopted.

As dissipative structure is conceived the material structure as formulated by the organisation of energy flow. More particularly has been observed that non-linearity in systems far from equilibrium may be a source of order and drive

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<sup>74</sup>Polynomial fittings of selected feature extraction time-series for instance.



the system in spontaneous ordered configurations; the emergent structures are called dissipative. These structures are open systems and able to exchange energy, matter, and information with their environment.

This view sets the ordered structures of materials as found in the compositions as emergent forms in accordance to the processes that formulate, influence, and regulate them (in a non-linear fashion). They are represented in the compositional space in a non-symbolic, dynamical way, and are considered the complex result of paths, attractors, and energetic flows acting on materialities in synthetic vector spaces.

The vector fields are the spatio-temporal arrangements of the results from the tracked material features as extracted by their morphological analysis. Additional fields of influence are placed on these synthetic vector fields to further enrich and steer the flows of the different materials. These fields of influence are vector spaces computationally created, adding force fields, turbulent areas, areas of curls, regulators of a field's divergence, and attractor areas.

A scene is composed by several vector fields and are all able to communicate and exchange 'matter' and information. The systems behaviour is analysed in terms of its internal states stability and by estimating the divergence and curl around critical points. A change of state is reflected upon these computations.

The overall behaviour in the compositional space stratifies the parameter space as well, segmenting it and organise it.

In that sense all the composition components<sup>75</sup> are interlinked, and the relations between them brings forth a complex form.

Given the above each composition presented in the portfolio may be perceived as a dynamical narrative composition system. The final form generated is an emergent structure from its intrinsic interactions, its external influence,

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<sup>75</sup>Including the composer which in many cases plays the role of one of the selection criterion functions *I*discussed in Part III.

and its initial conditions.

The following text, examines the structure of each compositional space, as well as, the resultant compositional forms and examines them for their morphological, narratological and artistic capacity.

## 7.1 Dreaming of Demons and Musica Universalis the ‘Linear’ Narratives in the portfolio

The first two attempts at composing and performing narrative, *Dreaming of Demons* and *Musica Universalis*, now seem, rather, to be an effort to set up a system that would allow the creation and performance of these narratives in one unified environment, thus less concerned with the narrative themselves. These initial narrative systems were mostly based on arbitrary linear symbolic relations and lacked the dynamical architecture that was theoretically conceptualised in a later research stage.

The generated content from these narrative systems has been reintroduced as part of the *X Short Stories* by projecting their generated content in the dynamical narrative environments used for the creation of the portfolio. The figurative elements were abstracted to actant attractors through the process, while the dynamics of the original narratives ‘drove’ the dynamics of the new narrative generated content.

### 7.1.1 *Dreaming of Demons*

**Dreaming of Demons** is the first attempt to implement a real-time cinematic narration. The performance is improvisational and involves the manipulation of narrative flow at performance time. A real-time system to control camera movements and scene-viewport management was implemented, allowing the navigation through and between different 3d scenes, very similarly to a game-like interaction. There are seven different scenes, forming the narrative universe, and situated in a unified 3d space simulation. The actor freely navigates between the scenes which are differentiated into sectors, i.e., enclosed spaces in the world environment and populated by particular scene elements. Portals were used to enable movement between different scenes. The idea of sectors ensures

spatial contiguity, even though each scene is significantly distant from the others in terms of “global world coordinates”. The whole idea revolved around the different ‘actors’ that navigate around the scenes. The viewer is able to follow the narration through the ‘eyes’ of one of them. Some of the actors are implied, or their presence suggested not visually but only from their aural manifestations (for example ‘*the Demons*’). Traditional cinematographical camera movements were implemented, such as panning, tilting, dolly, zooming and crane motions, in order to provide a narrative continuity based on the aesthetics of cinema. The camera motion may also operate as deixis, and facilitate focalisation. Two further typologies of actors, ‘physical’ actors performing acts such ‘walking’, ‘touching’ (in general having the ability to interact with the environment) and ‘fly-through’ actors filled the role of a ‘distant’ narrator. While the physical actors are part of the ‘action’ and are those that execute it, fly-through actors are massless and weightless. They are tasked mainly with bringing the viewer farther or closer to the performed action with techniques such as close-ups or a ”birds-eye” inspection of a scene. Several additional functionalities have been implemented in order to achieve dramatic effects. Key-presses allow the user to pause the scene, move frame by frame, apply post-processing effects and transitions, and exit the performance all together at any point. This facility was introduced in an attempt to manipulate the sense of time in the narrative, alongside adopting a cyclical narrative that offers the ability to the actor to start at any time from the initial point in the narrative.

### 7.1.2 *Musica Universalis*

The basic idea behind *Musica Universalis* is to use the environment itself to control the audio, using exported parameters. The audio is controlled from actions and events occurring in the virtual environment, i.e., the controller values are derived by the virtual environment’s correspondent parameters such

as location and movements of objects, model, view, and projection matrices etc. This artwork uses gestural controllers for input and stereoscopy for the visual output.

The audio-control messages received from the environment are the triggers, the viewer-controlled panning, proximity to objects, the game-time and the positions, or properties derived from the positional information. The heart of the audio tools lies in the analysis tool producing descriptors of the audio events and sending the data back to the environment. Geometrical manipulations of the 3d objects in the scene occur in real-time, producing spontaneous syncretic gestures and dramaturgy. This environment facilitates interaction with real-time performers. Narration is mainly environmental, and nonlinear, meaning that the environment itself (or events in it) control and shape the narrative flow. Specific actions need to be performed by the virtual avatar in order to control the narrative progression, i.e., being in a specific area of the environment at a particular moment, having proximity to an object in the scene, being inactive for a specific amount of time and other actions.

The design specifications in *Musica Universalis* were quite different from those in *Dreaming of Demons*. The first presentation of the work was in the form of an installation, where the users interact with the environment. Therefore, there were specific design strategies adopted to ensure the flow of narration, even if the user did not interact or navigate sufficiently around the environment. Stereoscopy amplifies the impact the system has on users, rendering an immersive environment that invites interaction. The narrative in *Musica Universalis* suggests sharp gestures and dramaturgy, while cameras and their directional control, in real-time, were simplified in comparison to the implementation in *Dreaming of Demons*.

Exporting parameters straight from the virtual environment required exten-

sive conditioning of the signals in order to be used in the audio programming environment. Furthermore, the vast amount of information involved made the task of mapping to audio parameters significantly more laborious and challenging.

### 7.1.3 The Architecture of the Narrative System of Relations

The work as presented currently in the portfolio may be considered an embedding of the initial domains onto the final narrative environment.

**My Remarks** concern the two narratives *Dreaming Of Demons* and *Musica Universalis*, which are not presented as initially implemented, as both have been revisited, revised and redesigned so as to be assimilated in the *X Short Stories* anthology. At accomplishing this required a *transposition* operation, brought forth by the *projection* of the initially created environments (and *storyworlds*<sup>76</sup>), onto the *X Short Stories* implemented environment (*storyworld*). Figure 61 demonstrates the schematic representation of the architecture of a projection *per se* where the environment occupied by the projection acts as a *blend* (abstract and schematic). Two options were recognised initially to accomplish this: the first involves rendering the environments as textures (the two dimensional projections of the forms in terms of *rgb* colour information) that are sent to the *X Short Stories* environment and occupy separate layers. The second requires sending the dynamics data in order to regulate an abstract representation of the dynamics as systemic particles organisation. A third hybrid

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<sup>76</sup>The storyworlds are the multimedia, and multimodal structures containing information about the story, in a way that one could recreate or deduct aspects of it by association. The topologies of actions as presented ‘in front of’ the camera (the communicated action and all the actions implied by it) are analogous to the conceptual topologies in the semantic narrative space. A neutralisation then of the thematics (as happens with their visual constituents) is inevitable, necessary even, in order for the ‘fusion’ to produce a consistent result. This is a case where the story did not ‘survive’ the transposition on a surface level. The actantial field though retains its morphology, which proposes for a symmetrical transposition and reversible process.

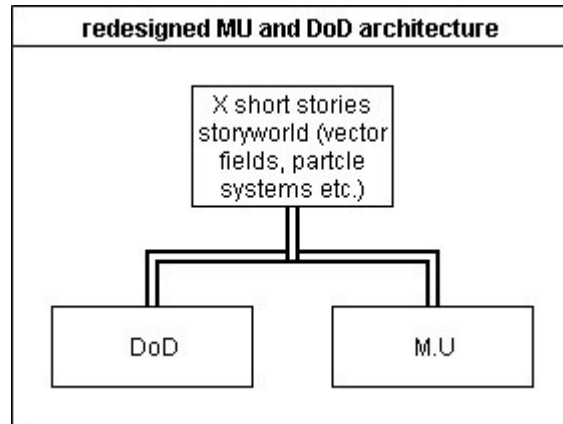


Figure 61: Two separate running environments are combined in the *X Short Stories*-(*the LadyBug and the Spider*) storyworld, and their combined dynamics displayed as particle systems, the two independent environments are synchronised through a server and also exchange data, while they do not share a common virtual world architecture.

option is the combination of the two. Initially these two projected environments were designed for interaction by a human ‘player’. However in the case of their projection onto the third environment the ‘cameras’ and ‘players’ are controlled by artificial intelligence bots, of which their main ‘mission’ is to reach (using an a\* algorithm) point B by travelling from point A - their location at a particular time. This *world logic* regulates the world accommodating the projection (which is the environment for the first story implemented in the anthology ‘*The Ladybug and the Spider*’<sup>77</sup>). A new random point of destination is generated when the goal is reached, in contrast, in the case of not being able to complete the ‘mission’ of reaching the destination point, the bots give up and roam in the environment randomly and ‘freely’, through a *random walk* algorithm.

In projecting the two worlds onto the third, thus operating as a blend of their distinct features, the portfolio appears more uniform aesthetically, while

<sup>77</sup>The first story was composed for the KISS 2014 conference in Lubeck Musikhochschule (<https://vimeo.com/113726088>)

an extreme act of narrative transposition has been implemented. Furthermore the incorporation of narrative concepts as perceived previous to the conception of the dynamical methods employed in the anthology, provides a good measure of the flexibility of the proposed approach in narrative conceptualisation and modelling.

Lastly this author's own predications as an artist, support the notion that our subjects of interest revolve around a handful of primary concepts and thematics. Hence, a fusion such as that concerning *Dreaming of Demons* and *Musica Universalis*, of different concepts into one complex conceptualisation blend, is possible if not necessary, and can be thought of as a diffusion of one concept into another taking place in a third blended domain. These are issues of focus and application in our practice, thus exhibiting a particular 'voice' not in merely a few, but in the totality of works produced. Another way of considering the methodology is as themes revisited by an artist and expressed under different prisms of investigation<sup>78</sup>.

**The structure** of the projected compositional space, is comprised by three 3d containers, a multi-dimensional container and a final layer which is the screen raster space. The overall composition structure though is far more complex since as stated above there are already two story-worlds (with their own complex structure and rules), 'running' in the background of the process.

Two of the containers are set in order to store the image texture values sent from the two separate worlds running in parallel. The third container is occupied by the tracked data from a dance performer. The multi-dimensional container is there to collect and store the morphological data as retrieved by the two background environments both for the visual and audio material.

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<sup>78</sup>Habitus (a hysteresis loop appears as emergent historical displacement in the works, and is defined by *sympractic* [composer and recipient] competence) appears as a highly involved regulator (selection mechanism) here.



All of the 3d containers are vector fields constituted by separate particles systems, and each contain different computational fields to regulate the displacement of the particles. The fields that the vector spaces created are in close proximity and communicate with each other. Furthermore the particle movement is affected by the output of optical flow analysis on the two trasmitted textures (per frame) from the background environments. Their temporal dynamics are controlled by the spectral analysis and statistical operations on the audio stream.

Several low level features as well as more complex statistical computations<sup>79</sup> provide richer-in-meaning information (more structured) for every acoustic and visual frame. Figure 62, displays different types of mapping of feature extraction output values onto different types of noise fields. This produces diverse morphological structure for each vector field. The field space is stratified in three dimensions, and their boundaries are traced, creating zones of influence that regulate the particle dynamics. In this topological distribution of the tracked audio features values underlying the scene architecture, the bottom isolines represent the presence of tonal audio material while the top isolines the presence of noisy audio spectra. The space where the mapping takes place is ordered so the distribution appears structured. Sudden shifts in the tracking values or the optical flow data, create a new peak that dynamically reforms according to the presence of noise or tone in the audio stream. The semi-periodic releases from the relaxation oscillator network creates a feedback effect, a phenomenon of hysteresis in the synchronisation between the visual and audio content. This behaviour may be observed several times during the composition for instance in the transitions found at 3'05" (sudden shift of the raster space due to the persis-

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<sup>79</sup>For instance the tracking of the presence of tonal or noisy sound in the audio stream stored in accumulators which are triggered at a certain threshold coupled to each other produce a very basic type of relaxation oscillator behaviour.

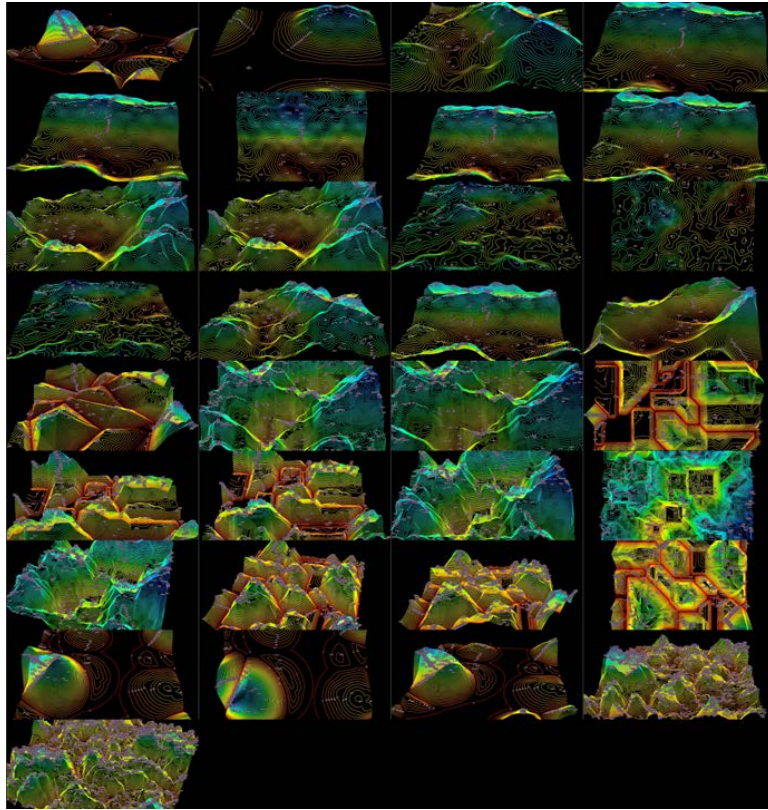


Figure 62: Contours from tracked audio features stratifying the parameter space of the scene affecting the field movement of particles. The tracked audio features build up to create peaks that elevate the isolines heights.

tence of noisy sound bursts from the bass clarinet<sup>80</sup>), in the period between 3'12" and 3'42" where the system oscillates between changes of state until stabilised, in the transition found at 5'06", at 6'11", and more prominently (amongst a few others) at 10'37".

The release of the coupled accumulators when a threshold is reached, disturbs the current balance between the content found in the different container spaces. During the intervals between these state-shifts this balance is subject

<sup>80</sup>Since the accumulators operate as some sort of memory device, and the entropy accumulation was not high enough the system returns to the original balance upon the presence of tonal sound at 3'12".

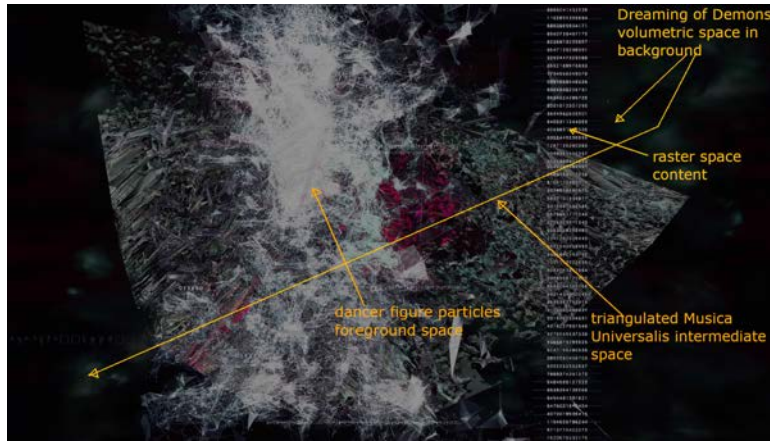


Figure 63: Structure of Musica Universalis scenic material.

to the energy of the audio materials and the background environments' activity. These systemic parameters affect the expansion or compression of the three core actants (four including the raster space content); the particle formations from the dance performer's figure, the particle formation from the Musica Universalis environment, and the volumetric representation of the Dreaming of Demons environment. The dancer figure is expanded by introducing entropy in the system, disturbing the figure's outline in a turbulent fashion, diffusing it further into the environment. The Musica Universalis intermediate layer expands through a triangulated three dimensional domain enclosing a trail particle system, also controlled by optical flow analysis and audio spectral analysis. The Dreaming of Demons environment is expanded through the density, colour and curl values of the volumetric representation in the background. These are displayed in Figure 63.

Overall one may observe a semi-chaotic oscillation between states in which each core actant appears to occupy more prominent space in the final scenic arrangement.

The opening scene contains a locally stable state of the system (uniform



Figure 64: Several frames demonstrating the expansion and compression of the core performance actants shifting the balance of their scenic presence.

colour, dancer's figure outline) that is disturbed by the accumulation of entropy from energy added by the audio stream. The system evolves in an irreversible manner towards intermediate states of balance (metastable states). This corresponds to the messenger archetypal elementary schema, where as the exchanged *object of desire* acts the energetic dissipation from one system to the other (acoustic space to visual space, and between the tracked activity in the background environments [optical flow] to several visual contained domains). Figure 64 demonstrates this from sampled frame sequences of the performance.

Real-time statistical fitting (after dimensionality reductions) of the multi-dimensional data vectors<sup>81</sup> (as processed in the background environments) to polynomial curves, controls the state of the regulators of the final composited audio-visual form and represents the system's output state in a compressed and condensed manner.

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<sup>81</sup>The tracked visual and audio features,

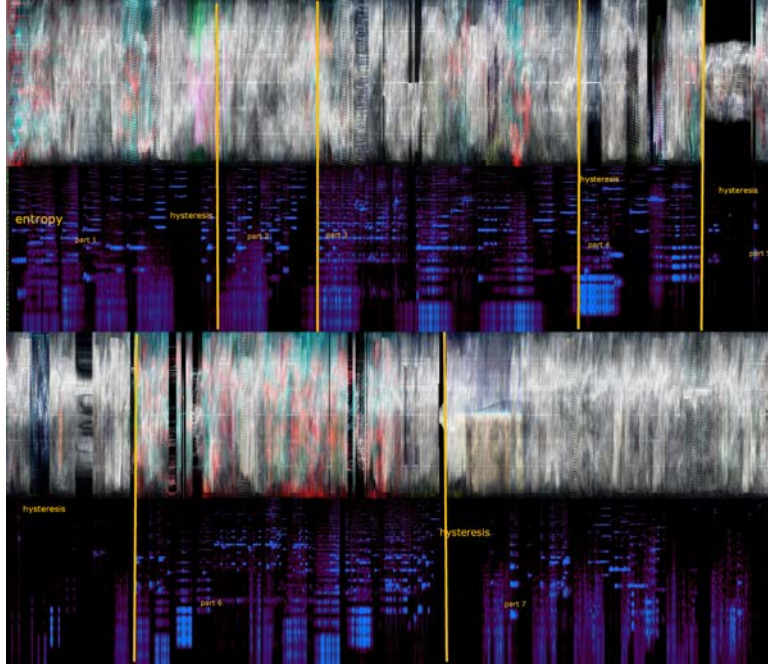


Figure 65: Segmentation of the performance as the morphological profile dictates.

A polemical narrative schema is suggested by the oscillation which regulates the system's states; the four attractor-actants are found competing for domination of the scene. The energy transfer between actants is partially fulfilled for the most part of the composition since rarely does an actant dominates the performance state.

The seven game-levels from the original Musica Universalis environment segment the final projection of the performance into seven parts where the morphological character of the audio-visual scenes display different quality. They are a skeleton for the performance to develop. The segmentation may be observed in the videogram and audio spectrogram of the content displayed in Figure 65. Phenomena of hysteresis may be observed in several places during the performance indicative are those found at the end of part 1, beginning of

part 4, part 5, beginning of part 7, as seen in Figure 65. These ‘moments’ of hysteresis in the narrative sequence are triggered by the ‘energetic’ releases of the audio feature accumulators network, tracking the presence of noisy or tonal acousmatic content in the audio stream.

## 7.2 The *X Short Stories* Anthology

### 7.2.1 Structural Character of *X Short Stories*

**Inspirational works** demonstrating relevant structural investigations as in *X Short Stories* equate approximately to the *Four Quartets* by T.S. Eliot, an anthology published over the course of six years, having a common thematic (a man’s relationship to time, universe and the divine), which is covered poetically by interweaving several superficially unrelated thematics. The notion of a ‘poem’ is essentially created by the degree of successful fusion of the independent layers into one new whole<sup>82</sup>.

There are five sections to each poem, and the later poems connect to the preceding ones. All five sections connect to the *Waste Land*. In that sense both the narrative and the artistic structure signifying and communicating it increase in complexity. Subjects such as the movement of time, along with brief glimpses of an eternal timeless reality, are captured, as are deficiency and scarcity as characteristics of existence; the need for affirmation, prayer, and divine mediation, or the problem of attaining artistic and also spiritual wholeness, some of the thematics expressed within these structures.

Aurally, works such as Pierre Schaeffer’s and Pierre Henry’s *Symphonie pour un Homme Seul* (1950; 1966 revised version) are of strong influence for this section of the portfolio, especially the compositions that include vocal performances.

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<sup>82</sup>Gardner, H., 1978. *The Composition of "Four Quartets"*

### 7.2.2 *A Girl In a Night-Dress*

*A Girl in a Night-Dress* is a real-time performance, based on impromptu choreographic material that was captured during two two-week residencies for the formation of the choreography of the artwork *The Fallen* also a part of the presented portfolio. These workshops were arranged in order to familiarise the artists with the conceptualisation methodology and the process of narrativisation, as proposed in this research, and the technology used on-stage for the realisation of the works. Two sections of the workshops were found to contain a strong narrative component and were used as a point of origin for the finalisation of the performance's concept. It is noteworthy that for the first time in terms of this portfolio 'green-screen' methods and multicamera capturing was used in order to capture not only the performance clips, but also acquire the desired spatial information (in previous performances 3d spatial information was acquired with the use of depth sensors that present limitations in terms of the performance environment).

The story includes three main themes, each with its own sub-thematics, and the presentation approach attains for the thematics to be staged in the form of an unbounded, almost inarticulate narration ('mental mumbling') that does not necessarily has a consistent purpose and even at times may appear nonsensical. Hence, the relation between the aural and visual components is weakly coupled, not necessarily providing for synchretism and direct associations, but rather, complete one another in a 'loose' manner, particularly after the middle section and towards the conclusion. In terms of reception, the goal for a long part of this work was to create a constrained but evolving narrative flow, that could appear to terminate or climax at any time.

As happens in other works presented in this portfolio, the structural form used in this performance is inspired by multi-scale diffusion patterns. In that

sense a gross stratification of the performance space is used as contour-like approach to differentiate it and create domains. Details then, are introduced by superimposing this structure in different scales and diffusing each superimposed layer in a different degree. Figure 66 demonstrates this type of structure.

Figure 67, presents an image averaging all the frames of the visual content, revealing those areas where significant and persistent activity happens during the performance. Upon closer inspection may be observed that the main figures dominant of each performance part are displayed in brighter areas (the female form, the ‘road’, the 3d reaction-diffusion patterns etc.). This represents also, a metaphorical structural interpretation of the multi-scale diffusion pattern demonstrated above spread out in sequences; each scene in the narrative contains different scales of reference for the observed phenomena, a micro-scale, an anthropocentric scale, and a macro-scale. These reflect the construction of a narrative universe where a particular narrative theme evolves. Each layer has its own set of rules governing the interactions between parts. Hence the morphodynamical profile of its layer is formed by similar morphodynamical components but in different scale between layers. The final observable patterns for each scene emerge by the superimposition of the layers representing the same narrative universe in different scale.

**The structure** of the scene is constituted once more by several tools for space segmentation and propagation, containers for storing data and a set of vector fields in order to direct the flow paths to desired locations in the compositional space.

The vector fields used to direct the paths of particle movement, are ordered. The ordering principal is based upon Turing reaction-diffusion patterns; two simulations (different initial conditions) are used for the structuring as shown in Figure 68. The first (shown in the top of the Figure) aimed at patterns that



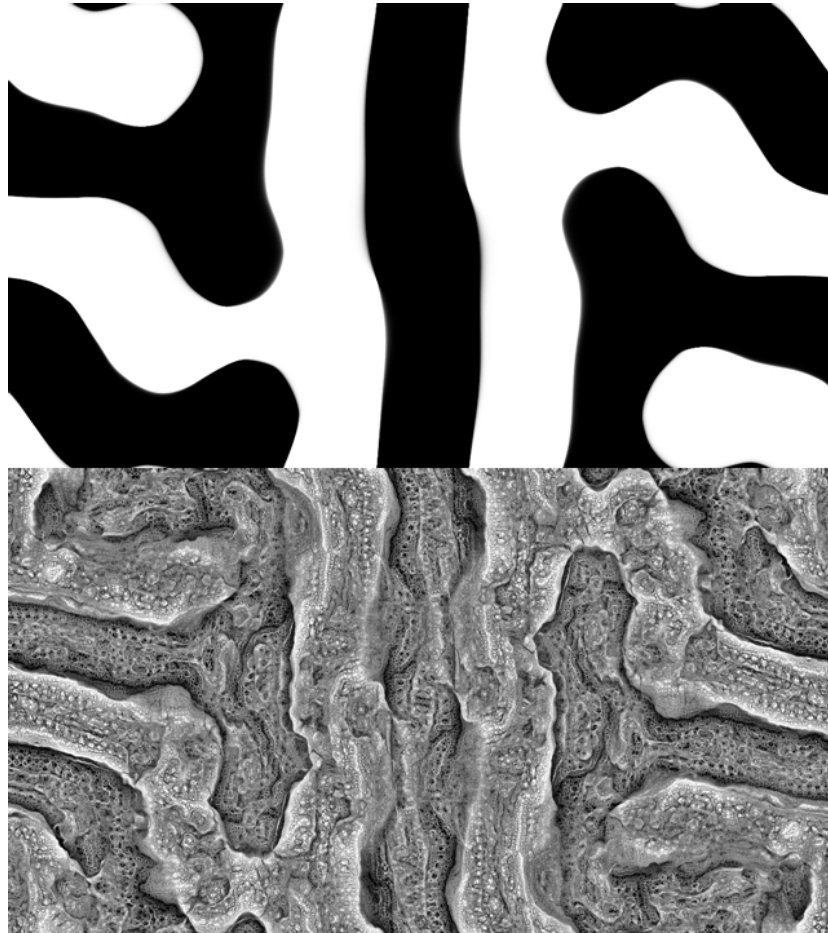


Figure 66: The first layer of a multi-scale diffusion pattern (top)  
Five layers of the same diffusion pattern with different scales superimposed.  
Each layer has separate diffusion parameters (bottom).



Figure 67: Average of all the frames of *A Girl In a Night-Dress*

would differentiate the simulation domain in such a way that a prominent central domain would formulate. The second (bottom part of the Figure), aimed at a more distributed disposition of the matter to all the simulation field, yet would still conserve a central cyclical domain at the center of it. Figure 69 displays the extracted contours and edges.

These two simulations (and their temporal evolutions), provide the total of the different morphologies that constitute the main skeleton for the vector fields regulating the matter of the composition and the form dynamics. The two morphological types are quite different and are used in different parts of the composition.

The grey scale images are used as elevation and velocity maps in volumetric visualisations. Slope and gradient operators were used in order to augment the morphological effects of the simulation on specific areas of interest, while retaining the basic contours and segmentation of the original morphologies (Figure 70).

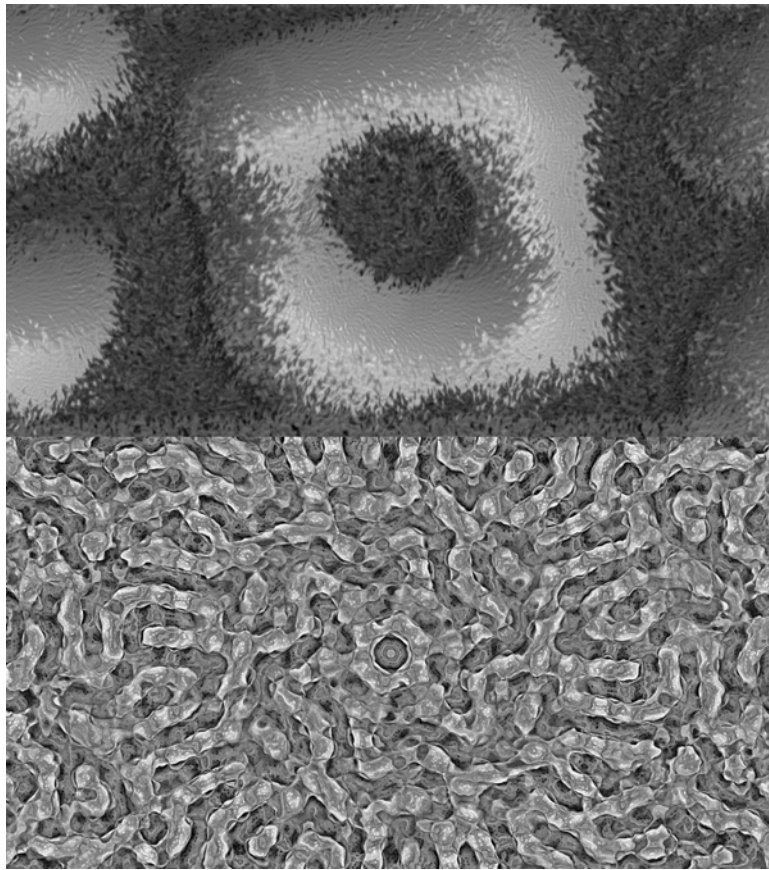


Figure 68: Turing reaction-diffusion patterns (simulation 1) infused with Perlin flow (top).  
Second simulation with different initial conditions (bottom).

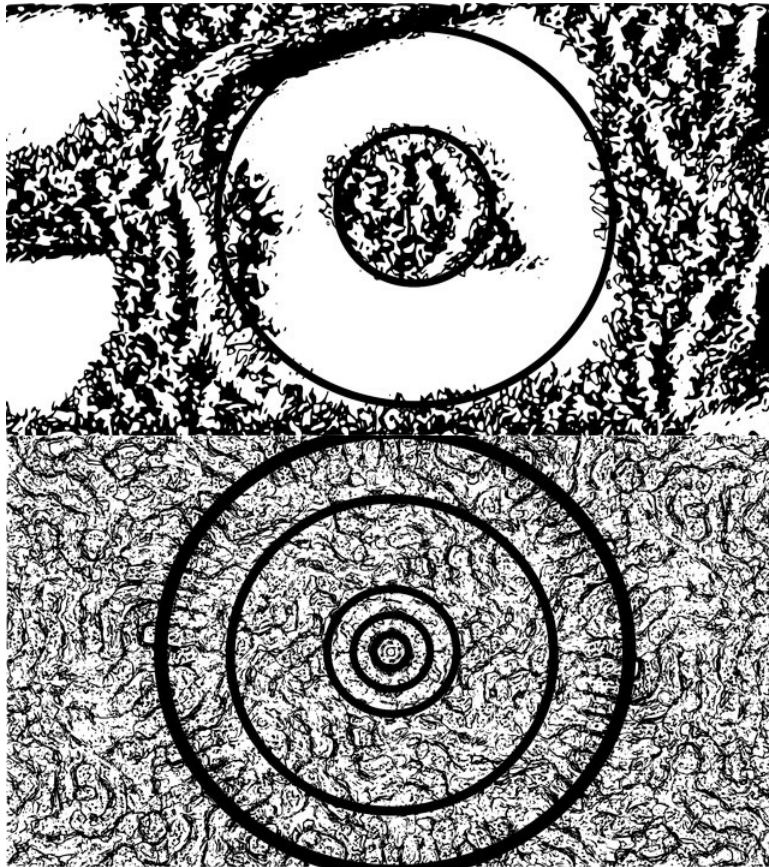


Figure 69: Contours and edges extracted from the simulations.

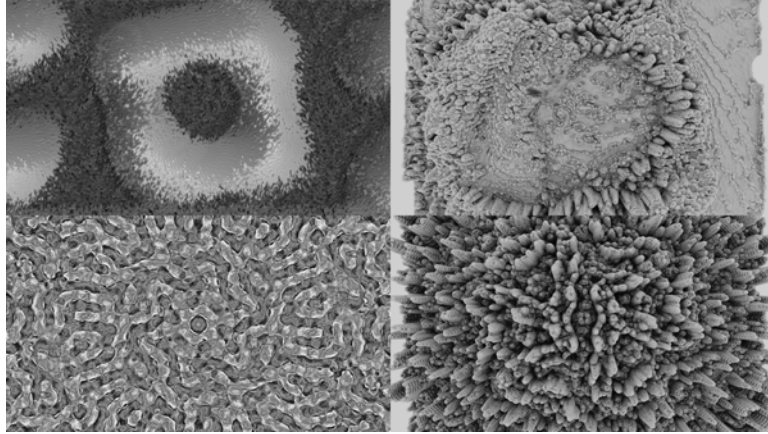


Figure 70: Volumetric visualisations of Turing reaction-diffusion simulations. Spheres were used to display zones of influence, while their radius represents magnitudes at those points.

In addition, hybrid topological spaces were created by coupling the topologies of the reaction-diffusion simulations with the topologies of Voronoi triangulations as seen in Figure 71.

Several visualisations of the above processes are running in parallel during the performance. To these one more visualisation (foregrounded) of the dance routines used in the performance is added. The dancer figure and movement optical flow analysis (magnitude, direction, velocities) control a particle system that is set to interact with the containers used for the reaction-diffusion simulations (landmarks). The core performance dynamics were set to bring forth a human-like formation attaining to the space created by the reaction-diffusion patterns. This setting conceptually represents the central character entering a sleep-like state. The human figure appears in two parts in the narrative.

The first starts around 1'55' in the composition, after the domain of events is bounded and segmented during approximately the first two minutes of the composition. The initial narrative gestures are abstract visually (but grounded



Figure 71: Reaction-diffusion used with Voronoi topologies offer interesting morphological variations.

aurally by the human voice in the audio stream). The abstract formations include voronoi triangulations of space, as well as a visualisation of k dimensional trees hierarchical clustering of the space topology. They are both based on the topological output from the reaction-diffusion simulations. This opening gesture attains on defining space, provide a sense of the system's rhythm and dynamics, and prepare the scene for the introduction of the human agent in relation to a stratified domain.

The second appearance of a human figure takes place around 10'04". This time the particles emitted and controlled by the figure are totally subjected to the effect of the reaction-diffusion topology and soft turbulent flows. This renders the human form less detectable and this diffusion of the form conceptually corresponds to the human agent's total immersion in a dream-like state, the domain where the narrative events take place.

As stated above the reaction-diffusion simulations characterise the morphology and the topology of the composition space. A few instances are examined underneath where the correspondence is more prominent. Instances like those displayed in Figure 72 may be observed for the majority of the composition, foregrounded or in the background<sup>83</sup>.

The paths traced by the flow of particles describes a core geometric schema regulating their dynamics. The placement of the sources of particle emission is accomplished in such a way that augments the schematic abstraction of the reaction-diffusion simulation (Figure 73) displaying a central domain (cyclical) of interest surrounded by complex morphological scape. The actant-forms then correspond to this basic schema and evolve using it as scaffolding.

A few instances may be mentioned in relation to the comments above; for instance, the placement of the human figure (1'54"-10'08") where the human agent is placed on the side of the screen space in order to create space for the

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<sup>83</sup>Mostly in the background when the human agent is present.

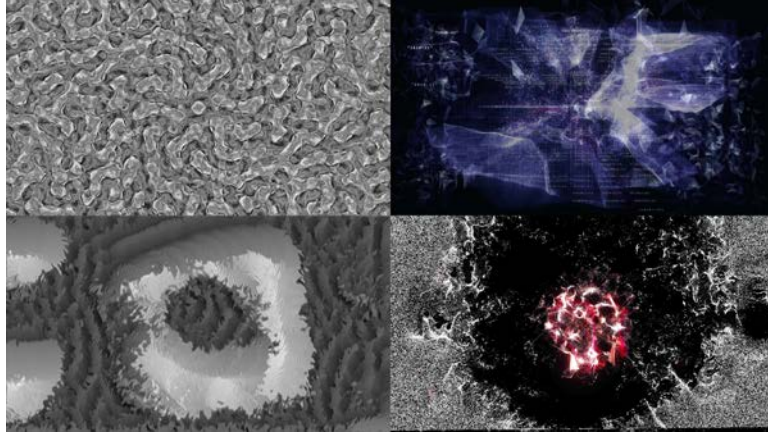


Figure 72: Correspondence of final composited narrative forms to the compressed topological information from the reaction-diffusion processes.

central cyclical/spherical formations. The particles emitted from the figure are attracted towards the central cyclical form; this corresponds to the archetypal schema of sender-receiver. The particle trails move in correspondence to this trajectory drawing the attention to the central object rather than the human form. Figure 73 displays the figural geometrical composition of the scene with those two constituents.

Here the focus is on the pathflows and the zones of influence, displayed with green lines and red circles in Figure 73. The source (human figure) dissipates energy that is absorbed by the central figure (reaction-diffusion structure inside the red circles). The energy dissipation increases entropy and forces the central form to collapse into other states, while at the same time constraints retain certain aspects of it. This schema is kept throughout the composition though represented by different figurative forms. It describes forces, and organises the distribution of the thematic units in space.

One example may be found at the appearance of a road-like formation flowing inwards and away from the camera (13'33"), while similar geometric ar-



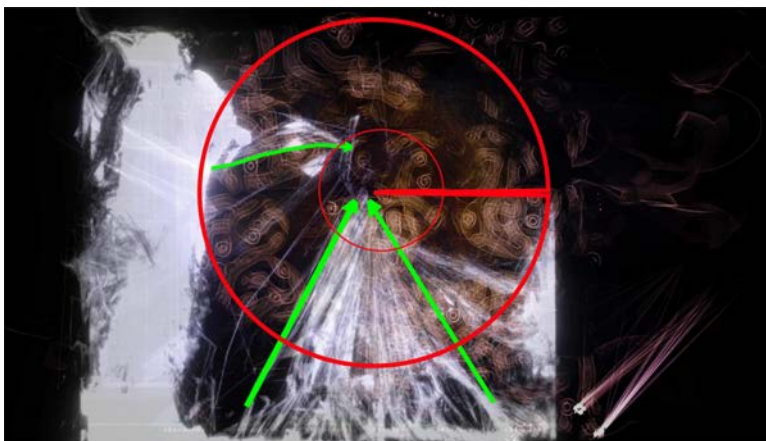


Figure 73: Geometrical composition of the scene.

rangements appear several times throughout the composition. The flow is an abstract conceptualisation of how energy dissipation between a system far from equilibrium and its environment, sustains but also alters its form. The narrative sequence then describes different constraint ways that these forms may evolve inside these environmental conditions that alternate their states of stability.

The narrative sequence and compositing is, as in *Musica Universalis*, the result of statistical operations in the system's complex phase space<sup>84</sup>. The available scenes are clustered dynamically on the phase space by a K-means<sup>85</sup> algorithm operating on low level feature-tracking operations providing the visual and audio morphological information. This computes a sort of similarity measure between the scenes based on the morphology, synchronisation and rhythm of their dynamics; the narrative sequences as formed most likely contain content that is closer in proximity on the phase space distributions. Once more the selection of the initial scenes affects the evolution of the projected narrative

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<sup>84</sup>Relevant tool displayed in Figures 58-59 in Part III and Appendix 13 ('complex.map.avi' video).

<sup>85</sup>Relevant tool demonstrated in Appendix 13 ('k-means.distr\_of.colourspace.clustering.avi' video).

sequences.

**Low level feature-tracking** techniques, as well as, statistical operations on the feature-tracking outputs are performed in real-time both in the audio and visual content. A structural analysis based on morphological observations is presented here, with a limited number of those features presented, namely:

- Quantity of Motion (QoM), a statistical feature based on a vector-field and optical flow analysis of the visual input;
- Amplitude of Motion (AoM), an averaged value for the overall amplitude of motion as emerging from the differences of each pixel between successive frames of the visual content;
- Spectral flux of the audio content;
- Energy of the audio content based on its moving average.

Since the statistical inference resulting from the analysis of the visual frames<sup>86</sup> includes the influence of the audio stream onto the visual, may be considered adequate for one to draw inclusive conclusions concerning their combined energetic shapings regulating the compositional narrative context; thus, the QoM statistical analysis may serve as an overall potential function concerning the audio-visual complex system.

In addition the relative spectrogram and videogram<sup>87</sup>, provide information on the morphological character of each section of the performance and its natural thematic segmentations. It should be noted that for the purposes of the

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<sup>86</sup>QoM and AoM for instance.

<sup>87</sup>The analogy of the spectrogram for the visual material, is based on writing to texture each frame with one pixel width; two videograms are created one for the x and one for the y axis. The videogram is created by a custom Touchdesigner tool, and is used for both real-time and non real-time analysis of visual material usually in correspondence with a spectrogram representation of the audio material.

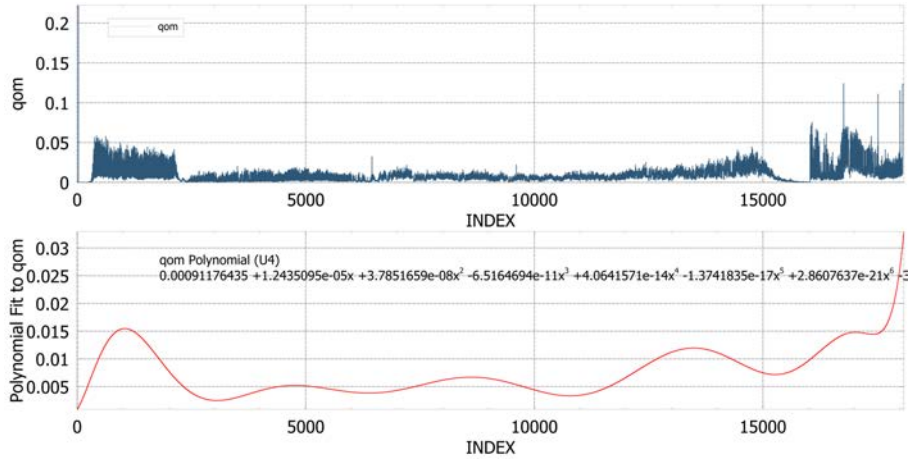


Figure 74: QoM and polynomial fitting of curve

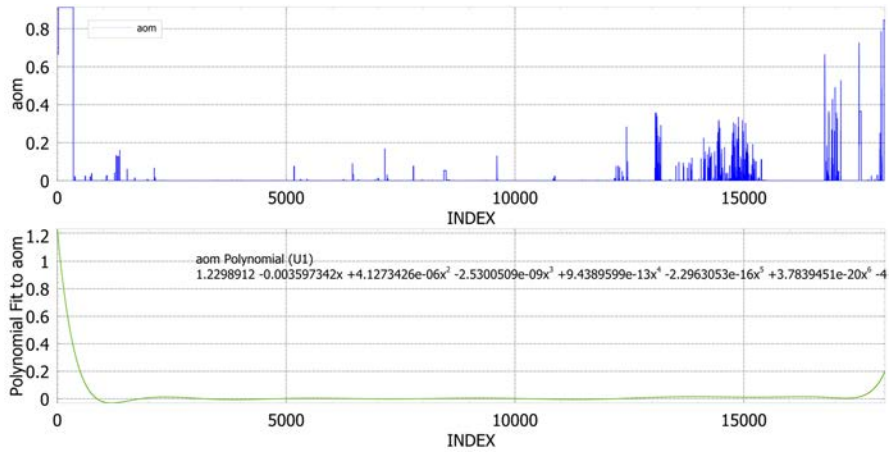


Figure 75: AoM and polynomial fitting of curve

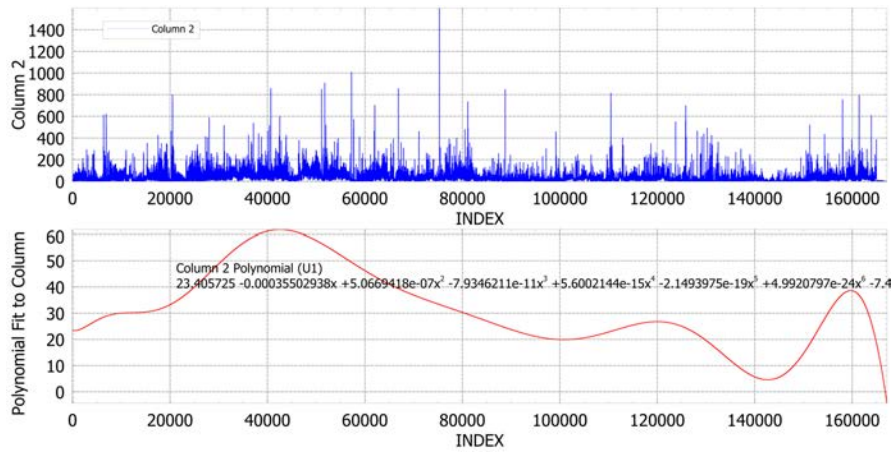


Figure 76: Spectral Flux and polynomial fitting of curve

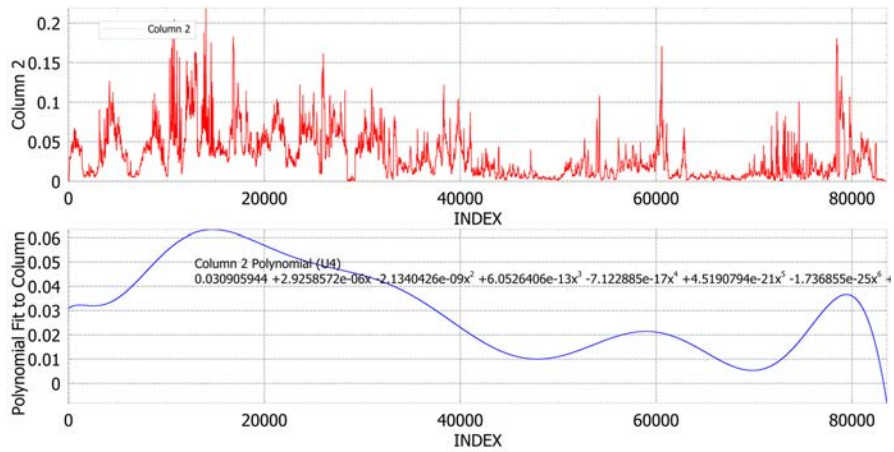


Figure 77: Spectral Energy Moving Average and polynomial fitting of curve

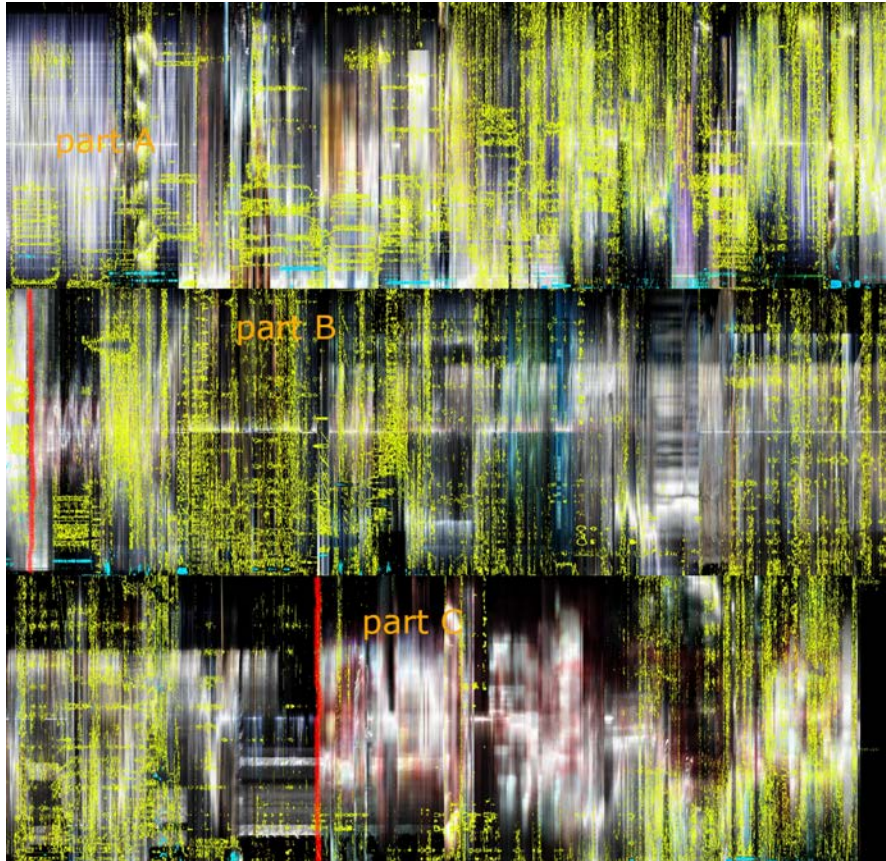


Figure 78: Combined Videogram and Spectrogram of *A Girl in a Night-Dress*, the three main Parts are marked with red vertical lines (high definition version of image found in Appendix 15)

performance a much larger number of features and statistical analysis operations take place. Nevertheless, studying the recorded results may be observed that several of these low level features present qualitatively similar graphs, e.g, spectral centroid with spectral spread, with their differences appearing mostly in the amplitude and slight phase shifts between the different tracked features. Hence, qualitative assessments dependant upon the relationship between two or more features may be objective even in omitting studying all of them.

The combined spectrogram and videogram displayed in Figure 78, marks three main regions as appear in the performance – the red vertical lines. Moreover, each region is divided further in several sub-sections; nevertheless different typologies of forms and movement appear in the visual and aural domains among the separate sections overall. The closer inspection of the image reveals that in several parts there is a correspondence between the aural and visual events, while in others the aural domain seems to retreat and create space for the visual domain. These may be found for instance after the middle part of Part B, towards the end of Part B, and at the first middle section of Part C. These relations were intentionally retained by the artist, in order to create sparse space that just barely carries through the narrative. The recipient may assume that the composition comes to its end, but remains in that state for the larger part after the mid-section of the performance. The audio events are sparse, and their occurrence frequency is just enough to provide temporalisation and facilitate the visual flow. The audio events are accordingly spatialised and occupy the space between the speakers in a manner that creates the sense of depth and varying distance from the listener. This may also be seen in terms of the spectral audio content in Figure 79 where the graphs of the feature-tracking in the aural and visual material are superimposed with the spectrogram and the videogram.

Further observations may be made by introducing the feature graphs: the QoM slowly rises towards the end of the two thirds of the composition, where it starts to decrease in a steep manner. This behaviour is in accordance with the evolution of the performance. There is no obvious correspondence between this visual feature and the audio features (spectral energy, spectral flux). The correspondence may be found though between the other visual feature namely AoM and the two audio features, while the QoM appears as an exponential fitting of the other curves (AoM, spectral flux, spectra energy). In fact, it may

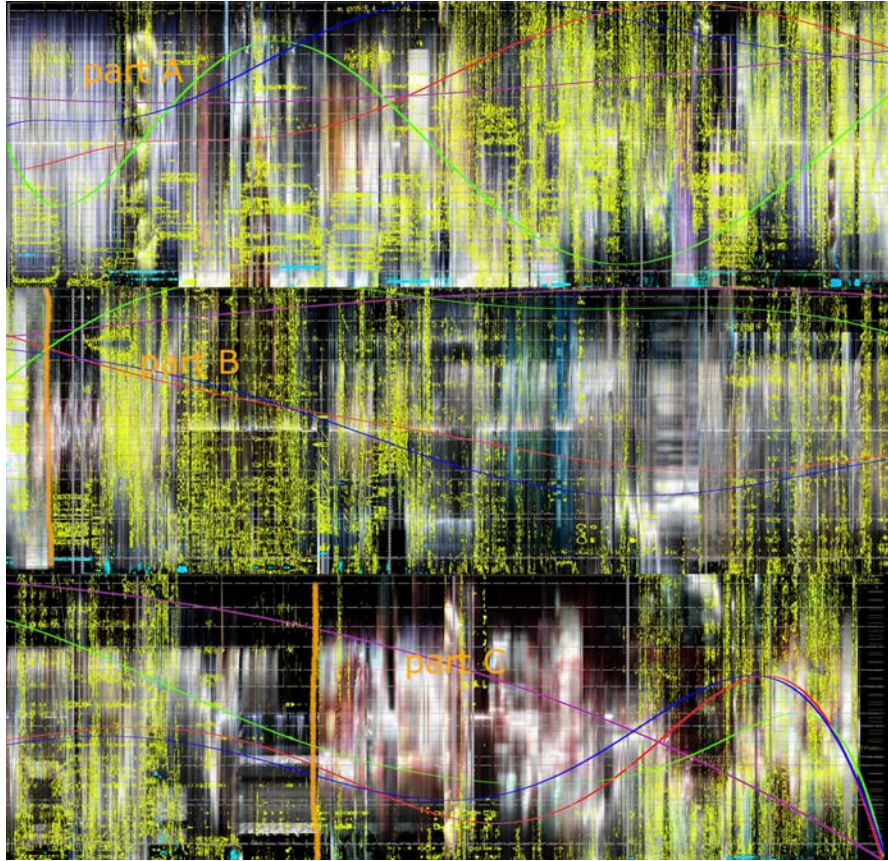


Figure 79: Combined spectrogram, videogram and the polynomial fittings of tracked features: the blue curve is the audio spectral energy, the red curve is the audio spectral flux, the purple line is the visual QoM, the red line is the visual AoM

be observed that the curves describing these three features are qualitatively of similar types of families of curves. This indeed makes sense when considering that the spectral profile of the aural content as described by FFT analysis, regulates the intensity of visual parameters, and the particle and field dynamics. The curves are described by three local minima, and four maxima, responding to the potential function of the Swallowtail and the Butterfly ECs. Thus an archetype of *transfer* (Sender-Object-Receiver) may be used to describe the relationships among the aural and visual content. These curves also suggest the possible evolutions of the material as has been described in several occasions in Part III referring to the potential function of three local minima and its possible transformation. Appendix 15 includes high resolution images of the figures and the graphs for detailed observations. It is important to mention here, that the brief observations above may be made without having a prior experience of the content, just by its morphological profiles. These observations may become quite detailed and refined by ‘zooming into’ these images and graphs of the evolution of the observable features of the content. Additionally these observations are not just qualitative but computationally attainable and objective.

The first thematic is the ‘Girl in a Night-Dress’: the title came out of the costume choices during the unscripted performances. In a discussion between the composer and the performer the idea of presenting a character on stage appearing vulnerable, in an intimate moment, yet facing in apathy ‘something glorious’, the performer came up with the idea of wearing a nightgown in order to perform, and after that they were directed by the composer to perform in a state of mind similar to that between wakefulness and sleep, the state of *hypnagogia*. It is a common experience in this state of consciousness for involuntary and imagined experiences to emerge, referred to as hypnagogic hallucinations, and appear in the form of sights, sounds, and feelings of movement.



The first part (0'00"-10'07") is an analogy of the first stage of sleep, where alpha waves drop and the transition to sleep is initiated. During this period the sense of 'here' and 'now' transitions from the real world to the dream world. Common experiences during this transition include: hallucinations, lucid dreaming, body jerks and sleep paralysis. These phenomena are the thematic for the improvised choreography. The material from the choreography appears as a shadow in the superimposed material, and is presented attaining a variety of intense abstract phenomena and forms. Particle flows having as starting point the human body are pulled towards the abstract reality of forms, formations, and processes, and represent the 'irresistible pull' towards deeper states of the sleeping 'reality'. Concrete forms appear and dissolve either in the form of strong abstract shapes (squares, rectangles, circles etc.), but also in the form of well defined 'screens' displaying figurative forms, e.g., people walking and human faces. This process starts in the beginning (0'00'-1'56") of the artwork by two abstract but explicit visual forms and one concrete aural form. The initial 3d voronoi structures and the 'graph network'-like particle system that are found in the start of the composition set the spatial boundaries and define the space where the narrative is going to develop. These are introduced in the simultaneous presence of the strong concrete form of the human voice and speech (0'15"-0'55") that fades away shortly after. After this movement the introductory section is fully developed gradually; its development presents eventually most of the forms (aural and visual) that are the narrative constituents. This part also introduces a set of processes that are used in order to provide a loose syntax and facilitate the formation of more comprehensive forms in the mind of the recipient as the composition evolves. In that sense a combination of processes as described above are presented both to segment space into regions and to present it as a whole. The process of creating a loose syntax involves

the marking of areas where events appear, marking of trajectories and paths, defining directions of movement, and creating oppositional forms, for example, subjects travelling with directionality as opposed to forms diffused uniformly, figurative forms as opposed to emergent complex forms, salient simpler shapes as opposed to organic complex aggregates.

The dynamics profile shifts to another state in the second part, determined mostly by the aural component. The aural space becomes dispersed especially after 14'50" barely suggesting a continuity and evolution. Its sparseness is counter-balanced by a persistent presence of the visual forms, that even in their schematic appearance (stated by their 'wireframe' aesthetics), they display continuity, e.g. the continuous evolving terrain – 'the road' actant, and are flashing in bright colours. This sparse space creates room for the appearance of the human body, once again, at 16'15" of the composition.

This time the human body does not appear as a solid reference but as a particle mass formation drawn towards different directions by environmental influence (attractor areas, turbulent fields etc.). This part presents the second section of the conceived choreography. Once more the concept is the concealed manifestation of the human presence, hence the previous environmental spatialised acoustic recordings were replaced by abstract 'small' performed noises implying a performer's presence in front of a microphone.

A final increase in the intensities (build up of entropy) is initiated around 16'55". Once more more the aural space appears more inhabited, with clear trajectories and gestural forms, nevertheless its current state never fully develops to climax. Instead it 'dies out' stabilising in a state of minimum energy (29'20") until it fades away towards the composition's conclusion.

The three presented large thematics have been presented here in a manner that replicates the transition from alpha waves to theta waves as found in the

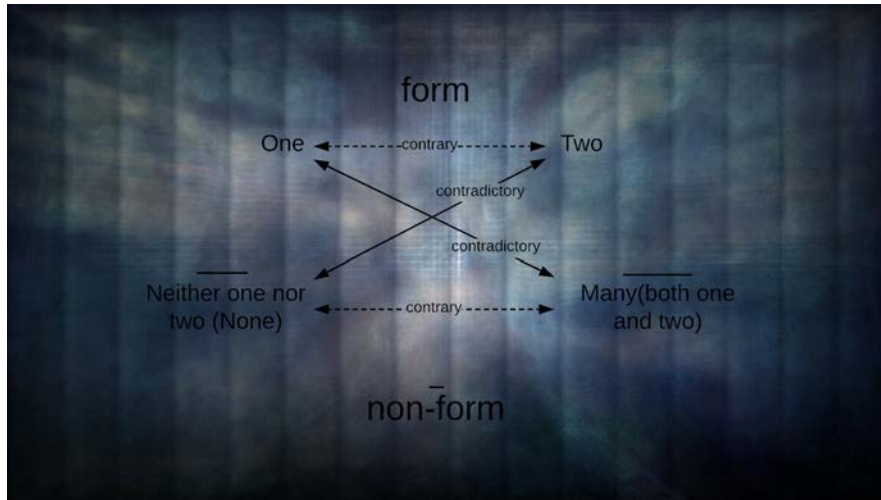


Figure 80: Initial formulation of the semiotic square for *Tibetan Chants by Two Monks*

first stage of sleep. This process typically takes only a few minutes, but the subject's sense of time is distorted during the process, hence it is not uncommon to feel the passage of time longer. In the artwork the five minutes transition between wakefulness and a deep state of sleep has been 'stretched' and extended in order to inform a thirty minutes multimedia performance.

### 7.2.3 *Tibetan Chants by Two Monks*

This artwork is a study in terms of the differences among a unit and dyadic structures, as well as diffused, spread masses and empty space. The initial semiotic square may be formulated as Figure 80 displays.

The average image of all the frames in the performance is displayed in Figure 81.

It may be feasible to uncover in the frame-average image salient forms of the performance. For instance, the imprint of the form of the monk in the opening section is detected in the center of the image, to the left of the central



Figure 81: Average of all performance frames

image fragments of the edge traced forms as appear in the duration of the performance, the brighter areas expose the domains of activity for the stable forms in the performance, while the bluish areas signify the space of diffusion of these forms (the landmarks). This average image may be perceived as an informal phase space of the visual components. It is also possible to map this to the audio domain through the observable relations between the audio and the visual as exposed by tracking features in the visual and audio domains.

**The structure** of the performance is designed in such a way that allows the investigation of another complex dynamical phenomenon resulting in dissipative formations, *embryogenesis*. The modelling approach references specific mappings called growth waves as Thom (1979) suggests. The composition evolution is based upon two processes embryonic development, and limb creation. The compositional space is considered as a simplification of a morphogenetic field in which two types of bifurcations may be observed, fold bifurcations (stable states  $\rightarrow$  empty states), or conflict bifurcations (competition between two

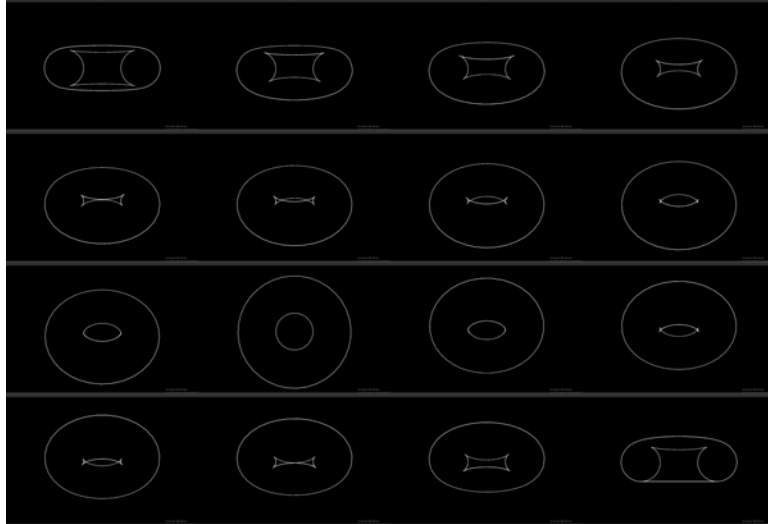


Figure 82: Projection of the rotation of a torus

regimes separated by a shock wave) (*ibid.*).

Since the above suggested simplified model needs both type of bifurcations present in its topology, the EC chosen to model the process is the Swallowtail. Infact what is needed are two Swallowtails in order to model the differentiation of a cell (*mitosis*). The simplest approach in order to attain a topology as such, is by rotating a torus on the vertical axis while keeping the observation point stable. This process is displayed in Figure 82.

Furthermore if the torus is rotated in a more complex manner more complex geometries may emerge by the topological operation such as shell like structures and growth as seen in Figure 56 in Part III.

**The structure** corresponding to the composition's underlying topological arrangement as described above, is the driving force for all the forms created which are the results of mapping the composition source material on a rotating torus. The initial material used in the projection comes from two sources; the

first is a 3d scene composed, and the second an underwater recorded choreography.

The materials were mapped onto a particle system that in turn was mapped on the torus surface, influenced by the rotational dynamics of the torus. In addition, a differential line aggregation (DLA) was also projected on the points mapped on the torus geometry (Figure 52 in Part III displays a projection as such) that controlled the intrinsic forces and dynamics of the particles, producing organic cell-like growth dynamics that expand. The basic steps of the simulation was to use the points as detected by the initial material projection on the torus (points extracted from the 3d environment and the choreography video source) as a seed to growth processes. Additional particles were added (walkers) enabled to move on the torus rotating surface; each walker-particle would move slightly in a random fashion and upon a collision with the seeded rotating points the walker-particle would become stable. The formations result in a rotating *brownian tree* mapped on the torus surface; geometric surfaces representing cell-like formations were reconstructed from the rotating brownian trees, using signed distance fields (sdf iso-surface extraction). The rotation speed of the torus, as well as the differentiation rate is controlled by the audio stream and the two systems (audio and visual) appear synchronised. The audio energetic formations are the driving force of the process which remains relatively static (only the intrinsic particle forces remain) in the absence of the audio energy dissipation to the process.

**The audio spectral descriptors** used in this performance are, spectral flux, spectral centroid, spectral spread, spectral skewness, spectral kurtosis, spectral slope, spectral decrease, spectral rolloff point. Using more than one features gives an overall sense of the form and evolution of the audio spectrum. Nevertheless, some features exhibit similar qualities as far as their detection

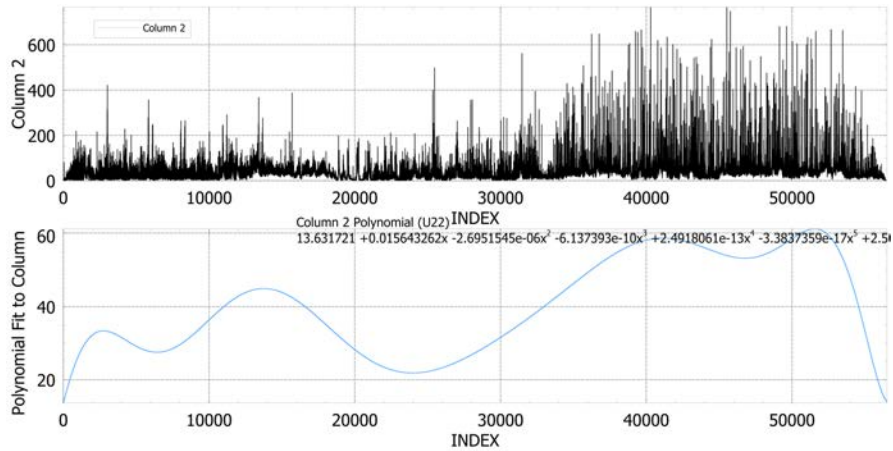


Figure 83: Spectral flux, with polynomial fitting

is concerned. Figures 82-90 display the spectral descriptors along with their polynomial fittings. Polynomial fitting is used in order to shape the tracked feature curves into families of four minima or less. If in the process the resulting curve is not detailed enough and increasing the polynomial degree produces more than four minima, the curve is segmented in smaller parts thus represented as the sum of lower degree polynomials. The polynomial curves correspond to potential functions of ECs.

From the graphs above a first qualitative assessment may be noted: the spectral flux, spectral centroid, spectral spread, spectral slope and spectral rolloff fittings appear as curves of the same family, while the spectral skewness, spectral kurtosis, and spectral decrease fittings appear as the de-compacted versions of the former curves.

In correspondence the detectable features of the visual component (QoM and AoM), are in Figures 91-92.

Once more, the feature graphs expose further characteristics concerning the dynamics of the composition. The QoM graph clearly exposes a three part

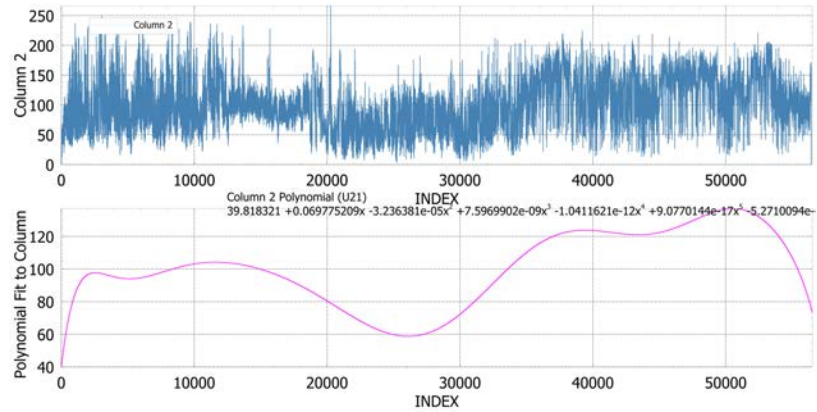


Figure 84: Spectral centroid, with polynomial fitting

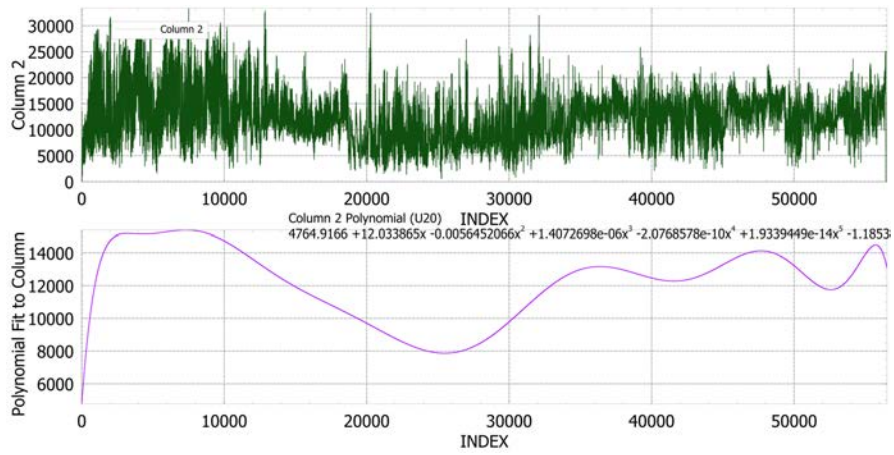


Figure 85: Spectral spread, with polynomial fitting



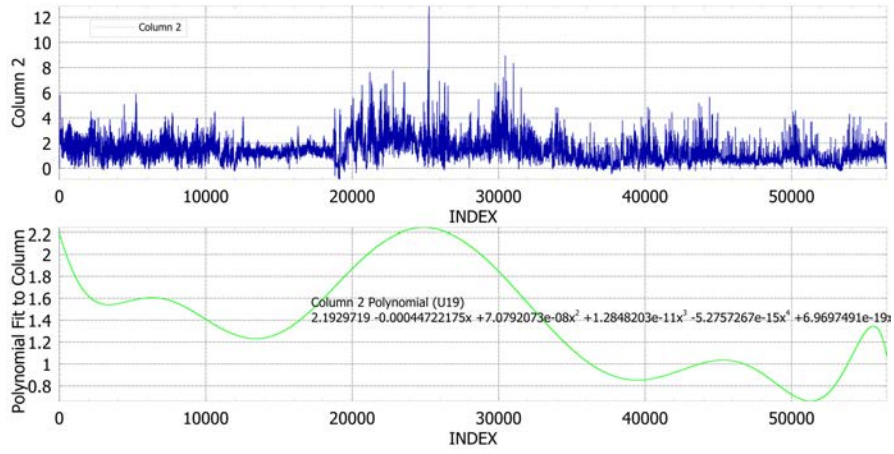


Figure 86: Spectral skewness, with polynomial fitting

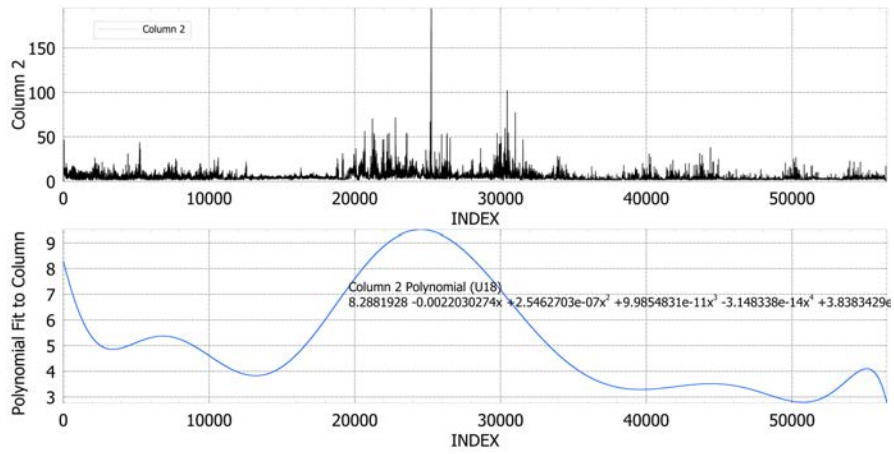


Figure 87: Spectral kurtosis, with polynomial fitting

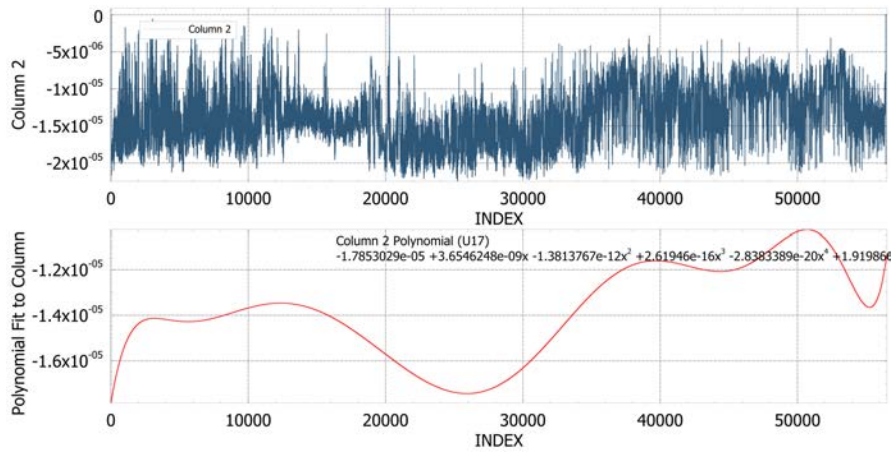


Figure 88: Spectral slope, with polynomial fitting

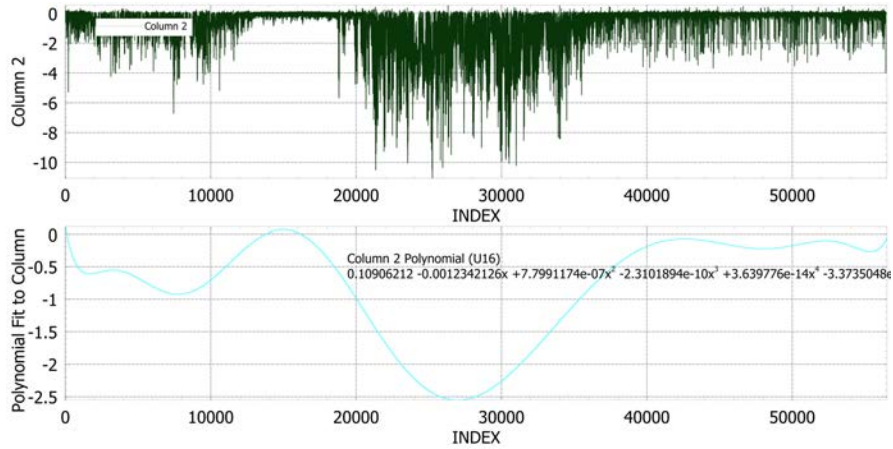


Figure 89: Spectral decrease, with polynomial fitting

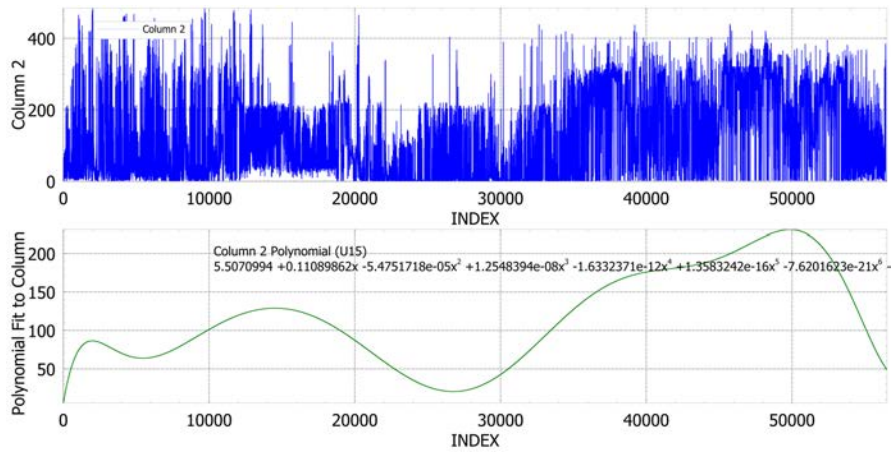


Figure 90: Spectral rolloff, with polynomial fitting

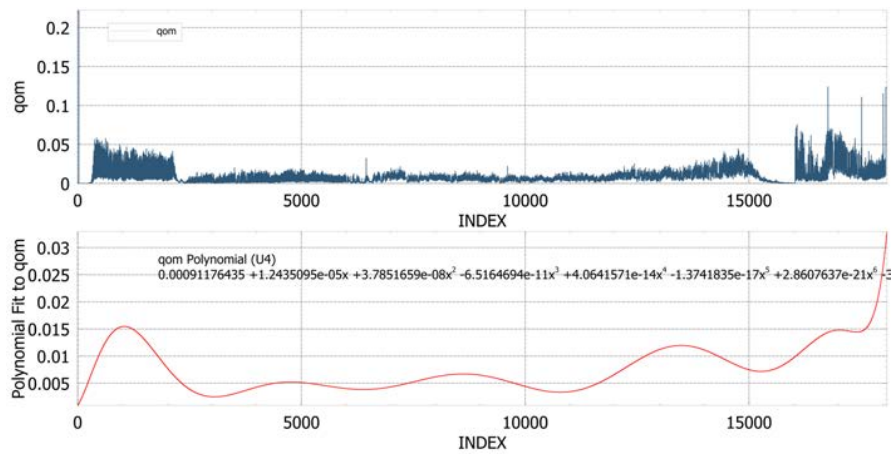


Figure 91: Quantity of Motion analysis for *Tibetan Chants by Two Monks*

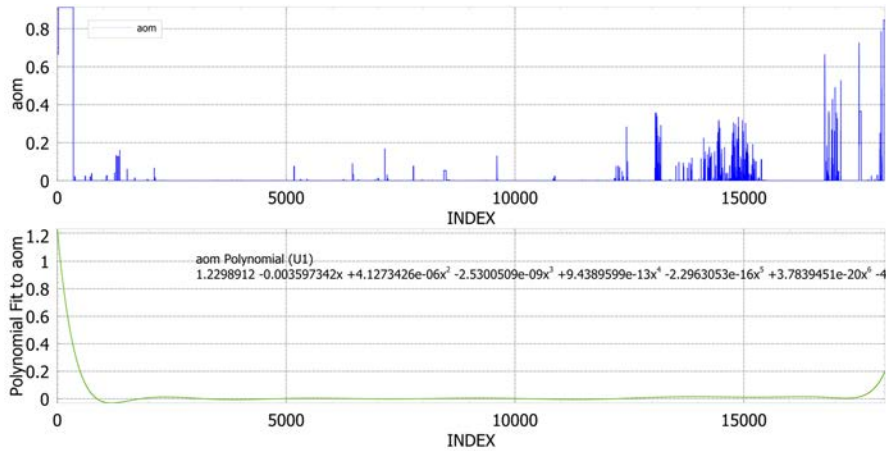


Figure 92: Amplitude of Motion for *Tibetan Chants by Two Monks*

segmentation of the composition in terms of screen occupancy. It is likely that the visual components in the start and conclusion of the the narrative occupy more screen-space, while the mid-part appears to contain compact forms. Also two main transitions may be observed from the graph; one between the intro part and the mid-section and one between the mid-secton and the final part. Turning the attention to the AoM graph indeed can be observed that these may be transitional segments since the dynamics appear to be faster in those areas of the graph.

In order to follow the morphological evolution of the salient forms of the performance the spectrograms and videograms were acquired (Figure 93).

The polynomial fittings of the audio spectral descriptor and the QoM and AoM visual statistical parameters are superimposed to the spectrogram and videogram respectively in order to expose the evolution of the forms:

The videogram reveals additional information about the content evolution. It is possible to observe that morphodynamically the composition can be divided in five parts. Appendix 16 includes a high definition version of the spectrogram

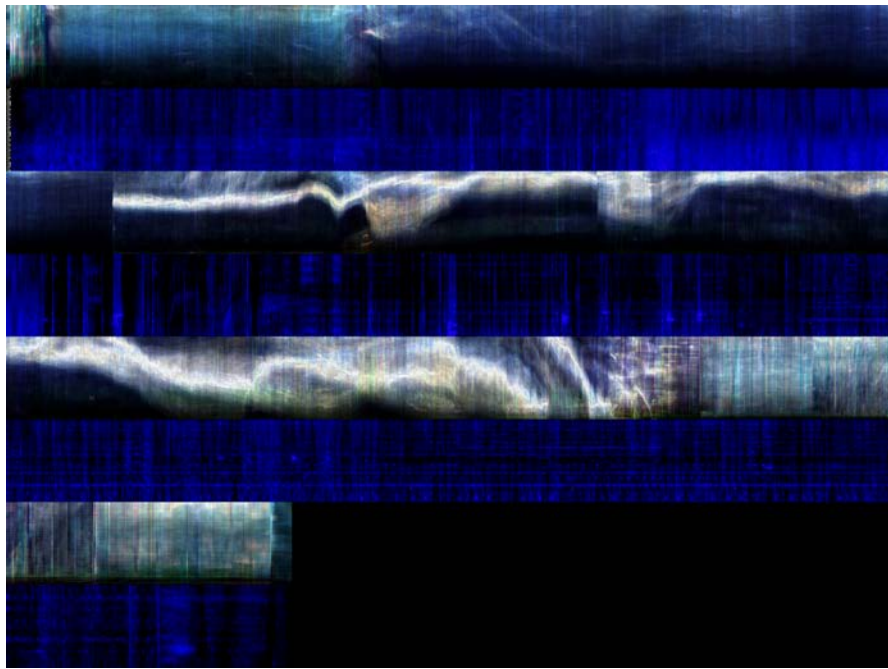


Figure 93: The videogram of *Tibetan Chants by Two Monks* is displayed on top and the spectrogram at the bottom. (high definition version of image found in Appendix 16)

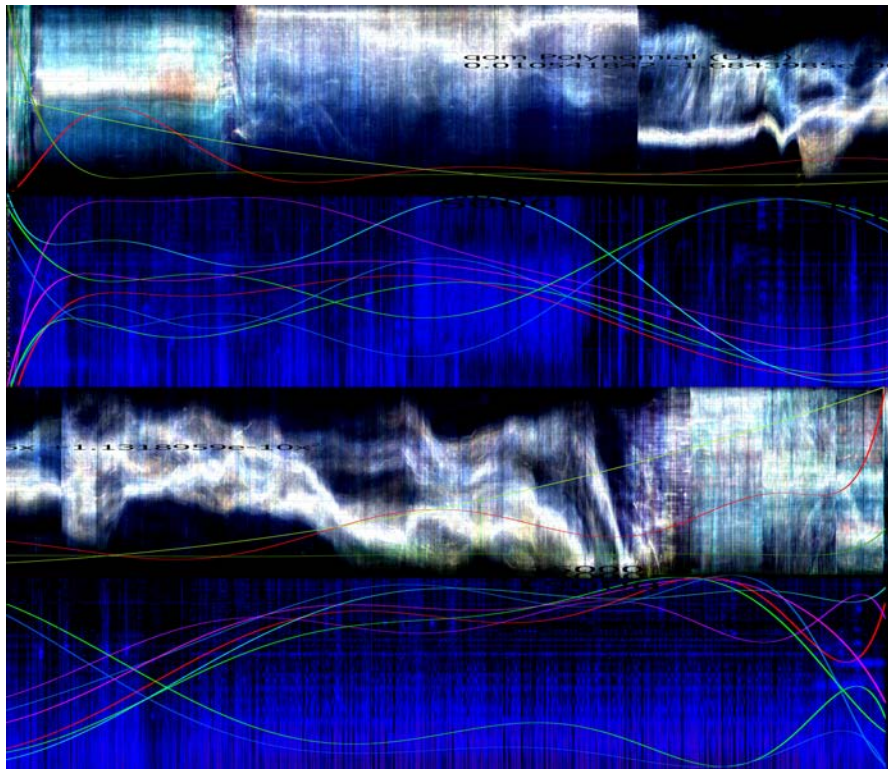


Figure 94: Videogram (top) and spectrogram (bottom) with superimposed feature-tracking polynomial fitted curves.

and the videogram that allows a closer examination of the morphologies and their trajectories.

The first part entails forms dispersed in the whole screen-space, a complete scenery with rapid decreasing dynamics. This seems to correspond to a fold topology and corresponds to a torus rotation where the torus vertical is facing the camera. The system settles in the second part, into a stable scenery where a compact form (stable attractor-actant) appears. The background presence is strong and augments the central form by moving towards it and eventually merging with it. A transition occurs leading towards the third part where two evolving forms take control of the space. These forms evolve and engage in an interaction of uniting into one attractor area and separating into two distinct entities. This is the domain of conflict bifurcations where the attractors are antagonising for dominance. Towards the third section of this fourth part the separation and unification between the two noticeable forms has been elaborated to the point that in their unification they appear as one. These two forms have strong zones of influence between them and allows one to diffuse into the other. These forms seem to engage in an interplay of the 'spit' Thomian archetype, which describes in its incomplete form the partial emission of a second attractor. This bears similarities to morphogenetic processes, and particularly the development and growing of bodily members and organs as found in biological morphogenesis. Eventually these forms appear to converge and dissolve, when another rapid change occurs returning the state of the screen components in a dispersed morphology occupying the entire screen-space both in terms of the x-axis and the y-axis (second fold). It is not clear from the present morphology whether this expansion of the form is the result of a complex aggregate structure, or the result of extreme proximity to an observable single source.

Given the nature of the observed morphologies and the similarity of their

dynamics, the three mid-sections can be considered as one section with three sub-thematics. The segmentation based on morphodynamical observations reveals the quite distinct dynamic character of each of the three parts. The first and the final sections appear as complex componential structures that seem to inhabit an expanded screen-space and exhibit universal activity with higher amplitude. Nevertheless, the nature of their componential structure makes the movement matter less, not allowing the clear formation of explicit trajectories; the motion is mostly significant in terms of interactions between parts of a structure.

The birth of stable forms in part three, and the interplay between the notion of unity and duality, corresponds to the axis of contraries of the semiotic square. In contrast with the introductory and final section the middle part defines the complex axis while the dispersed morphologies of the introduction and conclusion define the neutral axis. A first attainment finds that the three components of the semiotic square have manifested. The fourth that of the ‘radical negation’ may be presupposed by the relations of oppositions and deixes, nevertheless a further assumption may be proposed.

This concerns the case of the morphologies found in the transition between part three and part four of the composition. As it was mentioned the case of ‘non-form’ morphologies there, may either be the result of a complex aggregate structure between components or the result of close proximity to a stable well-formed attractor domain. In the case of the latter then the condition “neither one nor two” non-form is met. The observed morphologies are neither the result of one form, since the proximity reveals its intricate details and renders the phenomenological perception of the form as one unattainable, nor the result of componential interactions between similar units, but rather the result of phenomenological distortion. This distortion then may be interpreted as an



‘empty’ space (fold topology) where is not inhabited by the unity, the duality, or the complex networked structures, it is a space/perception artefact.

Given the relations as determined by the proposed potential functions having found their correspondence with the polynomial fittings, and having defined the positions of the semiotic square as *Monadic*, *Dyadic*, *Complex Aggregate*, and *Empty Space* the potential transitions and their manifestations may be predicted. These choices may be translated as paths on the Dual Butterfly morphology as shown in Figure 95.

Starting from the domain where determinations are not defined  $S/\bar{S}$  the red path leads to a conflict domain between three attractors. In the case of the present artwork there is no observable object of value but audio energy dissipation. Nevertheless, the Instrumental schema may be found in terms of the expansion of attractors and their unification through the use of extended bodily members, e.g., the extension of arms. This indicates the desire for an exchange through the instrument of the arm. In that sense the orange path indicates the ‘play’ between the three attractors, while the green and cyan paths lead to domains of dominance between one attractor representing the monadic structure, and the other representing the dyadic structure. In order to make this interaction more clear the Swallowtail topology may be introduced for the scheme of relations as found in the middle section of the composition. The topology of the Swallowtail and several paths are indicated as follows:

The purple path indicates the genesis of the dyadic structure and the marking of the monadic structure. The blue path leads to the area of conflict between them no longer in terms of a third attractor. It may be observed here, as the red path indicates, that crossing the boundaries inside the triangle represents the scenes where both attractors are present and the one tries to dominate the other. The green and cyan paths indicate the crossings to states where

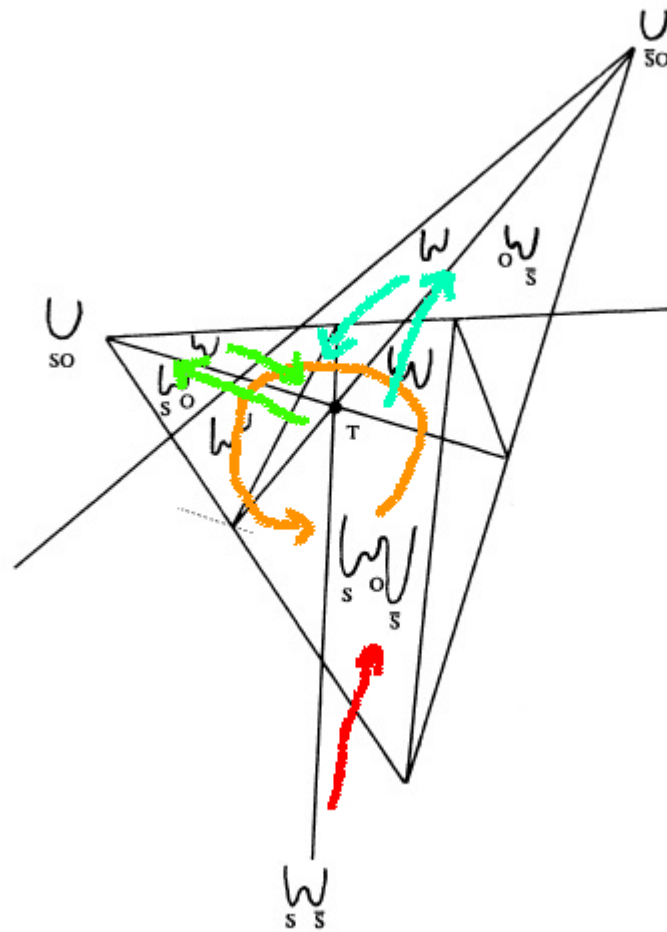


Figure 95: The Dual Butterfly topology and the relations of the actants

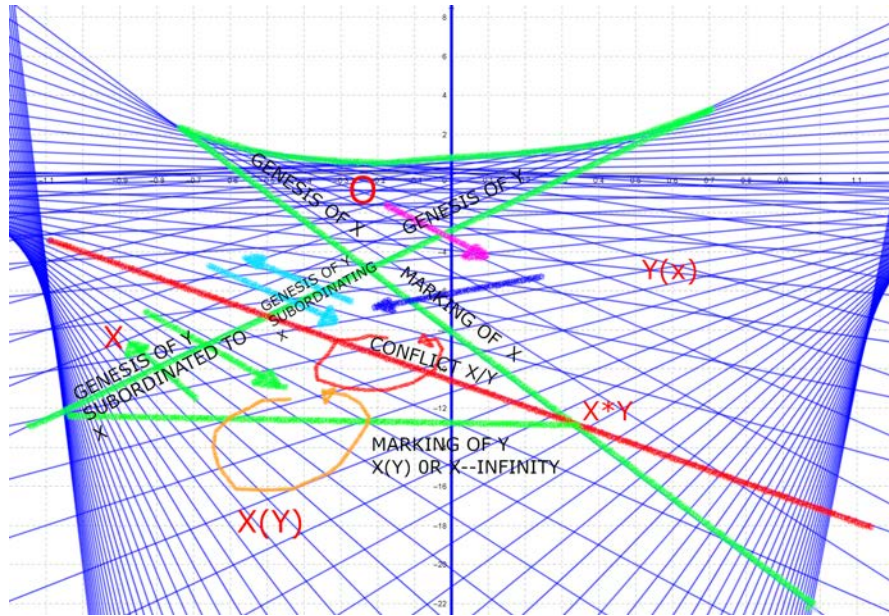


Figure 96: Paths on the Swallowtail , mid-section of *Tibetan Chants by Two Monks*

the dyadic forms are united into one stable form, or their state is stabilised as two separate forms. Interpreting the interactions by alternating between both topologies (the Dual Butterfly and the Swallowtail ) provides an interpretation not only for the relations of the two stable forms found to interact in the mid-section of the narrative, but also for the instrument facilitating their interaction which in this case is the extension of bodily members of one attractor towards the other and the corresponding acceptance or rejection of the exchange by the other. The acceptance unites the two stable form and the first position of the complex axis in the semiotic square is manifested, the rejection manifests as dominance of its contrary, the second position of the complex axis in the semiotic square. Similar segmentation may be proposed also for the translation of the potential functions of the system that correspond to the several polynomial fittings of tracked featured presented above. To acquire an overall perspective of

the narrative relations and evolution one may study the graphs as the potential of the Dual Butterfly, but for more detailed observations the graphs may be segmented and interpreted as potentials of simpler topologies.

In regards to the aural counterpart, a ‘bird’s eye view’ inspection may lead to an initial observation that the audio spectrum appears noisy with no particular salient forms or dynamics, such as, melodic modulations, or gestural suggestions. Nevertheless, upon a closer inspection by ‘zooming in’ it is possible to observe a wealth of micro-gestural components that appear similar to that of the visual domain but on a smaller scale. Thus, a loosely defined multi-scale diffusion structure as presented in *The Girl in a Night-Dress* may be observed here between the aural and visual domain. The visual domain appears as the first layer of the diffusion, while the aural counterpart is following similar patterns in a micro-scale and by more subtle components following their own diffusion relations. This ‘natural’ superimposition is reflected in the correspondence between the graph of the spectral slope and the graph of QoM. Furthermore, there is an overall synchronisation between the visual and audio entities that seem to move in time through a common flow. Figure 97 outlines some of these micro-movements of the aural components, with the more gross movement of the visual forms.

**This narrative** was conceived during a composer’s trip to Amsterdam when during a walk in the city two monks were spotted overtone chanting. The energy these monks were emitting was a transformational experience evoking images of places never travelled and deep realisations about the human nature and the universe. This idea was recorded and several years after the concept as presented here started to formulate. As mentioned previously the raw material is a mix of 3d created scenes and video footage. The introduction and the conclusion are 3d reconstructions by the composer of two images found online;

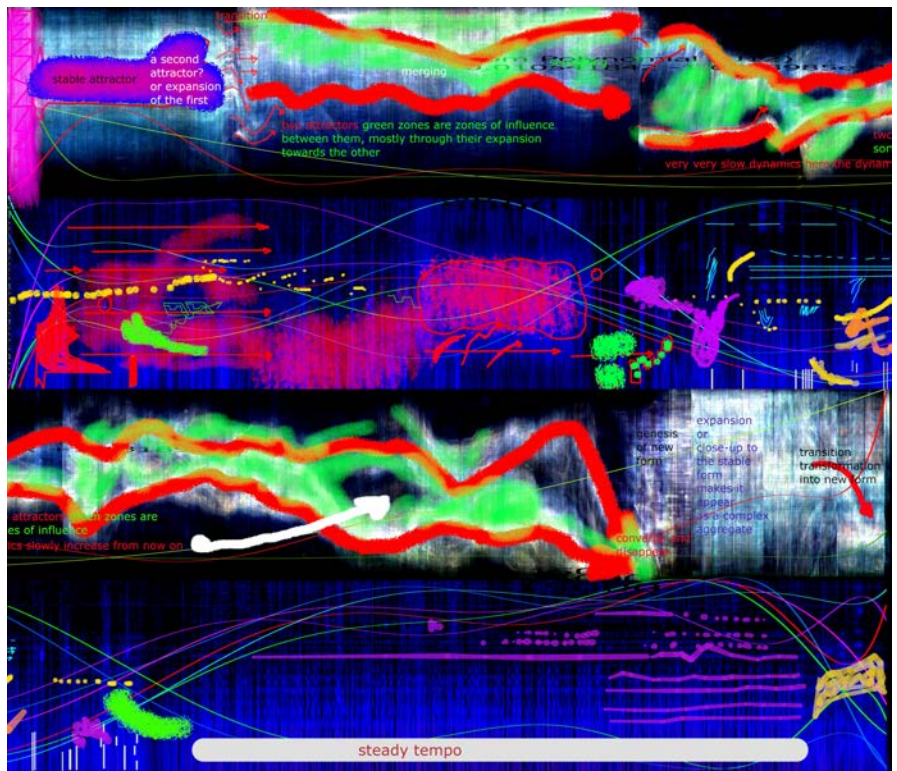


Figure 97: *Tibetan Chants by Two Monks*, attractors and trajectories outlined in both the visual and aural domain.

the first was that of a monk as a central figure being approached by a herd of elephants, and the second, as found in the conclusion part of the composition, the image of a lady dressed as Kali outside her home. The mid-section of the narrative is created from underwater footage of two dear friends of the composer swimming in a choreographic manner. The material through skeletonisation, edge detections, and triangulations was abstracted in a manner that the main morphological characteristics of the material were retained in the abstraction. The concept inspired by the experience in the presence of the two monks was formulated as presented here as a morphogenetic process, and regarded the idea of differentiating a spatially a type of *mitosis*. Also the fractal nature of reality where complexity may equally be found in macro-forms, as well as, micro-forms was a main axis for the conceptualisation of a semiotic square that captured the logico-semantic relations of those basic concepts, but also the core morphology of brownian trees used in the implementation algorithm.

#### **7.2.4 *The Saviour***

*The Saviour* is one of the last artworks completed in the portfolio. It was conceived while in the process of formulating a narrative universe for the work *The Fallen* in a spontaneous fashion. While the composer was conceptualising the types of interactions that stemmed from concepts relating to *The Fallen* in a light-sleep state a whole scene description spontaneously appeared. The intuitions concerning the scene upon its conception were comprehensive including dialogs between characters, camera movements, lighting etc. The original conception was retained as a sub-thematic for *The Fallen* forming a sort of anthology, but in order to be presented as a separate narrative the scene was reconceived. The following script describes the original intuitive conception that brought to life the ‘central’ character of this narrative.

The fallen (f) in a dialogue with his former self, the saviour (s):

- s: I just want to there for you...(scene break)
- f: There was this, hum, soul I used to torture back in hell, and like a good masochist he'd call the shots..."burn me...hurt me...fraise me..."...so I did...(sighs and says tired) and this went on for centuries...until one day for some reason I missed his daily punishment...when I returned he was crying..."please my king", he said, "don't ever forget me again...I promise I'll be good (f says softly)". It was then I realised that he was so full of self loathing, void of any self respect, that no matter the depth of my cruelty, whatever miniscule attention I paid...gave meaning to his...pointless existence (f says softly).
- s (says deeply): Why are you telling me this?
- f: Because he reminds me of you...and you think I've changed (voice breaking)...? YOU!...the former angel! Powerless and pathetic!, a disgraced failure...! with no better way to spend your days that yipping at my heels for scraps, to remind YOU of a time of when you once mattered...?
- s: Uh...I..I..know what you are doing... and you can kill the messenger if you must...but just know I AM here for you...

Close up to the eyes of the f, burst of anger from f follows.

The short script above remained as a scene in *The Fallen*, and has been used as a script by the *Butoh* performers performing retellings and reconceptions of the artwork; they use parts of this script in order to develop them in the form of *butoh-fus*. Nevertheless, certain qualities emerge from the above script which were conceptualised as a different narrative conceived as a prequel to *The*

*Fallen* anthology. There is a contradictory idea in the script concerning the two characters being the same entity in different spatio-temporal settings. So while there is a dialogue, the characters participating are one and the same. In *The Fallen* the character seems contaminated by ‘the fall’, so this assumption presupposes the character being in a pure state of existence prior to the fall. This is the initiatory state triggering the script above.

The initial intention of the saviour is to save the fallen, presupposing he has the power to do that. The genderification of the saviour as a ‘he’ is not accidental in the descriptions here, and this shall be further elaborated. That power as proven from the dialogue seems to be the product of a false notion since while the dialogue unfolds the saviour finds himself dominated by the seemingly weak fallen entity.

At the end of the dialogue the saviour seems to accept his own fall from grace and re-embraces a new kind of power that comes from understanding and self-realisation, rather than an inherited status of being.

This setting was reconceptualised as a false patriarchal belief of male power being the dominant entity in nature and society. The saviour is perceived as a male energy, one that projects a strong, self-assured presence, but also may ‘crack’ upon facing an unexpected situation suggesting this self-assurance is the real weakness.

The current narrative portrays a stable state of existence, a stable sense of being. Thus, the use of the male human voice in the audio component that is stable and assuring but also breaks when stretched into fragmented, ‘out of breath’, fading utterances. This stable state is depicted both in the aural and visual domain, as seen in the videogram and spectrogram of the composition (Figure 98), there is only one complex morphological profile (state) evolving in time.



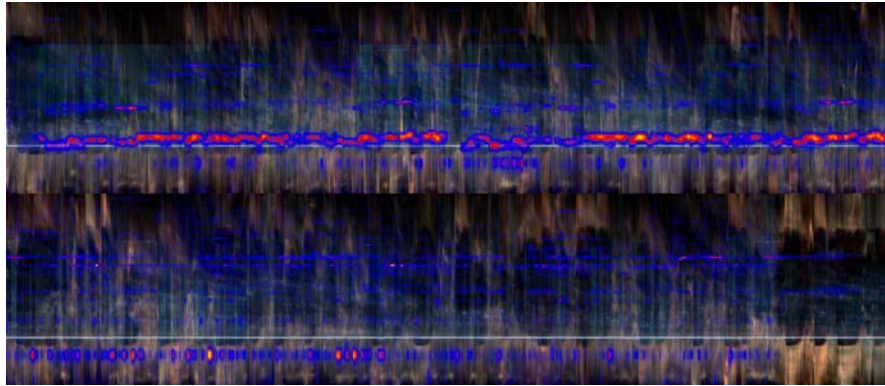


Figure 98: Combined videogram and spectrogram of *The Saviour*. (high definition version of image found in Appendix 17)

The seemingly stable state of the composition is perceived as a cyclical structure, with a cyclical type of logico-semantic implications as depicted in the diagram in Figure 99.

The complex axis of the square is occupied by two contrary terms the [Saviour] and the [Fallen] while the neutral by a term representing [both Saviour and Fallen] and [neither Saviour nor Fallen]. The neutral axis represents the real state of the Fallen and the real state of the Saviour. In the first implementation the complex axis is occupied by ‘absolute’ entities, while the neutral by ‘real’ entities.

In accordance to the conceptualisation described above, the term [both Saviour and Fallen] is replaced by the male figure in the society, while the term [neither Saviour nor Fallen] by the female figure in our society. The new neutral axis formed in this second semiotic implementation is found in the terms [both Woman and Man] and [neither Woman nor Man], which by excluding the biological semantics, i.e., gender, and assuming a sociological perspective, may only be depicted in the mythical forms of absolute Beings, beyond the human realm. Thus the [Real] neutral axis from the first implementation is transformed into

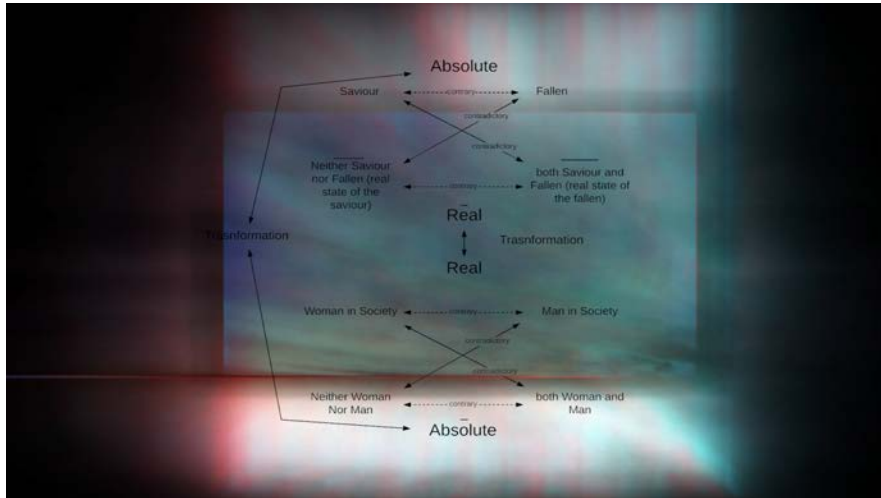


Figure 99: The semiotic square of *The Saviour* ‘exploded’ into a cyclical structure

the complex axis of the second implementation, while the complex term of the first implementation is transformed into the neutral in the second articulation. This structure of the logico-semantic relations is cyclical.

Averaging all the performance frames into one image reveals the main boundaries and domains of activity in the screen-space (Figure 100).

It may be noticed that clear outlines, stratification and structure characterises the screen-space; in the centre a well defined rectangle is observed, this is the virtual screen seen in the performance that is the domain of existence of the Saviour as a character. It is bounded, explicit, and artificial. Inside the virtual screen rectangle, several areas of contrasting light and shadows are found. The dark areas are imprints created by the performer’s movement. The virtual choreography is superimposed with a 3d volumetric representation of clouds and ocean simulations. The simulated structures are also traced by a particle system creating an outline; its imprint may be noticed in Figure 100 as a straight line at the bottom of the central rectangle.



Figure 100: The average image of *The Saviour*

**The structure** of the performance reflects the monotony of the morphological profile of the audio-visual stream. It is a basic setup based on visualisations through three containers positioned one behind the other in the world-space, and a visualisation in the raster space superposed on the rest of the narrative constituents.

The raster space contains particle trails tracing boundaries and edges of cloud forms, coupled with an operator accelerating and affecting the velocities of the trails. A well defined domain where figural constituents, i.e. the human form, are enclosed and displayed through densities in volumetric formations in the intermediate space. The background is occupied by a particle system, there to visualise the acousmatic gestures and dynamics from the utterances and their spectral manipulations. This system possesses higher degree of kinetic energy and is excited (entropy increase) by the energy in the audio stream.

The audio dynamics are subject to a dynamical controller (described in Part III) inspired by Thom's descriptions on the dynamics of memory, the *Memory*

*Machine*<sup>88</sup>. The controller outputs spectral information that may be used both as a controller values at sample rate, or as spectral content themselves. In this situation the output values are controlling the dynamics of more complex swarms of partials as well as the parameters of processes such as networks of spectral delays and spectral feedback modules. The audio stream in turn is the basic regulator of the visual content, including the final raster space compositing.

The compositional intention behind the performance design, is to create cloud-like and wave-like audio-visual forms changing steadily, continuously, and with slow dynamics. They are ‘pure’ stable forms with slow evolution but attributed with continuous variation and change. The resynthesised material is considered representative of persistent, stable (perceived as static), yet ever-changing structures, such as those of clouds evolving and travelling waves. These forms display a contradictory character due to their slow – in some cases out of the human perception limits, dynamics and their continuous evolution.

The choreographic choices reflect and express similar notions. The perpetual motion of these forms (clouds and waves) – also implicative of their absolute nature, is depicted in the subtle motion characterising parts of the choreography. The manifestation of the human figure through the Butoh dance, extends the notion of a perpetual existence and reveals another axis of the semiotic square that of sentient entities. There are moments when fragility is expressed by the performer by collapsing his stable form and strong posture into vulnerable states, e.g., throwing the body out of balance, assuming curved shaped postures and non canonical positioning, attaching the body to external elements, and even through excessive, exaggerated facial expressions. These gestures are frequently concealed by the surrounding cloud and waves simulation, nevertheless,

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<sup>88</sup>Modules as such are usually coupled for further variation with other dynamical operators, such as turbulence, chaotic and semi-chaotic oscillator networks, or periodic oscillator networks in order to profess a range of dynamics. Has been stated several times that these modules being at sample rate may both regulate content or directly output spectral content.

there are times that the performer's figure and gestures are revealed as shadows – gaps in the overall complex composite form.

The virtual choreography presented in *The Saviour* was initially used in *The Fallen*, and its inclusion in *The Saviour* was a compositional choice to facilitate the augmentation of the underlying link between these two narratives.

An additional visual narrative element, is the particle system situated in the background of all the other forms. Its appearance is schematic, bearing no textures, or any kind of feature to state its materiality; it is depicted through points and lines. In that sense the dynamics of the particle system are brought forth, along with their subtle dependence on the evolution of the audio material. The particle system's state (dynamical profile, direction, speed of motion, brightness, etc.) is controlled by the audio material, and is the core regulation to achieve the temporalisation of this static scenic setup. The imprints of the particle system in the average image of the performance (Figure 100) may be found in the diffused brightness in areas around the central rectangle.

As stated it is the aural component that primarily has the task of temporalising the narrative and attributing to it a sense of directionality and purpose. The intentions governing the choice of the material and its implemented transformations are related to how intimate the material may be to a human listener; in turn, the attainment is for its transformation to take place in such a manner that creates a continuous almost self-regulated flow that is not 'contaminated' by repeated audio events.

To achieve this the human voice was chosen as the raw material from which the rest of the audio typologies would be generated. As far as the spectral processing of the material, the principal ideas revolves around generating sounds that may not be identified with the source material and sounds that would reference the most distinct aspects of it. Nevertheless, the source modifications

take place in such a way that the final result may seem alien to the listener.

The two main typologies resonating with these concepts were sound families from stretched or compacted partials and spectral components of the vocal recordings, and spectral reconstructions of the actual recordings with stretched, fragmented, and granulated spectra in such a manner that would create a source-bonding disturbance for the receptor. It needs to be noted that the only recordings used as were recorded, are the first few seconds found in the opening of the narrative.

The rest of the material (even that which may be considered as an identifiable vocal performance), is in its entirety artificially created by using less than ten seconds of recorded performance processed as mentioned previously. In that sense identifiable aural events may be found through the piece but may, for instance, be of significantly longer durations than those found in the actual recording. A conflict thus created upon reception. The sounds with higher degree of surrogacy, significantly dislocated from their source, act as a glue for the composition bringing together not only the combined total, but also providing the necessary spectral energy that ‘make things move’ and evolve including the events and dynamics in the visual domain.

Notably, from the videogram and spectrogram one may realise the persistence and dominance of the salient aural forms in correlation with the salient visual elements. The saliency in the visual forms is invested to the performer figure appearing as a dark area with continuous presence in the videogram, and also to the particle system controlled by the aural components and seen in the videogram as the orange-brown oscillating vibrations.

The rhythm as dictated by the audio manipulations and processing similarly ‘sets the pace’ for the rest of the narrative elements, that appear to pulsate in an almost periodic and synchronous manner. This type of audio passages fulfill

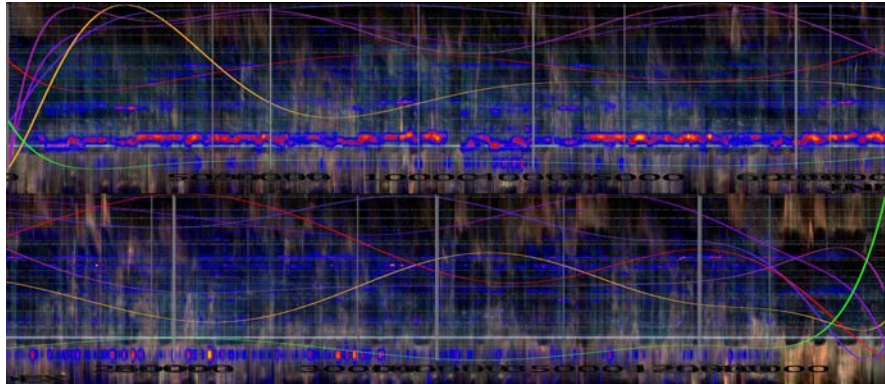


Figure 101: Videogram-spectrogram of *the Saviour*

a desired aesthetical attainment for the aural domain; depicting the subtle slow evolving movement of waves as could be found, for instance, in the motion of the ocean or large fluid masses.

The electronic sound elements are regulating the modulations that augment the identifiable vocal sounds; at times they are found supporting the vocal presence, at times propelling the audio events ahead. In an oppositional aural variation of the identifiable male utterances, female processed vocal sounds are set to fortify the slow modulations among the material and enrich not only the spectrum but also the perceptible semantic field with the opposition male ↔ female.

Recalling the videogram and spectrogram this time superimposed with several visual and audio features verifies the above commentation (Figure 101).

Observing the audio spectral and visual descriptors the static oscillating nature of the morphologies may be verified. A significant spectrum decrease (puple curve) may be observed after the middle section, while the spectral rolloff, spectral centroid, spectral spread (green curve), and spectral slope appear as the inverse curves of the QoM and AoM (represented by the light and darker purple curve) of the visual descriptors (the spectral centroid, the spectral rolloff and

spectral slope are not included in the figure since they are of the same family as the spectral spread). The morphology of the kurtosis (orange curve) presents interesting measure of non-Gaussianity exhibiting a super Gaussian distribution. This stability in the spectrum indicate the dominance of the salient, tonal utterances and that of the lower tones over the higher tones; this attribute that may be exhibited in the centroid too, once more, are idicative of the dominance and saliency of the identifiable source utterances in the composition. This type of spectrum distribution is the outcome of compositional choices seeking to attain a stable aural situation for the composition.

This work as is the work *Dolores* are presented in a stereoscopic format. Since these works are also conceived as choreographic and stage-performances similarly to *The Fallen*, the author's desire is to express the spatial character of these compositions, that were also conceived in terms of their stage presentation and their spatial dimension. The stereoscopic format creates for the purposes of this portfolio the sense of depth facilitating the idea that these are also virtual stage-sets. The folder found in the portfolio includes a short video virtually demonstrating one of the stage conceptions for this artwork for reference ['The\_Savior(Echo)\_holographic\_virtual\_demo1\_(Grace+Marinos).mp4'].

### 7.2.5 *Dolores*

If admitting *The Saviour* artwork to represent the male 'energy' manifestation in the portfolio's narratives, *Dolores* is the female manifestation. The perceptible characteristics of this composition anticipate a similar overall effect as that of *The Saviour*. Hence the performance design strategy adopted was similar.

**The structure** reflects a complex feedback system. As in *the Saviour*, it is the audio stream that 'drives' the visual events and dynamics. Here, the design is more minimal though as far as the visual domain is concerned. The initial state



of the forms used is of minimal complexity (spherical emitter of particles) in a field of dynamical operators affecting the particle flow and expansion in space by modulation with the audio feature tracking. A data retaining container tracks the history of the audio feature values and creates vectors from them, while a second storage container store the state of the particle system at the end of each frame, acting as a memory device. The history of the audio features and the history of the particle system states are then visualised in a third container of particles found in the background of the virtual performance space. This setting acts as the visual feedback system, and as a result after some time in the performance, formations start to appear in the background with different dynamics from the particle events taking place in the foreground system. The life cycle of the particles is different, and is set in order for them to remain present for longer time periods, before they fade and dissolve.

The vector fields affecting the particle simulations are common for both of the particle systems, and are vector space composites of turbulent, curl, and fluid dynamics constraints. In addition the previous frame audio dynamics as stored in one of the data containers also regulate the current frame parameters, once more a basic feedback network design that smooths the particle motion and their response to the audio excitation.

In the audio domain a complex spectral feedback network is set in order to capture sound in real-time analyse it and feed it back to the stream in a dynamical fashion. As a first step the sound is resynthesized, while different spectral components are stretched, filtered, 'freezed' and delayed. Around four minutes in the composition spectral waves from the spectral manipulations starting to be fed back in the audio stream enriching the spectral content, and start to modulate with the current audio frames.

Once more the desired morphologies both in the visual and the audio attain

to a continuous flow of visual and aural material, self regulated, and modulated by various kinds of augmentations. To achieve this short recorded performance segments following an abstract written score, were analysed, stretched, and broken down to their basic components, only to be rearranged in such a fashion that they appear to modulate and produce a slow evolving, but rich acousmatic scenery.

The cognitive interplay lies on the distinction of identifiable vocal sources on the one hand, and their significantly processed artefacts barely exhibiting a bonding to their sound sources on the other.

The vocal performance by a group of female vocalists, during a residency in Lubeck Music Academy, fortified oppositional relationships between vowel sounds and noise consonant sounds, distorting their nature by following compositional instructions urging the prolongation of the consonants and the shortening of the vowels. These articulations were later further permuted, by separating these different spectra types and performing additional operations on them such as spectral separation and stretching, recombining then the partials into new artificial articulations as may observed in the performance. The spectral descriptors fittings of the aural forms, the spectrogram, and videogram are displayed in Figure 102.

The aural and visual components as seen in Figure 102 are in correspondence in terms of their rates of change. Increasing tendencies in the audio spectral qualities cause increasing tendencies in the QoM and AoM features in the visuals. Since the rhythm of the evolution of the material was considered in terms of the aural transformations, the visual domain attain in providing a representation of the relationships among the aural qualities of the narrative.

Thus, the audio features are controlling the vector space responsible for the fluctuations and pulsations observed in the visual field. The spectral centroid

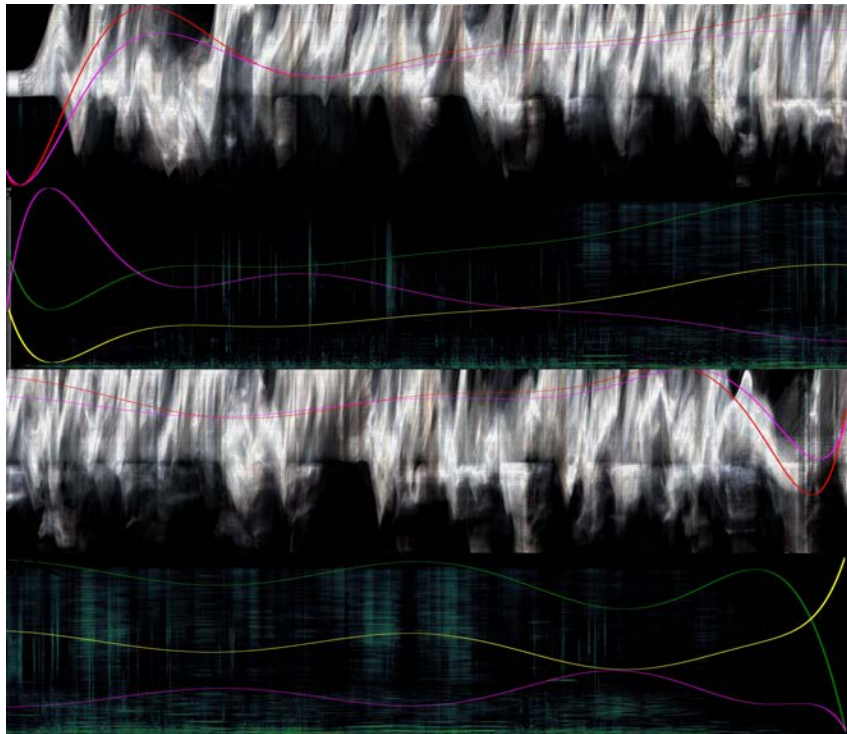


Figure 102: Videogram and spectrogram with polynomial fittings of visual and spectral descriptors. (high definition version of image found in Appendix 18)

(green curve) exhibits a shift of the energy in the audio spectrum towards higher frequencies for the first half of the composition, while it remains in these higher levels, that is an indicator of the more noisy spectral qualities, for the other half.

In turn the skewness gives a sense of the distribution's symmetry, and it may be noticed that the values tend to converge towards the centroid as the composition develops. This represents a compositional choice in terms of the influence on the spectrum, which tends to create a more noisy, but balanced distribution.

The saliency of certain forms is obscured in order for more salient musical relations between the aural material to arise. Hence, the spectral movement overall in the composition reflects a transposition into a 'musical' domain, where the abstract, transformed vocal spectral partials institute an environment that facilitates the revelation of the musical relations among the aural material. It may be noted that the visual material in correspondence appears to be more symmetrically distributed in the screen-space at this state.

To numerically display the situation described above, one more descriptor is introduced indicating when the sound is speech-like and when the sound is music-like. This is found in the red curve superimposed on both the spectrogram and videogram below, while the green arrow indicates the direction of the transition between speech to musical relations (Figure 103).

Skewness, displayed in purple in Figure 103, decreases as the aural spectrum becomes more symmetric around the centroid function. The energy is transferred in a more symmetrical function among the partials, and the salient identifiable forms merge into a musical composite. The perceptible qualities correspond to the utterances becoming obscured and transforming into musical material, while this shift corresponds to a more symmetrical and intense

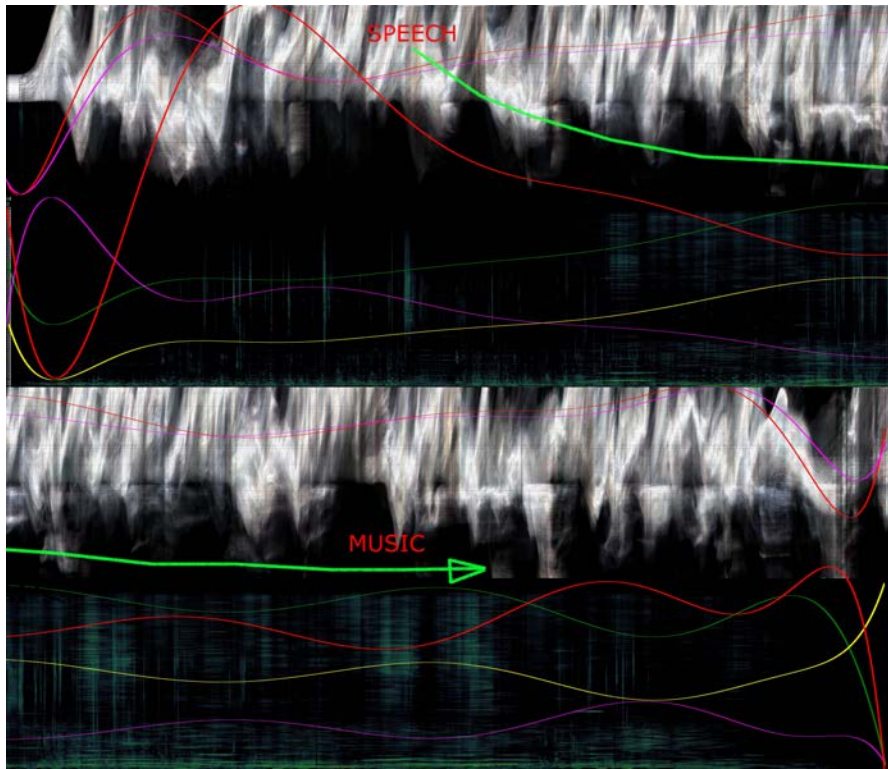


Figure 103: The red curve and the green arrow indicate the speech to music transition

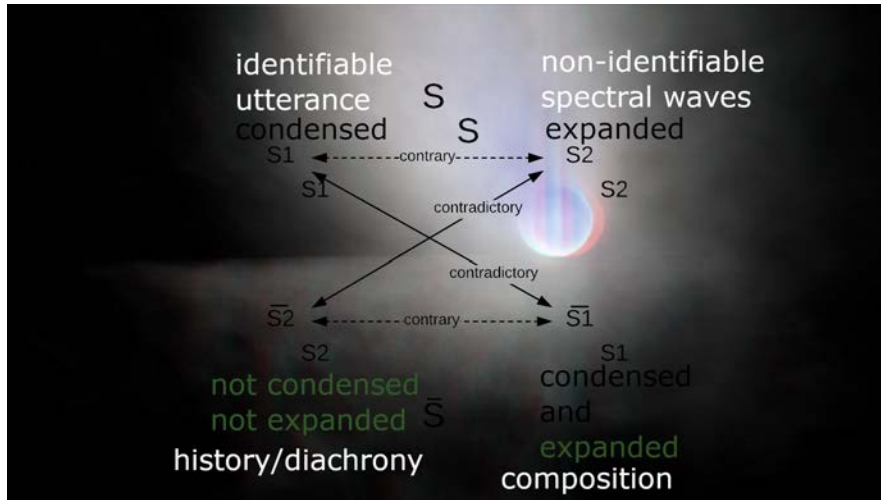


Figure 104: *Dolores* semiotic square.

distribution of the particle system in the visual narrative space.

The motion type in the composition is almost oscillatory, while the structure is rather cyclical. The point of origin finds the visual material all concentrated in a sphere, while the passage of time is marked by the expansion of the condensed field in a wave-like manner until towards the end that retracts back to its original condensed state. This is the aural development strategy also, where the identifiable utterances from the vocalist group develop till they reach a level of musicality where they start to become compact once more into a simpler type of spectrum.

The distribution of the features though does not suggest symmetrical dynamics, but rather different type of dynamics may be detected in each half of the cycle of transformations. Hence the cyclical form refers more to the distinguishable surface forms rather to the deep compositional components which seem to be subjected to a symmetry breaking.

A proposed signification schema for this composition is found in Figure 104.

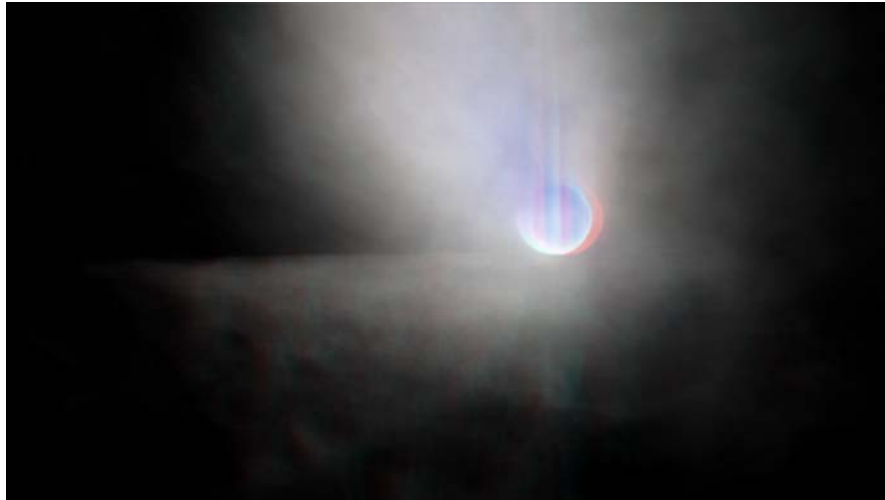


Figure 105: *Dolores* average image.

The identified actants may be observed in the average image of all the composition frames (Figure 105).

All the elements of the square have been imprinted in Figure 105. The compacted visual forms are found in the noticeable sphere, while their dispersion as is dictated by the audio components are seen as a diffused brightness around the sphere. The composite of these detectable elements constitutes the third position of the square, while the dark areas in the diffused brightness are the effects of the diachronical elements, the imprints of the system's memory.

The diachronic elements are represented in the visual domain as imprinted forms found in the background of the composition that also define the depth, and set the boundaries of the narrative space. They may be seen in the Figure 106 displaying a frame from the composition.

Each semiotic square components occupy separate domains in the narrative space. The 'condensed' component remains static and ever-emitting; the 'spread' component occupies the main area of the 3d space (in x, y and z di-

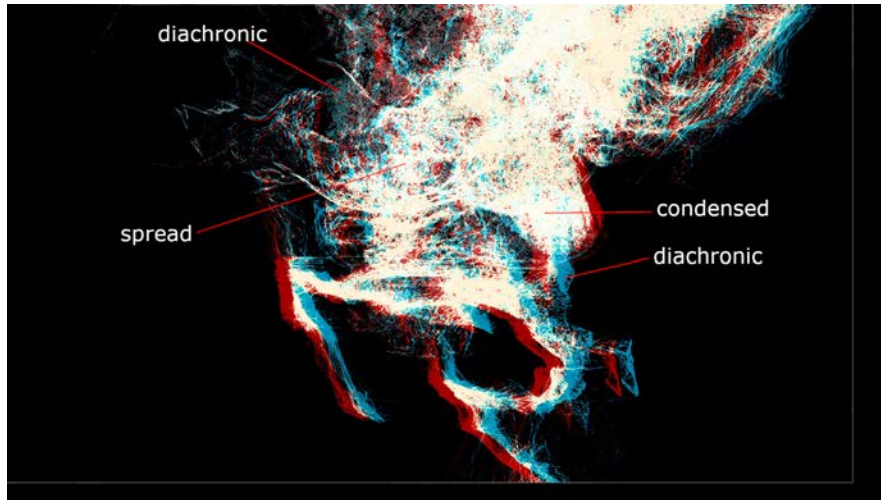


Figure 106: Condensed, Spread, Diachrony, Composition terms of the square as found in a single frame.

mensions), since it is the synchronic narrative element; same as the ‘composition’ component which is the union of space occupied by the previous two components; the diachrony component is located in the background (in reference to the Langackerian landmark). ‘Travelling’ the semiotic square in a figure of eight as proposed by Thom (1989a), outlines the possible transitions *Condensed* → *Spread* → *Diachrony* → *Composition* → *Condensed* . This cyclical structure may be observed overall in the composition as its global form.

A final note should be made on the visual aesthetics chosen for this narrative. They are abstract, schematic and minimal referencing only very basic geometrical shapes, points and lines. This is in accordance with the complex semiotic implications between the three artworks *The Saviour*, *The Fallen*, and *Dolores*, of which the loose underlying link was discussed in the previous section referring to the analysis of *The Saviour*.

It is stated there and at the beginning of this section that *Dolores* may be



considered as the manifestation of the female ‘energy’ in the portfolio. The female component in semiotic terms may be understood as the unmarked term in relation to the male (*The Saviour*) which is marked. The visual in both artworks reflect this relationship and while in *the Saviour* one may find marked and figurative visual components, the depictions in *Dolores* were chosen to be schematic to reflect the semiotic status the term.

The sphere was chosen as an origin shape in that is understood to entail the most characteristic quality of the female manifestation in our reality; the ability to bare life by containing it in a round shape (the egg, the belly of a pregnant female etc.), the *containment* schema.

This reference may be found linguistically in the Greek language tracing the root of the work *egkyos* meaning ‘pregnant’ and composed by the elements ‘*en*’ + ‘*kyo*’ roughly translated as ‘being pregnant’, literally translated as ‘being in roundness’; the greek word contains the root *kyo* which is coming from the word *kyma* and means ‘wave’. The morpheme ‘*ky*’ is found generally in words describing roundness such as that observed in wave dynamics, e.g., the world *kyklos* as in cycle, cyclical (English translation circle). In correspondence to this the sphere in the beginning and the end of the composition represents this primary female trait.

### 7.2.6 *DEN*

*DEN* is at its core a study into the dynamics of form, brought forth by a complex, real-time system network architecture, built for the creation and staging of diverse, immersive, multimedia environments.

The elemental system of interactions in *DEN* is modelled after the discursive *narrative* form inferred from a series of individual recorded Bokusho experiments, constituting the *narrative acts*.

The structural narrative components are the *program* forms of the complex

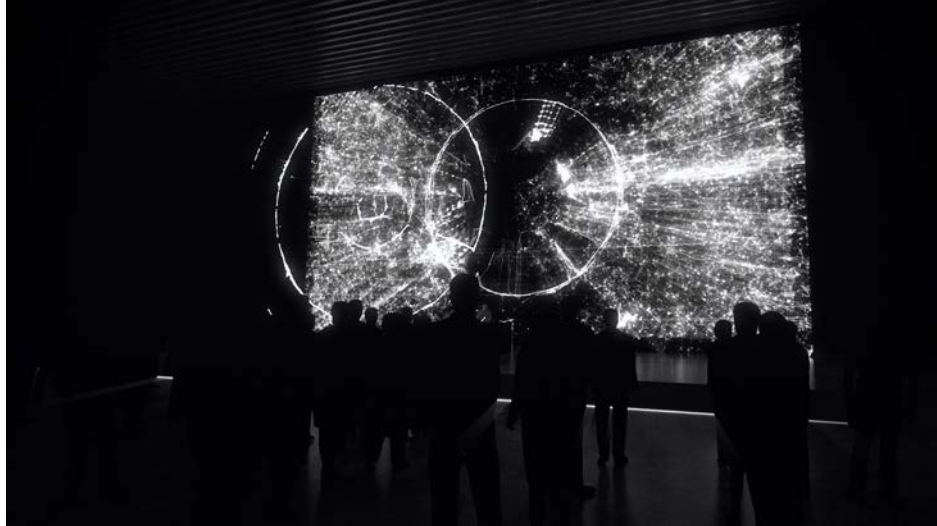


Figure 107: Virtual staging of the holographic work *DEN*

ponential interactions emerging upon the physical realisations of projecting ink onto paper and catalysing the process with diversiform brushstrokes and the addition of chemicals. These acts are the input to an advanced multicomponent (i.e., multimedia feature analysis, computational reconstructions, vector fields, machine intelligence *orchestration*, and staging) multimedia analysis and performance system, capable of re-synthesising in real-time, spatial, temporal, multimedia, and narrative units from the abstracted dynamics.

These are the new syntagms upon which transformed paradigmatic Bokusho elements (*the Line, the Point, the Circle, the Square, the Column, and the Wall*) are projected, revealing in the process a continuous generative trajectory accounting for directed *natural* transformations from one onto the other. These natural transformations constitute basic semic categories which are the distributed figures on semantically charged syntactical structures of visual and audio streams. The temporal, spatial, and causative formations are highly interpretive, and designed to evoke *poetic* modalities in the communication between

the participant and the *storyworld*. Not unlike electricity flowing through conduits to carry meaningful patterns of modalized information, charges of codified syncretisms of experiential realisations are anchoring points for the establishment of a meta-language, laying out a continuum of co-localized internal narrative elements and their experiential mental interpretations.

*DEN* refers to the electric, *dynamic* character of electricity, i.e., its potential, flows, and trajectories, analogies of which are found in these semantic *charges* that constitute the *flow* towards a *grasped* elemental meaning.

The almost alchemic character of this transformation is interpreted in *DEN*, as homologous to the transformational function of electricity, where it complexifies elementary morphologies (0' s and 1' s, dots and no-dots, or sounds and no-sounds) into the meaningful technological hybridised whole of perceived 'realities'. With Bokusho serving as an inspiration, advanced visual systems study the abstraction of the ink on paper and use its dynamics to reproduce similarly abstract expressionism on 3d space, using electricity as the 'ink'.

This collage of visual 'haikus', is driven by and interacts with a counterpart collage of concise micro-compositions, producing a fusion of organic and synthetic sounds, bound by deconstructive narrative, pulsating rhythms and unforeseen irradiation. *DEN* is a fluid, unpredictable study of the form, one that creates a new experience through combining traditional craftsmanship and advanced programming. It is a musical study into complex rhythms, unpredictable patterns, and controlled chaos. The evolving processes in *DEN* facilitate the sense of perpetual structural collapse and restructure, creating a continuous involvement of disjunctions and conjunctions between abstract human and computer-controlled composition.

#### Den Project Setup

*DEN* is set up and performed around a powerful, custom, modular, software

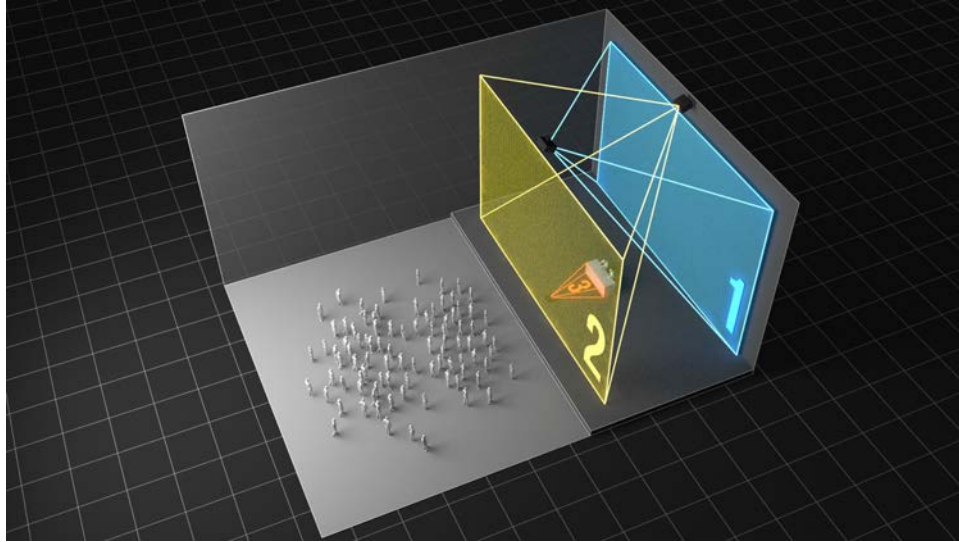


Figure 108: *DEN* project set-up

and computer network, serving as a multimedia system, capable of producing the narrative retellings in a variety of formats.

The system can be adjusted for full HD, up to 8K analysis for standard high-end venues such as planetariums and dome venues, to a ubiquitous computer system network of multiple clients producing analysis up to 48K (for building projection mapping for instance, or extended arrangements of video walls), all in a synced unified 3d virtual world. The visual and audio elements, although presented as a unified whole, have a layered architecture, allowing each element to perform separately, and on a different projection layer.

*DEN's* layered architecture, allows for the proposed holographic setup, which can have up to six different projected layers of depth. Similarly, the audio setup is built around real-time synthesis, and performance software, following a similar layered approach. Again, that allows for various performance and output formats, such as from stereo to more than one hundred speakers, in any format from 3d cube to dome arrangements. In this case the proposed arrangement is

an eight-channel 3d cube setup, which can easily be complexified and extended. Finally, *DEN* can be its own executable application to run on a server-client model, provide interactivity, and immersiveness in VR, and various visual stereo formats, or perform as an installation in self-run mode.

**The structure** facilitating the performance in terms of its morphodynamical profile, is quite close to the one described for the work *A Girl In A Nightdress*. A number of simulations are running in parallel while the system is informed concerning the morphological profiles of the material that is used and produced during the performance. The system is set in order to receive material and information input, process it with low level and statistical operators, and dynamically produce output in various projection formats. The components constituting the narrative have been composited into aggregates in such a way that allow for explicit conceptualisations to be ordered and assembled to facilitate the core idea of the composition, that of an abstract understanding of *flow*. Given the use of the word in natural language one may perceive that this concept may also be perceived as evolution. In that sense, the core abstract idea the performance design is set out to bring forth is the evolution of form; in a different wording the trajectory from an abstract minimal irreducible unit to aggregates of complex form.

To that regard, the initiatory scene introduces the most basic geometrical unit, a point in a defined domain. The initial gesture suggests a morphogenetic process of *autopoiesis*, where the (auto)catalytic<sup>89</sup> influence of the audio stream on the primary unit provides the necessary initial energy for a differentiation

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<sup>89</sup>Depends on the point of view of the analysis, whether one perceives the digital representation of a point and its correspondent audio object as one complex unit, or as two separate components interacting. Adopting the second view, allows one to identify the function of the audio to that of the chemicals used for the diffusion of ink in bokusho compositions and the digital visual entity to the ink spilled on paper. In a bokusho performance the dilution solvents disturb the stable state of ink as formed by the performers gestures and produces new forms with quite diverse dynamics from the previous state.

process to take place. The environment of morphogenesis is constrained and the development is ordered. The initial scene is a computation device for this sort of visualisations, where a unit may be multiplied several times to fill a defined (seeded) domain and expand in spatial and temporal terms. The gesture following the autopoietic differentiation process, is an operation on scale where the complex aggregate of units appears as one. The cognitive associations to the initial scene expositing a point, are still strong since regardless of the differentiation and scaling operations the produced forms are still perceived as similar.

The disturbance of the system's local stability is once more attributed to the energy dissipation from the audio stream that compels the visual component to a breaking of symmetry (the object evolves in a non-uniform manner spatially), the start of the formation of complex forms.

The following scenes, promote the symmetry breaking phenomenon in terms of the constraint environment the process takes place in, and in order to do so dilation gestures outline boundaries and stratify (triangulate) the available for expansion space.

Given that the above described process was predominantly the product of visual design conceptualisation and not one explicitly informed by the biological process of morphogenesis, one may suspect the degree of integration of primary processes as such with conscious high level cognitive compositional choices.

The triangulation of space signifies a series of operations (starting from basic and progressing to complex) that further differentiate and define the compositional space in terms of its constituents expansion and the layering of different spaces. The visual aesthetics are minimal, defined by the absence of colour and the use of basic geometries, i.e. lines, maintaining the attention focused on low level boundary and contour formations.

The primal visual aesthetics prepare for the complex form aggregates that follow later in the narrative sequence. These are complex geometrical structures ordered by the flow particles and the environmental constraints. These forms are mainly perceived in a Gestaltic fashion due to their complexity.

The fluid dynamics regulating the formations are extracted with optical flow analysis by bokusho performances and are combined with synthetic vector spaces products of computation and computer simulation. Some of these include lattice gas cellular automata (*LGCA*) and non-linear Voter model simulations. Once more as in *A Girl in a Nightdress*, the dynamics of these simulation regulate the forms and their evolution in the narrative sequence. Figures 109 and 110 display some instances where the correspondence between the final narrative composite and the form of the underlying regulating dynamics is prominent.

In terms of its dynamics *DEN* is a cyclical structure. The initiation point and the conclusion point are a dot symbolising the genesis of the artwork from a pixel. In that sense their dynamics may be analysed in terms of Thom's proposals (Thom: 1989a), for analysing semio-narrative structures in terms of cyclical, reversible phenomena as the deep structural components underlying their dynamics. Figure 111 exhibits in sequence sampled frames from the artwork, the initiation scene and the conclusion scene are marked with a blue rectangle, while the frame found at the centre of the composition with a red.

According to Thom's suggestions (Thom: 1989a), the first operation to perform in order to transform a structure into a cyclical one, is to adjunct the initiation and the final point. From there, two types of dynamics may be investigated, oriented and symmetrical dynamics. In order to enable a better understanding the videogram and the spectrogram are introduced in Figure 112.

In order to show the paths of analysis for both cases (oriented and symmet-

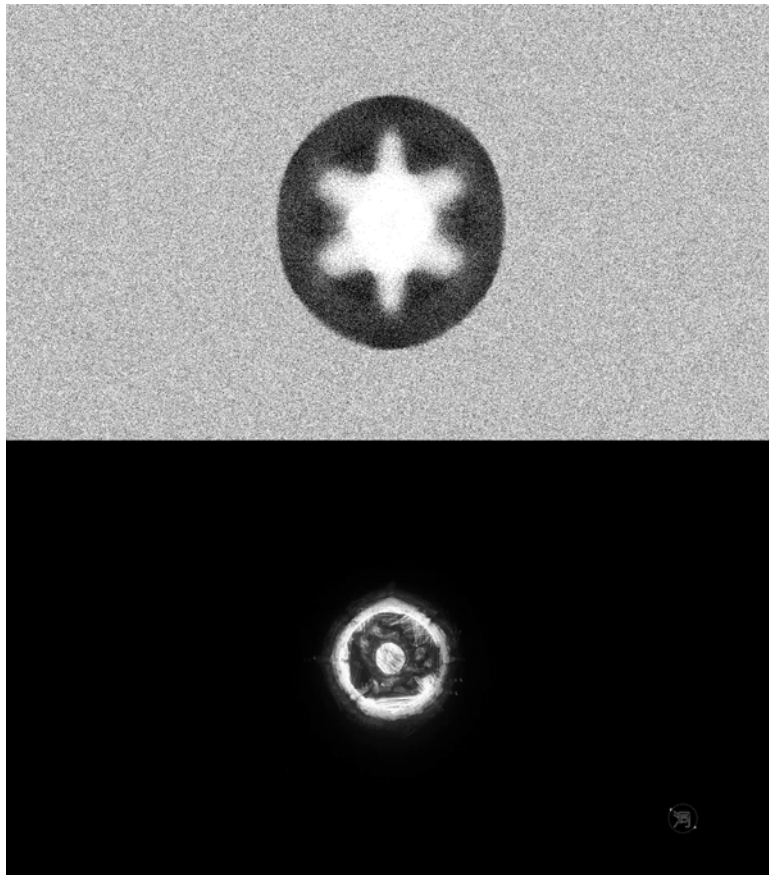


Figure 109: LGCA simulation (above) final narrative composite (bottom)



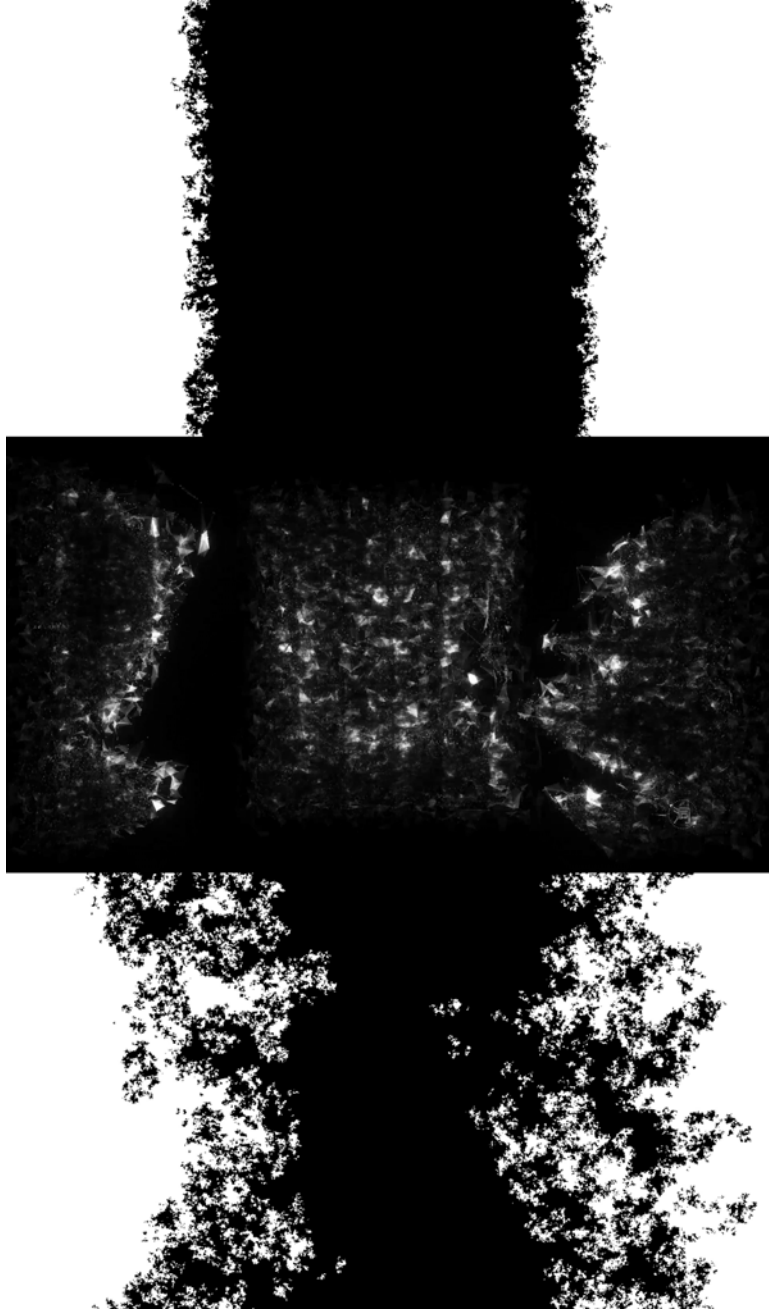


Figure 110: Two instances of a non-linear Voter model simulation regulate in combination the form and dynamics of the final visual narrative object

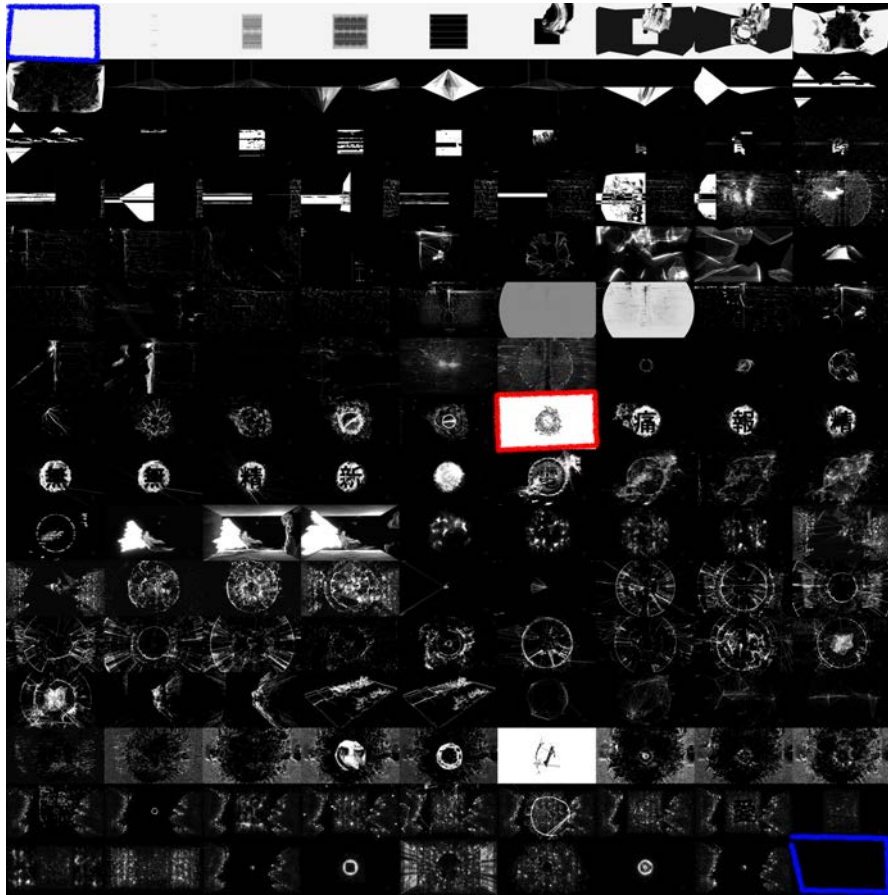


Figure 111: *DEN* as a cyclical structure

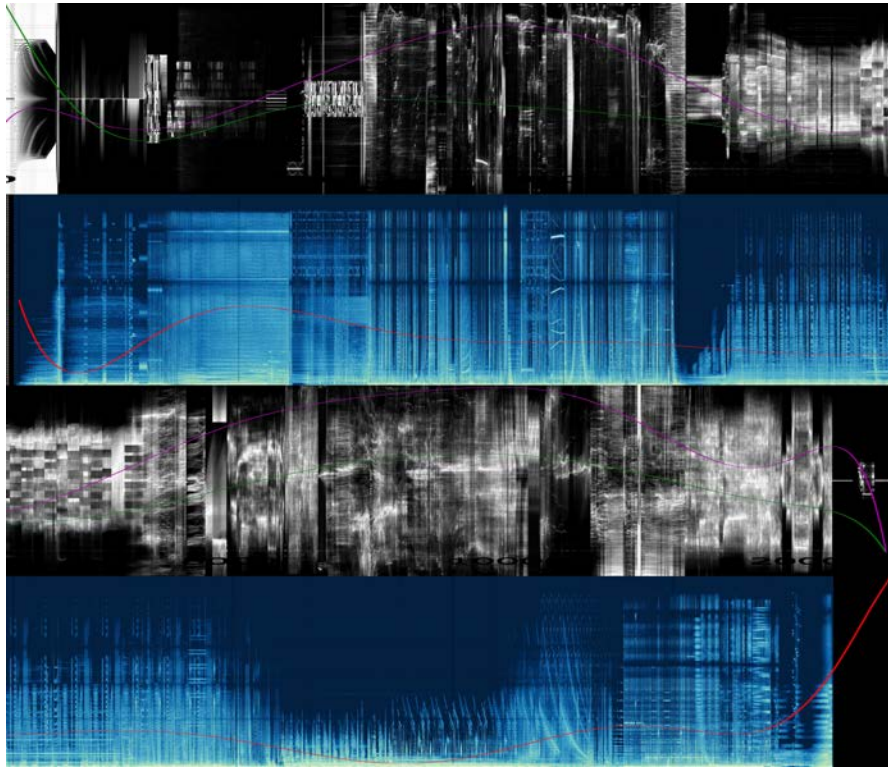


Figure 112: Videogram and spectrogram of *DEN*. (high definition version of image found in Appendix 19)

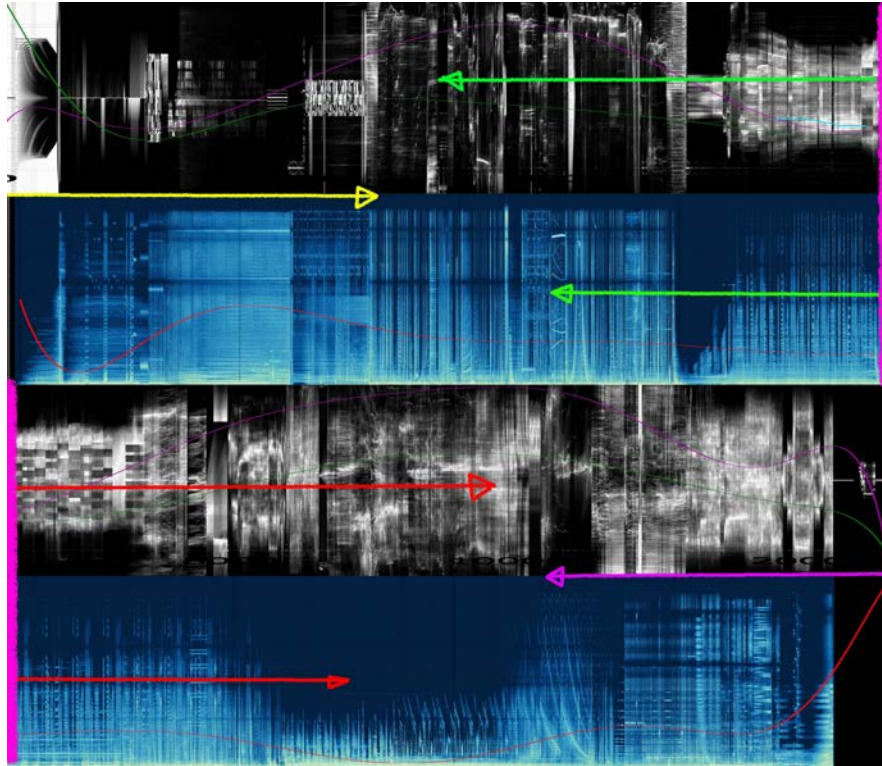


Figure 113: Videogram and spectrogram for cyclical analysis of pregnancies and actant creation.

rical), the middle part of the composition in shown in Figure 113 is marked with a purple line, the yellow and red arrows indicate the two directions of the oriented dynamics analysis, while the green and red the direction of a symmetrical analysis.

**Oriented dynamics** analysis in terms of the forms' saliency, considered as the invested pregnancy in the manifested structures, and pregnancy, the general systemic determinations regulating the structures, may provide insights on the actant-forms' stability – maximum pregnancy signifies unstable forms while maximum salience stable forms; this insight may in turn inform the understand-

ing for the birth and elimination of the actants, and the changes of state in the narrative system of relations (cycle of hysteresis in Thom: 1989a).

It should be noted here that since there is strong correspondence between the morphological evolutions in the visual domain and the audio domain the conversation here is based on the evolution of the visuals but it largely corresponds to the audio domain. Starting in the direction of the yellow arrow, the initial scene is a white background with a black dot in the middle. The empty space and the simplicity of the unit component (a black pixel), is a state of maximum pregnancy in the sense that this empty space is ready to be modulated, stratified, and occupied with agents and interactions. The saliency of the form on the other hand is at its minimum level since the scene may be considered as the definition of ‘an empty canvas’. This state finds correspondence in the Bokusho performance as the source material, i.e., to the empty white rice paper just before the first ink-stroke is attempted. Maximum pregnancy triggers a morphogenetic process; this, results in the pixels multiplying and creating a plane, followed by the plane multiplying to create the sense of a volume, which increasingly becomes dense until it reaches the state of a solid black square. The black square is a stable manifested form of minimum pregnancy, and as such, of maximum saliency. This state of maximum saliency, can only be followed by a change of state, and this is reflected in the composition by introducing the first ink artefacts breaking up the symmetry of the black, solid square’s form. This concurrently signifies a change of state for the narrative environment, and moreover, a transformation of the types of pregnancy that may be found in there. Not being a blank white canvas anymore, the space is instituted by actants that in this new system state are identified in the solid, linear shapes (square, triangles, rectangles and lines) and in their oppositional manifestations complex, organic non-linear forms. This once more is in correspondence with

the dynamics of the source Bokusho performance, where the initiatory deposits and strokes of ink sometimes possess linear qualities, e.g., drawing a line, while others non-linear, e.g., initiation of the performance by spilling ink on the paper. The antagonist actants' conflict then transforms into that of dominance among different saliencies in the presence of explicit pregnancies. Given Thom's analysis (Thom:1989a), the antagonising actants driven by pregnancy and depending on their saliency, described by the potential functions of the system, are displaced towards the object of desire  $O$  and towards  $\infty/\emptyset$  in a synchronous and symmetrical manner. The one acquires it while the other is deprived of it. This creates the question, as to the type of the object of desire that these abstract actants as found in the composition are antagonising for. The object of desire in this case is of an abstract nature as well; the actants seem to antagonise for their 'place' on the screen-space, their survival and their dominance over their antagonists. Indeed this *agon* is evident in the artwork between 0'.11" and 01'.29", and transforms later to a different type of *agon* since once more the environment invests the actants with different pregnancies.

Indeed a conflict of determinations that may be seen overall in the composition is between simple, minimal shapes and complex aggregate structures. During the composition's development the attention of the recipient is oscillating between these two typologies of structures, including the shapes produced by the combination of the two, i.e., complex structures constraint by identifiable boundaries. The type of pregnancies and the crystallised saliencies invested in the stable forms dominating the process are similar to those found in the artificial systems of 'intelligent' agents (see *Musica Universalis* in this chapter and *Methods and Tools* in Part III). Physarum simulations or ant colonies simulations may produce similar type of morphologies in the process of propagating space through pregnancy. Diffusion processes are also extensively used as a pro-

cess of collapsing one form into another, and creating morphed shapes between two or more forms. Furthermore, these processes are very efficient in modeling the dynamics of a Bokusho performance, since the use of chemicals on the ink and other similar Bokusho processes are diffusion processes.

This is the setting where the narrative takes place and develops and this type of dynamics guide the attention of the recipient, in order to shift between oppositions that create local potentials and give a direction to the flow of the visual and audio aggregates. Instances demonstrating this may be found at 03'26"- 03'.57" where the kanji characters are superimposed on the complex round form of particles core, or at 04'21"-04'25" where a diffused volumetric and particle based kanji character is suddenly found contained into a room-like structure; a proposed gesture as such, aims at shifting the senses from an open space, suggested by the black background and the central form – that gives a sense of gazing at the macro-cosmos, to a sense of confinement into an enclosed artificial space. This is also one of the explicit moments in the composition that a weak reference to the classeme 'human' is made. Other similar moments may be found at the kanji character superimpositions, or at 6'00" onwards, that two human related figures are briefly displayed (a human skull and a statue of Mary). Finally the presence of the human classeme may be found at 1'21" when the directed particle flow 'carries' with it data from immigration records to the United States of America for the year 2018. These references though are mainly symbolic rather than morphological.

After the 6'.27", the antagonism between actants settles in the presence of 'The Wall', a composite structure dense enough to be considered impenetrable. Following its full formation this structure 'opens up' to reveal 'The Core', which is one of the main Bokusho shapes from which the artificial visual forms came to be. The last compositional statement is found in the rapid compression of

‘The Core’ into a pixel similar (with inversed colour palette) to the one that initiated the morphogenetic processes in the beginning of the composition.

**Symmetrical dynamics** on the other hand suggest moving in two different directions from the object of desire  $O$  found at a common arbitrary point towards the common point of origin-destination. In the spectrogram and videogram (Figure 113) found above the directions of analysis are indicated by the red and green arrows. This type of approach is found to reveal the most interesting results in terms of the morphological analysis concerning this composition. The point of origin chosen, is the middle of the composition marked with a red rectangle and a thick purple line in Figure 111 and 113 above displaying the sequences of frames. A first interesting observation in terms of the morphological evolution is that in both directions there seems to be a continuous compression of the forms until they reach a place of minimum complexity, and of minimum potential, i.e., the pixels found at the beginning and at the end of the composition. This tendency may also be observed in the polynomial fittings of the QoM (green curve) and AoM (purple curve).

Furthermore, the symmetrical structure of the composition is one of its prominent morphological characteristics, and this symmetry may be found in both the visual and the audio components. Starting from the frame situated in the middle of the composition, this symmetry is spotted effortlessly from a general inspection of the spectrogram and the videogram; it appears similarly sustained in the focused and detailed inspection of smaller audio-visual segments. The symmetrical structure is portrayed in the qualitative feature curves numerically.

The most interesting morphological observation though, may be discovered in the manner that the visual components are situated in the screen-space during the first and second half of the composition. Following the directions proposed



by the symmetrical analysis, it may be noticed that while the overall shape of the morphologies is symmetrical in both directions, there seems to be an inversion in the densities of the events captured by the videogram. Particularly, it may be noted that while the events in the first part seem to have as a domain of activity the edges of the screen space, the events in the second half are denser in the central area of the screen-space while maintaining the same shape. If, for instance, the videogram was folded in half, the overall form of the events in the first half would almost perfectly enclose the form of the events in the second half exhibiting a complementary structure similar to that found between an open group set and the close set containing it.

This observation is interesting in that it demonstrates that conscious compositional conceptualisations concerning the evolution of a form to its next state, may produce symmetry as an involuntary artefact. In that sense, it is shown how following a naturalist framework, in terms of analysing forms and their evolution and constraining these forms to simple, general rules, may inform the production of a comprehensive development of the global compositional form.

### 7.2.7 *The Fallen*

**A system of narrative embodiment** In many ways the *X Short Stories* investigation has, as a methodology, concluded with the incorporation of Butoh notion into the creative process. In these practical investigations, the figurative and the referential were, augmented in an abstract, generic, deep sense by the corporeal. At the heart of Butoh ‘understanding’, lies a narrative essence. The desirable form is an abstract structure ‘distilled’ as individual essence out of a subconscious (*sub-body*) corporeal responses to an abstract theme outlined by the *butoh fu* (a haiku style description of a ‘state’). The term for describing the morphology of such a structure is described as Jo Ha Kyu, which corresponds to three primary structural components of a story, the story-beginning (thesis, *Jo*), the implication (antithesis, *Ha*), and resolution (synthesis, *Kyu*). An example of this can be portrayed in the classic *butoh fu* of the founder of butoh, Tatsumi Hijikata, *Bugs Crawl*, which starts by introducing the awareness of the performer to the situation (a single bug, *Jo*), then the implication and development of the ‘theme’ are introduced with the infiltration of bugs until nothing more is left (*Ha*), concluding the ‘composition’ with a resurrection (*Kyu*). Of course there could be a Jo Ha Kyu for the whole performance, and also for each part of the composition (including even one gesture which reflects the Jo Ha Kyu structure). The notion of this structure also implies some sort of natural rhythm regulating the process, a rhythm that allows the audience to resonate with it, and in many situations an example is given in terms of the rhythm of sexual intercourse.

Hijikata used extensively *butoh fus* to communicate abstractly but explicitly the deep aspects of his choreographies. Even the unorthodox and ungrammatical use of language in his *butoh fus* demonstrates the level of depth he attained in his artistic communicative practices. This notion, one of the deep communication of concepts through their surface manifestations, remained in butoh practices;

these employ representations based on deep and not on figurative elements even when the surface manifested performance aesthetics are perceived as highly figurative. The practice of reaching such a level of performative *presence* requires a deep commitment to the practice; furthermore, it identifies diachronic paradigmatic performance components regulated by deep and abstract structures of sense and logic. These are the sub-bodies, the schematic representations called upon while performing a particular , which ultimately involves a performer-paradigm actantially involved in abstract though explicit situations/scenes.

For instance one of Hijikata 's sub-bodies was 'the Girl', a mental representation of his long-lost sister, who was sold young into prostitution, and committed suicide after a few years. The 'Girl' can be found to 'perform' in various situations in some proposed as 'innocent', in others as 'evil' or 'devious'. The development of the paradigm from Hijikata was achieved through a focused and intense study, resulting in the type category to acquire its own 'life'. His own descriptions paint the following symbiotic relation:

I keep an older sister living inside my body. When I am absorbed in creating a dance piece, she plucks the darkness from my body and eats more than is needed. When she stands up inside my body, I can't help but sit down. For me to fall is for her to fall. But there's even more to our relationship than that. (Hijikata anecdote)

It is understood from these descriptions that the development of the performative paradigms is for a performer a continuous, self-generated and self-regulated process. It started for Hijikata from the beginning of his Butoh dance practice and his early conceptions, continuing for decades even after he stopped performing, which made it quite different in its essence from mimetic or consciously controlled development processes.

In its negotiation with the world, Hijikata's butoh practice became deeper

and multilayered, using direct reference especially where traditional Japanese culture was concerned at one end of the spectrum, and de-familiarisation with these references at the other. This led to multivalent elements in his composition, layered combinations of motion and movements, ultimately to form complex narrative components. Hijikata's deep narrative components were in most cases topologically distributed on stage and in relation to the audience. Their arrangement directly correlated with the performance strategy chosen to communicate meaning on-stage (for instance male dancers with their back turned to the audience).

In a similar fashion the butoh performances in *X Short Stories*, were formulated focusing on this deep level regulation of the communicated narrative message. Several performative paradigms (elementary actants), emerged during the narrative explorations concerning the portfolio:

- 'the Saviour '
- 'the Prophet'
- 'Virgin Mary touched by Devil'
- 'the Fallen'
- 'the Puppet Master'
- 'the Puppet'
- 'the Voluptuous Clown'

Each performer was invited by the author to investigate their sub-body references and allow their own to emerge, in order to call upon the performance or parts of it (one of my own being 'the Rat'). The above prototypes are adopted by the narrative elements in semio-narrative scenic setups, used later to formulate more complex narrative assemblages, i.e., Butoh Morning, Good Morning,

The Lady, and the others are all semio-narratives used as seeds for complex narrative scenes.

In the process, attention is focused on the deep narrative structures, determining mainly the symmetry or assymetry of the transformations, and the reversability or otherwise of the narrative scenes. The following example in “*The Fallen*” (first and second performance versions) demonstrates operations as those described above.

The first conceptions concerning *The Fallen* narrative were more figurative in character, as reflected in the *butoh fu* and the choreography. There were three levels of narrative descriptions in this version:

- a deep level based on the morphology of the materials (including the deep form of concepts) related to the theme of falling (a perpetual directed, natural displacement towards different points);
- a *butoh fu* describing the performers’ understanding and symbolic descriptions of the scenes (mid-level or intermediary);
- surface level narrative components and thematics, as communicated from the multimedia-body blend on-stage.

The first narrative is not symmetrical in its structure in terms of the initial and final narrative state, as can be seen in the sequences presented in Figure 114.

The second version, retained the deep structures such as the number of actants, but in terms of the surface manifestations remained simpler in its aesthetic, thus providing clearer correspondences between deep and surface level components. While the surface narrative components differ, the main trajectories and transitions are retained, as is demonstrated in Figures 114 and 115.

The four main abstract segments of the first version are rigid to dynamic,

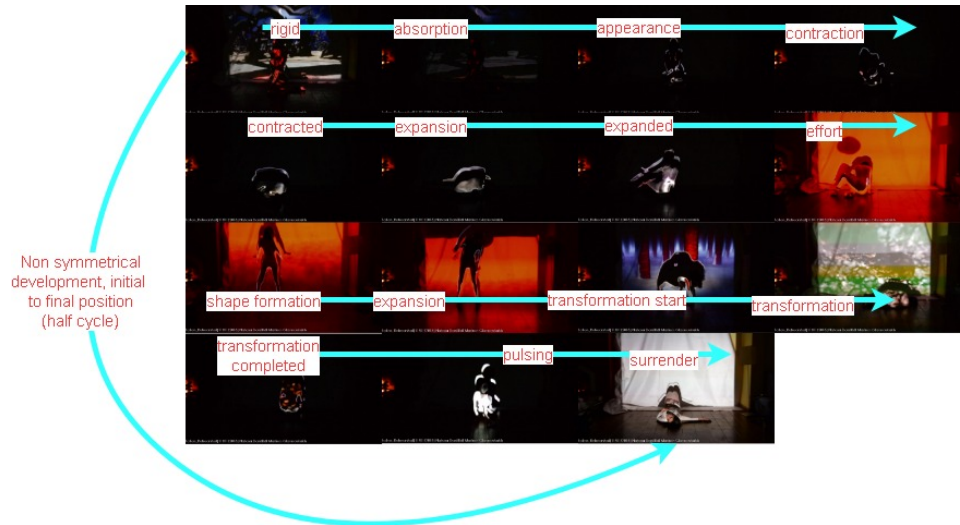


Figure 114: "The Fallen" first version: narrative sequences and main movements. The narrative is incomplete in terms of its asymmetrical development

contraction to expansion, formation to transformation and effort to surrender, abstracted and represented in the second performance as body twists and changes of direction in the performer's movement (see twist1, twist2, twist3, and twist4 in Figure 115).

There was a significant abstraction between the *butoh fu* describing the first performance, and the *butoh fu* describing the second. The first one was more figurative in its descriptions, while for the second my instructions for the dancer were "you have fallen ... and are perpetually falling". In certain respect the second performance was a distillation of concepts from the first, as seen below:

- a fallen existence, concrete, full, robust, complete, like a photograph, Within its entirety the cells are cramped, stranded, collide within their stillness, dense;
- the parts become inert forming sand particles flowing and collapsing inside the body until they become a sandy mass on the soil. Nothing is retained,



Figure 115: "The Fallen" second version: the trajectories of movement are more basic, although the deep level structures and transitions remain. The narrative is compactified as a cyclical interpretation of the first version. The narrative development became naturally symmetrical.

nothing has remained similar, everything became separated as sand grains;

- the particles search for their existence, they merge into each other forming structures become one like iron. The iron components are inadvertently attracted to each other and adhere until they form an amorphous rigid body. The body is heavy and can not resist gravity. Effort is introduced to resist it;
- in touching the ground, the iron melts and becomes fluid until it becomes a fluid metal mass. It has an internal pulse; waveforms and curves give it *pneu*. It moves and the movement becomes faster, the *pneu* increases in volume;
- the curvatures transform, become sharp, scratching the skin internally until they tear it. The pain grows while bugs start to invade the body, they sting it, crawling on it, feeding off it. They leave their faeces and larvae on it. The larvae feed of the body until they totally consume it;
- the body surrenders, no more strength left for it to move. External life violates it as if the body is nothing.

**The structure** employed to implement the performance involved the use of several components in combination enabling a complex design for real-time use. The approach is not different from the artworks described previously; what made this setup diverse was the dynamic aspect of the moving human body acting as a projection canvas.

Low level computer vision techniques (skeletonisation, contour extraction) where used to separate the foregrounded dynamic actant to the static background environment. Once more several simulations were running in parallel, while being interlinked, exchanging information among them. One process to



mention concerns the projections on the body of the performer; they were constrained by the skeleton of the detected form and contained within their outlined contours. In order for the projection not to appear distorted, the space of the performance needs to be analysed and reconstructed previously, accounting for the lens and distance distortions. Corrective projection matrices are calculated for different depth zones of the performance stage, which upon projection on the body of the performer are multiplied with the original projection matrices.

The projected content is generative based on shader programming once more allowing extensive real-time control (mainly from the performer's motion trajectories). The background material is regulated by perlin flow and fluid dynamics particles seeded with textures and 3d scenes compositions.

The audio processes here, attain to a 'clean' minimal self-regulated spectral wave evolving slowly in time along explicit observable trajectories; this corresponds to a general translation of the term 'falling' as a continuous stable displacement towards a point of attraction. This acousmatic motion is accomplished using swarm dynamics audio spectral particles, modulated during their trajectory with non-linear oscillation networks such as Van der Pol oscillator networks. Once more using dynamical controllers coupled together while controlling their influence on the signal, gives the ability to shift the behaviour and form of the computations towards different morphologies and dynamics. Thom's Memory Machine dynamical controller regulates the influence of each dynamical controller on the signal acting as the selection criterion.

The regulation of time in the performance is the product of the audio domain dynamical controllers; since the audio stream dictates the pace of the choreographic evolution, made sense to act as the regulator of the temporal dynamics for the visual composites as well.

The dance performer's gestures initiate the start of the dynamic body projection which corresponds to a system's shift to the relevant body tracking scenes. Similarly the performer is responsible for initiating the closing scene and is able to do so any time during the performance, in order for them to be able to control the duration of the composition based on organic, somatic responses to the passage of time and the material as experienced. The intermediate states of the composition are not controlled by the performer. Once the process starts there is either the choice to follow the temporal trajectories the audio stream dictates, or to end the composition<sup>90</sup>.

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<sup>90</sup>As in falling the point of departure and the point of arrival are the only states where the agent 'actively' participates.

Part V

## Conclusions

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## 8 Conclusion

This research places under scrutiny a primary question on the study of form. In general, this question refers to the associations between perceptual low-level forms to higher order referential and symbolic forms employed to assign meaning to structures, focusing in particular on those structures that could be described as contemporary art-forms in multimedia artworks. Having identified this as the main venture of the structuralist tradition and linguistic and narratological research, a narratological approach to the quest for an explanation has been adopted.

Therefore, narrative throughout the present research has been described as a strategy, a mode of thinking, a deep organiser of content, and a primary cognitive function accountable for attaining meaning from organised content formations, and particularly, multimedia content formations. The deep elements and their organization in narrative structures are considered here in a homology, and may be singled out in structural formations found in semiotic systems other than the linguistic, and especially in musical and visual fields, as far as the current study is concerned. Thus, stripping narrative of its linguistic valence opens up its potential use as highly equipped analytical and compositional tool, even for the artistic expression of content.

Nevertheless, formal descriptions of narrativity do not provide for the non-symbolic associations that are mostly relative to the deeper levels of semiosis, and do not offer consistent and comprehensive models through which to describe them. These deep forms appear paradigmatic, yet abstract, hence exhibiting an ever-changing, continuously transforming and self-regulating character.

Regardless, they provide a direct and explicit relation, through their transformations and emergent complexity, to figurative surface forms, predicates to the real world of manifested phenomena. In the process, meaning is situated,

and through projections and grounding in reality, enables a recipient towards an equally explicit decoding of the forms of the artistic message.

Formal approaches then, may provide a point of departure for an elemental understanding of the relative concepts, and the aims and scope upon which an enterprise as such depends.

The conceptual leaps found in formal approaches are normalised by embracing a naturalised perspective on the subjects of study, describing these, their relations, and the operations performed on them, as homologous to natural phenomena. Such an approach, is proposed by dynamical and cognitive models in narratological studies.

Inspired by dynamical systems analysis, morphodynamical models such as those found in natural sciences and humanities studies, offer a consistent articulation throughout their descriptions of deep and surface configurations of content. The situation then, revolves around the relationship of natural structures (that exhibit material manifestations), to mental forms, concepts, and the cognitive routines regulating them (structures that seemingly possess no materiality). Establishing a relation as such attributes the required relevance of the proposed modelling methods for analysis of forms that seemingly possess no materiality.

Cognitive linguistic and narratological descriptions provide the general framework within which a relationship as such may be described. These descriptions suggest an image-schematic understanding of meaning formation cognitive processes and operations, grounded in embodiment and encyclopaedic knowledge. At the same time, their spatial constitution affords the subjection to topological models for analysis.

The geometrical and positional explanations, that result from this perspective, provide space for computational analysis and numerical simulation. This

factor allows the realization of a practical implementation that is based on the correspondence between the geometrical descriptions to signal streams, and the topological operations to signal processing routines. Both the static and dynamic character of the manifested forms is thus represented in the nascent simulacra that constitute the overall sense of the perceived multimedia projected representations.

The process described here, informs the architecture and design of extended reality, virtual (in the sense of computer simulation) environments providing a narrative-based, comprehensive method for the arrangement of the multimedia content. The hypotheses were set to be validated in the form of a presented portfolio of multimedia artworks submitted along with the current document. Together, these aspire to reflect on the feasibility, intricacies and efficacy of the employed conceptualisation and modelling techniques.

The thesis has been divided into four parts, each touching upon a subject of interest concerned with the research methodology.

The first part serves as an orientation chapter, in order to situate the reader within the subject of study. General background information as to the author's interest in narrative studies and the origins and settings of the presented investigations is given. This chapter describes the general paradigm shift in human sciences the last few decades, defined by the infiltration of narrative as an analysis method in these fields. At the same time narratological and linguistic enquiries have been marked by a paradigm shift towards cognitive explanations of the function of narrative, which broadens the scope of narrative as a field of study outside the linguistic domain. An introduction to the idea of the naturalization of narrative phenomena, i.e., the study of cognitive phenomena as natural phenomena in an effort to provide mathematical explanations of them, is established, and has been identified as the main abstract research strategy

towards a methodology. An important aspect of the first chapter lies in correlating the current multimedia studies with the primary inquiry of the structuralist tradition, the study of form and the problem of semiosis in semiotic systems, and is presented here as the abstracted thematic in the current investigations. This also serves as a preparation for the reader for the chapters to follow where a detailed exposition of several elemental deductions in the study of structure and the problem of signification is given.

Furthermore, Part I clarifies the aims and scope of the present research, as well as describing the methodology developed, and followed through the course of the practical and theoretical investigations. The main aspiration of the current narrative study has been established as the articulation of a comprehensive framework of practice for the composition of new-media artworks; a matrix, that takes into account the morphological, dynamical and cognitive dimensions of the emergent phenomena during conceptualisation, composition, and projection of a work of art. The process of naturalizing and offering mathematical, and geometric descriptions for the phenomena present during these acts is the main proposal for approaching the problem of providing comprehensive narrative descriptions that reflect also the final manifest forms of content. Catastrophe Theory and topological mathematical analysis of dynamic systems, were introduced as the main mathematical tools for an approach to modelling, while the use of computer simulation, 3d visualization, and digital signal processing techniques, as implemented in modern 3d game engine platforms is outlined in relation to the mathematical analyses. To achieve this, and to complete a description that provides for the spatio-temporal arrangement of narrative objects and events in an extended reality virtual environment, appropriate transformations of the geometrical models and operations into signal processing routines, and *vice versa*, are required. These have been identified mainly in techniques

relating to contour extraction and boundary detection, diffusion equation and scale-space analysis, convexification, grouping operations, skeletonization and modelling space through oscillation networks. Each of those routines perform operations relating to space segmentation, reduction of space dimensionality, and providing hierarchical organisation of constituent structures. These techniques relate directly to basic structuralist questions concerning the main problem of the composition and segmentation of complex structures.

The necessary normalization between the naturalised morphodynamical descriptions of content, and their transformation into narrative components is provided by the use of cognitive frameworks; they address the relation between perception, syntax and action in linguistic semiotic systems, based on image schemata, embodiment of meaning and the presentation of an encyclopaedic typology of knowledge. This has been articulated thoroughly in the context of case grammars and the notion of a scenic conception of meaning.

The second part (Part II) is an exposition of primary structuralist deductions concerning, signification, meaning formation, and narrativity. There is a conscious effort to bring forth the cognitive character of these deductions, in order to provide a link to the cognitive frameworks presented in the last part of the chapter. The transmedial transposition of narrative and the semiotic and semantic dimensions of this operation are described for their value in terms of the relation among content, grammar, and manifestation. The semantic dimension is investigated in the last section of this part, introducing notions from cognitive linguistics, and particularly those of conceptual structures, image schemata, case frames and conceptual domains. Thus, this chapter functions as a detailed exposition of the point of initiation of the current narrative inquiries, and the processes that are the subject of the naturalization processes presented in Part III.



The main theme of the third part (III) is to describe in detail the operations and process presented above in terms of a catastrophic theoretical interpretation, one that ultimately resolves and normalises conceptual gaps caused by Greimas' presupposition for an isotopic form of meaning and deals with the discrepancies this may introduce; these aim towards the effort of producing a consistent and comprehensive model for the narrativization and discoursivization processes. Such a model is achieved through both the topological analysis of the structure of the semiotic square in terms of Elementary Catastrophes, and the interpretation of the logical, syntactic operations, and the modalisations, aspects of the generative process, in terms of paths on the topologies of Elementary Catastrophes.

In particular, a topological description of the basic form of the semiotic square and semio-narrative structures is given, in terms of differentiable models possessing internal states competing for actualization. The internal states are identified with the local minima of the potential function that describes the system's state, while a selector mechanism brings forth actualizations and selects the dominant states. The change of states is dependent upon a closed set of points known as the catastrophe ensemble of the external parameter space, corresponding to the values for which the potential function of the system is structurally unstable. In turn the potential function defines the internal states of the system and results in the stratification of the parameter space, creating boundaries that correspond to joint subspaces. The fundamental postulate of the application of Elementary Catastrophe theoretical interpretation, is that a determination (a seme or an actant), occupies a place of minimal complexity found in the minima of the potential function of the system.

The first catastrophic description presents in topological terms the notion of the paradigm, the discretization of space by the basic abstract semic categories

constituting the semiotic square. The two following sub-sections, describe the basic oppositions found in the semiotic square in terms of two types of Catastrophes: those of conflict and bifurcation. The catastrophe of conflict presents the qualitative oppositions of the square as two competing minima on the potential function. The privative oppositions correspond to the Fold catastrophe, characterised by the appearance and disappearance of a determination, and mirror the opposition between a term of the square and its negation. The structure of relations between qualitative and privative oppositions, constituting the logical status of the semiotic square, is in correspondence with the topology of Cusp catastrophe. The section describes the semiotic intricacies of the topology in terms of its boundary conditions, paths and crossings of boundaries. The main observations relate to the following:

- crossing at the beak point of the projection, a critical point where the bimodality is abandoned in favour of one of the determinations;
- the neutral area of static fusion, corresponding to the neutral axis of the semiotic square, and depending upon the direction of the path the states become either “neither term1 nor term2”, or “both term1 and term2”;
- the potential of translation of the path described above, corresponding to the neutral and complex terms of the square, in terms of a cyclical form exhibiting the ‘unity of the opposites’;
- the sudden ‘jumps’ of state characterised by the exchange of one determination to the other, and related to the crossing of the boundaries on the topology.

The relations of deixis, as found on the semiotic square, correspond to a more complex topology, that of the Swallowtail catastrophe. This topology includes all the paths and boundaries of the Cusp, but in addition includes

paths corresponding to one of the relations of implication. Though a more comprehensive description of the terms of the semiotic square and their relations, this schematisation captures half of the semiotic square. This is due to the dissymmetry where the genesis of the marked term starts in an area of no apparent determination in the presence of the unmarked term, but there is no path corresponding to the other way around.

To complete the catastrophic representation of the square, thus expose its full development, the topology of the Dual Butterfly is introduced. In this schematisation, the potentials are organised in such a way, that are able to provide paths not only for the genesis of the unmarked term from an area of no apparent determination in the presence of the marked term, but also for the genesis of the marked term, from an area of no determination in the presence of the unmarked term. This indeed appears to be a comprehensive topological explication of the full development of the semiotic square, one able to schematise a narrative program.

Furthermore, this section displays the competence of the geometric and positional descriptions offered by the catastrophic models, in overcoming the problems presented in changing signification levels (from deep to surface), and the transformation, through modalisations, of the abstract structures into an anthropomorphic syntax. The formal conversion, refers to the translation of the taxonomic and paradigmatic interpretations into the actantial and syntagmatic. It is complemented by the ‘conversion by duality’ accounting for the transformation of semantic values into subject-object relations, and the ‘metapsychological conversion’ accounting for the modalisations e.g. desires, thymic investments, as well as axiological evaluations where narrative programs develop. Once more these are contained in the initial descriptions of the proposed topologies, available for translations that enable changes in levels of semiosis.

The idea of a frame of knowledge and all its spatial intricacies reforms the catastrophic narratological observations into spatial terms that may be core components of modelling a scene's spatiality, and the framework to do so is provided by the notion of case scenes as proposed in case grammars.

A set of computational methods and signal processing procedures is proposed and may serve as the tools enabling the bottom-up construction of a scene in a Gestaltic fashion, aligning with cognitive and morphodynamical deductions. The tools properly mathematise in a dynamical fashion a range of processes involved with the composition of new-media artwork. These processes may concern conceptual or technical subjects, and the use of these tools may inform the composer in such a way that a uniform inclusive understanding may be attained. The tools range from low level operations, such as edge detection in a signal stream, to complex statistical operators providing obscured output. Whatever the case might be, the output of these tools enriches the content of a scene with the underlying, concealed information entailed in it and allow for an informed and not arbitrary manipulation and regulation of a scene's content. Since the proposed tools provide a dynamical non-deterministic output their analytic and generative potential is under scrutiny (Part IV) and their capacity to carry and regulate meaningful information concerning an artwork is tested.

Part IV is where the practical implementations of the models presented are realised. The tools used for the facilitation and implementation of the type of composition and analysis proposed in Part III are applied for regulating the process of composition of the submitted artworks implementing the topological arrangements described in Part III in a bottom-up fashion. As mentioned previously, the hypothesis refers to the basic morphological and geometrical analysis of a scene, in terms of its boundaries, contours, skeletons, and space partition techniques, and their correspondence to signal based descriptions. The first

type of topological analysis determine the scenic arrangements of content into 3d simulations of space, implemented in 3d game engine platforms, while the second representation deals with the processing of the visual and audio signals that occupy the 3d space.

The artworks are analysed in terms of their deep level components, their actantial arrangements and interactions, and exposed in terms of the deep components correspondence to the manifested arrangements projected towards recipients during performative acts. In addition their capacity to carry and communicate conceptualisations rendering an artwork meaningful is examined. Each composition strategically targets specific questions, as are contextualised in the present work, relating to their materiality and morphodynamical evaluation, their medial identity, and the overall affordance of the chosen structures as formed by compositional choices in order to display narrativity using abstract and referential forms of expression.

This project resonates strongly with the notion that art and contemporary art expression in particular, is constituted by acts of signification, both in the compositional and the interpretational acts. As such, accounting for the structures responsible for the formation of meaning is of primary interest in developing conceptualizations for an artwork. The point of departure of this venture is found in the very same structural properties of an artistic form, thus an initial analysis in terms of the structuralist views on structure may be beneficial. Analysing structure provides morphological information about it; to achieve scientific objectivity in the morphological appreciation of non-material forms, appropriate means of analysis are required. These can not be found in the classical formal approaches to analysis that for the most part display a preference to symbolic algebraic operations and are based on arbitrary associations. Rather, topological and geometrical models of explication such as those used in dynamic

systems analysis are preferred in the context of this venture. These presuppose that conceptual and mental formations bear a type of materiality and as structural phenomena may be treated as natural phenomena. This view correlates to cognitive descriptions of meaning formation routines as found in recent developments of cognitive grammars. The use of dynamical mathematical analysis in the context of a cognitive framework of explication may indeed account for the multiple dimensions that must be considered in order for the semantics of the compositional and performative act to be determined.

As a consequence of the above, the term ‘storytelling’ has been avoided by the author throughout this text in preference for the term ‘narrativisation’ when referring to the processes that organise meaning so as to render it available to the syntagms of manifested content. In other words while storytelling refers to the act of communicating a specific story in an explicit fashion, narrativisation is perceived as the intuitive process that organises content prior to communicating it, in such a way that renders it available for interpretation. These operations may be described and modelled both in geometrical and computational terms (Petitot:2011), and in that context may be simulated. The simulations refer to a paradigm for a narrative understanding as described by Ryan, that of “mental multimedia”.

The cognitive representation that I call narrative could thus be  
the mental equivalent of a “multimedia” construct. Ryan (2004:12)

Mental multimedia, the cognitive representation of narrative, appear to be valid candidates for a cognitive morphodynamical analysis, one that enables a correspondence between the morphodynamical models and the projected multimedia realisations informed by these models.

The descriptions and analysis of the artworks though extensive does not exhaust the processes involved in their making. Nevertheless may provide an

appropriate detailed thesis in terms of adopting a dynamical approach to composition.

Ridding of the symbolic classical approaches is not the aim of the current research venture. The attainment is rather to inform the symbolic associations, which are for the most part arbitrary, between low level perceptual processing with higher level cognitive routines creating referenced figural forms. To that regard the morphodynamical profiles are found to have the capacity to carry meaning through morphological associations and regulation of dynamics.

The works in the portfolio employ several morphodynamical models in order to conceptualise and synthesise coherent thematics of explicit aesthetical attributes and while enabling the composer to materialise their conceptualisations, also provide for the processes taking place during the artwork projections.

To do so the regulation of deep thematic components was necessary and the suggested models enriched the compositional process with a proper, scientific objective mathematisation of deep level operations. Furthermore, this mathematisation provided valid input to simulation and facilitated the materialisation of a concept into a fully developed, composed, coherent performance. In that sense treating the object of interest (in many of the cases presented here the audio-visual object) as a dissipative structure, the result of a dynamical process, provides useful insights (and points to the relevant algorithms) to predict and regulate its diffusion into performance space and ultimately to the conceptual sphere of a recipient.

Whether the output was found meaningful depends on the notion of 'meaningful' one adopts, especially in the realm of abstract art appreciation. If meaningful suggests meaning-functional then the results appear inconclusive since linear processes might as well be used in order to obtain similar aesthetic results. If the term suggests abstract but explicit form-related meaning, then

the result may appear decisive; there is a universal, gestaltic understanding of what ‘explicit’ may be in artwork aesthetics and acquiring methods providing for abstract processes that resonate in the mind of a recipient for meaning and conceptual coherence to be created, may indeed be a primary and on-going research subject.

Furthermore, the replacement of the term abstract with the term complex allows for more objective observations to be attained. Hence the works presented were not only discussed for their generative potentiality but also for their analytical richness, meaning whether there was a subject for analysis entailed in their complex forms.

In relation to that, several elucidations, products of the morphodynamical analyses of the forms, were concealed even during the time of composition, and only revealed after the final projected form was perceived and cognitively processed with the proposed frameworks.

There was a conscious compositional and research choice to present the artwork found in the portfolio with a minimal knowledge base about them. The reason being to enable one to focus purely on the morphological traits and the dynamics constituting the art-forms. The only additional information about these narratives is given by their titles that deliberately were descriptive of a situation (as in *A Girl in a Nightdress*). Given this limited access to the knowledge universe of each composition, the only available source then was the morphological information on the one hand, and the encyclopaedic knowledge available to the recipient through their everyday experience and history on the other. To that regard the formulation of figural components was conceptualised by the composer as universal and the narrative connections were considered to remain pure of particularities till their projection and reception.

The study concerned whether full narrative programs may be carried through



the composites created from the dynamical topological arrangements (in fact their computational equivalents) and which are based on the catastrophic descriptions found in Part III (catastrophisation of the semiotic square with Folds, Cusps, Swallowtail and Butterfly geometries etc.). To that regard as the analysis of the audio-visual forms in Part IV exposes, oppositions, deixis, and signification have indeed formulated semio-narrative audio-visual structurations which upon their projection may create coherent proto-narrative sequences of artistic rigor and significance. Hence, narrativity may be supported in dynamical arrangements as such, and an objective correspondence to morphological profiles may be achieved and additionally developed through a uniform parameter space stratified by dynamical processes.

The progression of this research entails a detailed elaboration of morphogenetic processes, be it materialistic or non-materialistic in their manifestation. Further development towards dynamical narrativisation of complex concepts and processes, providing minimal irreducible units of signification and processing these through complex systems of interpretation, points to extensive research in neural networks and sub-symbolic modelling retaining at the same time the more generic prism of the morphodynamical approach. This venture is twofold: one aspect would provide informed (of an explicit process) tools for modelling, reproducing and transforming a process, the other would provide a naturalised explanation of the obscured-from-complexity algorithms that model sub-symbolic processes. A further attainment would be the implementation of a comprehensive ‘narrative server’ that would inform in real-time several narrative spaces in a uniform approach, irrespective of their materiality, form, and function. The idea that the ‘shape of an algorithm’ is entailed in the ‘shape of the message’ as I have expressed it several times in this thesis may provide ground for an elaborative investigation of the shape of algorithms as it relates

to decoding and breaking down ‘the message’ to its core components, in order for them to be understood universally.

In the modern media scape, which is the primary communication channel for artistic expression, the narratives constituting it as the semantic investments, i.e., the messages these narratives entail, are shaped, formed, and modulated. There appears to be space for an approach to composition with the capacity to mediate the different components of a complex narrative act as dictated and manifested in this setting.

Of equal importance, appears to be the identification of a place of operations that abstracts the invariants of narrative expressions in different transmission media settings and through different materialities. Creating space for heuristic approaches in composition from different fields of research, such as linguistics, semiotics, cognitive sciences, and natural sciences, informs the nascent art-forms with all of the structural elements that constitute a complex surface form appearing in an explicit fashion.

A ‘common ground’ of operations may thus not be considered as a task of complexification of the compositional act; rather, it may appear as its objectified explication.

Part VI

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Part VII

## Appendices

## 11 Appendices

### 11.1 Appendix 1: Narrativity in Contemporary Artworks

The main focus concerns here, the work “*L’ Inconscient de la Forme*” (1970) from Francois Bayle in the collection “*L’ Experience Acoustique*”, and the multichannel composition “*Spectral Lands*” from Denis Smalley. For the former partial analysis of the artwork is presented, along with the composer’s comments concerning the work in question. These were translated from French by the author, and are not exact translations of the original texts and quotes. For the latter the exposition of the creative process from the composer was recorded and transcribed in a lecture that took place in the Music Department of the University of Aberdeen in 2015.

The descriptions presented here, concern the composer’s intent and the compositional strategies employed for manifesting in the final projected material that intent.

#### 11.1.1 *L’ Inconscient de la Forme*

Francois Bayle, being a close friend to both Rene Thom and Jean Petitot, was deeply influenced in his compositions by the new mathematical notion that emerged at the time concerning the project of morphodynamics and particularly Catastrophe Theory. He consistently used the notions of morphodynamics in his compositions, in an effort to consciously shape and reform the deep material components, in order to provide surface arrangements that correlated with the deep morphological profile of the sonic formations. For Bayle that deep component in the sonic-forms was bearing a substantial influence on the surface compositional structures, and as a result was a conclusive determinant during interpretation. In his descriptions of the sound-image (*i-sound*), a seemingly schematic understanding of sonic-forms is proposed, leading Jean Petitot (1989:

171) to admit that Bayle exhibits a wealth of morphological and morphodynamical lexicon in his descriptions of sound images, sound structures and sound organisations – more than a mere vague, poetic approximation, but rather a demonstration of how the morphological component may be the basis for higher-order semiosis in music.

In *L' Inconscient de la Forme* a basic position of Bayle reflected in the idea that “[t]he universe of listening, the world of sensations, is understood through a first level: alert listening” [author’s unofficial translation] (Bayle:2013), is realised. The composition has 10’02” duration and is made up of two large segments. The first according to the composer (*ibid.*) gives the sensation of an ‘acoustic curtain’, creating the sensation of a harsh, ‘flat’, aggressive sounding layer, a ‘closed’ form, that sounds almost frightening. This ‘acoustic curtain’ extends from the beginning of the composition until 2’21”. It is composed by electronic sound-forms occupying the low and mid-range frequency spectrum. The mid-range forms are oscillating and evolve around a relation of a perfect fifth  $B_3 \longleftrightarrow F_4$ . An interruption to this composite layer occurs from 1’05” to 1’19”, by a disassociated fragment announcing the second part of the composition. This fragment is framed by two *arpeggios*, one at the beginning and one at the end of it. The second part of the piece, starting at 2’21”, consists of various animalistic sounds, cries, birds etc. create an environmental acousmatic scenic. The sound that dominates is that of the birdsong, persisting announcing its presence and interfering with the evolution of the rest sonic events. This sound-form slowly descends in terms of its frequency spectral profile. The composer describes this part as a “landscape/scenery of cries” (*paysage de cris*). This part evolves both in terms of its gestural movement, as well as, its textural character, reacting to the cyclic appearance of the birdsong sounds. This *motif* becomes quite acute at the end of the composition.

It may be observed that the only musical terminology used, in this brief description of the piece's musical development, is the term arpeggio referring to disassociated birdsong sound fragment, and the description of the 'perfect fifth' relation to the 'acoustic curtain'. The rest of the sonic-events, as presented here, have been described in a metaphorical sense, that may provide a cognitive, experiential, and schematic understanding of the nature of these sonic-forms. In fact, what the above descriptions announce is the form of a non trivial structural phenomenon (e.g. qualitative oppositions between sound-forms and their composites).

Throughout the acousmatic music field, descriptions as such are being employed in order to capture the multidimensional nature of the acousmatic form, that it may neither be decoded or codified exclusively in terms of its physical properties, nor it possesses any objective symbolic value as may be found in classical musical notation. In the context of the current research, they may be considered as cognitive narratological depictions of explicit sonic composite forms.

### 11.1.2 *Spectral Lands*

*Spectral Lands* is a six-channel audio composition by the composer Denis Smalley. A lecture that took place in the musical department of Aberdeen University, where the composer exposed his methodology behind the creation of the work. The information presented here are transcribed from the recording of that lecture.

*Spectral Lands* is a composition completed over several years, and given Smalley's description it was informed by explicit techniques that allowed him to communicate in the manifested sonic-forms and their composite structures his intentions concerning acousmatic spatiality. The compositional attainments are a distillate of a thought process that started several decades ago, presented



in the notion of sound *spectromorphology* (Smalley:1986) and its implications as an adopted listening strategy during reception. This first development of his assumptions entailed morphological appreciations of sonic-forms, while introducing the notion of a *naturalised*, cognitive understanding concerning their potential evolutions in time in the context of a composition. *Spectral Lands* was presented a few years after supplementary considerations concerning sonic-forms and their ontology, were presented by Smalley in his written work regarding acousmatic *space-forms* (Smalley:2007).

Smalley in his explicit description concerning *Spectral Lands* initiated a conversation in terms of acousmatic perspective, seemingly a notion not directly related to sonic-forms. He proposed that ‘playing with perspective’ (personal recording of lecture ), gives the impression of spaces that are larger, or exist beyond the perceived space where the act of listening takes place. Going beyond the technical aspect of these transformations and focusing the cognitive aspect of them in terms of interpretation, presupposes that there is a ‘sense of space’ intrinsic to the listener that facilitates transformations as such. Here, once more sonic-forms and their arrangement are described in extramusical, metaphorical terms. In his own words “[s]pace in general does not exist prior to identities or entities and their relations. So I am creating space not through creating acoustics or creating spaces, but through the musical relations. The solid relations stretched over time, they interact together and create and accumulate the idea of space or spatiality.” (personal recording of lecture ). Describing Pozzo’s emblematic ceiling of St. Ignatius church, and the architect’s methods to achieve this impressive notion of depth, Smalley mentions that this kind of methodology was followed during the creation of the acousmatic notion of depth found in *Spectral Lands* . The sonic environment so far is completely described in visual terms, and this metaphorical act facilitates a better understanding con-

cerning the sonic content and its arrangements. Transcending space, according to Smalley , occurs through the activities space may facilitate and encompass.

Experiencing the artwork indeed may verify the composer's intentions. The sonic-forms are arranged in such a way that they create an ever-evolving environment, allowing the listener to oscillate between perceiving the referential aspects of spatial perception, to acquiring an 'alien' sense of non familiar, mutated 'space' and activities. There exists an abstracted sense of understanding resulting from perceiving sound's physical qualities through their transformations. Hence, a cognitive understanding of the experience is embraced upon the exposition to the explicit sonic-forms.

In the beginning of *Spectral Lands* the sense of height is formulated, achieved "[t]hrough the way I (Smalley) use mechanically sound modalities" (personal recording of lecture ). Smalley outlines in his descriptions the deliberation of including this composition here as a cognitive narrative act of synthesis; In his own words "[I] (Smalley) am always deploying spectral space, that does not mean that every deployment in every space evokes impressions of spectral spatiality. That really depends on how you use the sounds and what sounds you use. As a composer by definition you are always working with spectral space, but you are not necessarily always create the impression of spectral spatiality." (personal recording of lecture ). In that sense the conscious choice of working with narrative terms as far as artistic expression is concerned situates the narrative forms of a composition in a more lucid manner for the listener to interpret.

Spectral spatiality is bound with perspective or space, the two are often integrated to an extent that it is not realistic to separate them out. For example we 'roll up' high frequencies to make a bright sound more distant, as you get the impression of sound moving.

Thus creating the impression of travel, for example, because sound seems closer to you when it is brighter...changes in spectral spatiality or spectral space are paralleled by changes in perspective. In other words, they will move in the space in a certain way, or move to a different part of the space. (personal recording of lecture )

In his descriptions he further defines that the notion of space creates a notion concerning the entities that inhabit it. In the example of the birdsong sound in *Spectral Lands*, he explains that:

[W]e associate a birdsong with being higher because they are smaller creatures. And we can think of all those sounds of birds that could be down on the ground, but you don't think those being down on the ground, you think of that as being elevated up from the tree...so they are all these cultural conditioning factors that are going to determine the way you think about the kind of sound you are listening, in this case, source by source. (personal recording of lecture )

The criteria for 'choosing' and appropriately arranging sonic-forms in relation to the rest of the sonic landscape in a composition, are for Smalley clearly morphological. He expands this concept by outlining the process of spectral correlation:

[I]n other words, you take strands out...separate different strands which can be distributed in different ways. Now you might think that this is going to break up the sound, but it doesn't; the sounds are moving in a related way, the ear joins or unifies all these different elements that are stratified, and recreates the unity of the sound, even though it is distributed in different portions...so the separa-

tion of sound in spectra layers in one of the possibilities. (personal recording of lecture ).

Smalley continues describing that he proceeds in a morphological correlation of the transformed sound material and by mixing these collectively he alters the perception of how a sonic event would resonate with space.

Furthermore, he explains that one of the most important things in his compositions is the idea of continuity.

[C]reating a holistic space...I want to create an environment or a 'feel' of environment that over time feels holistic...in *Spectral Lands* the spectral lens is less holistic...we have moved through a series of different spaces, but because the same phenomena recur, and they come around in a slightly changed or slightly different environment, one has the feeling, at the end of the piece, of having created a territory (personal recording of lecture ).

In his conclusive remarks he adds, “[j]ust to finalise, remember that spatiality as a whole results from a close collaboration of spectral spatiality, with perspectival space, and source-bonded space, it is all of these things. And remember that space and time are intertwined...we can't separate them...it (space) needs time.”(personal recording of lecture ).

This sub-section will conclude with a final question proposed by the author to the composer concerning the narrative aspects of his descriptions:

- (author) I observe a path starting from describing sound in terms of its morphological attributes arriving to a narrative understanding of sound composition where you describe the act in terms of creating space, populating it with characters, entities, etc. What is the connection?

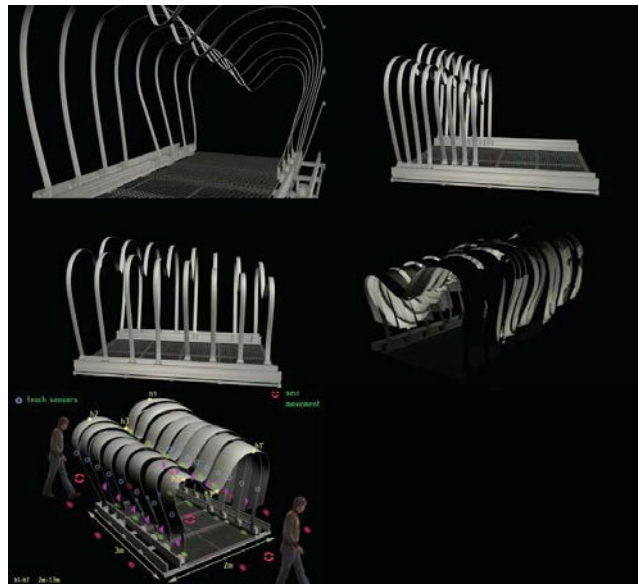
- (Smalley) You have encapsulated the most of it, yeah this is the process and it's very dependent on the types of morphologies, and yes creating an environment is basically happening by populating it in certain ways, and whatever it is populated with will behave in certain ways through time. It is just spectromorphology and timing!  
(personal recording of lecture )

### 11.1.3 *Self-Space*

After the explicit reference to the acousmatic musical forms a brief extension on this subject is provided in order to describe some contemporary art-forms as they are found in multimedia works of art.

An interactive kinetic installation created by the author is going to be presented. It was influenced by the work of the architect Kas Oosterhuis, and his ideas about *responsive architecture*. The work "*Self-Space*", was completed in 2007 in Ionion University and was presented at Lefkada in the fourth *Sound Music Computing (SMC)* conference. More detailed technical descriptions are to be found in the relative article (Giannoukakis:2007). The primary idea behind this composition, revolved around the notion of *Self* and the individual space internal and external, physical and mental. The notion of the personal space is posited in relation to the technological artefacts surrounding the individual on the one hand, but also in relation to the allegorical archetype of the *Cave*, as proposed by Plato. Hence, the form of the installation was such in order to be able to contain the individual and provide a space for performance of its individuality, a form deeply inspired by a schematic notion of the physical caves. In addition, given the common attributes of the shape of caves to that of corridors, as physical potentials of *passage*, this work entailed in its conceptualisations the idea of death of the form and the passage to another form of being. There was a significant narrative sense to the installation, mostly conceptually at that point,

and in order to balance the strong technological presence of the robotic form with a strong mythological background. It was the first artwork by the author exhibiting a strong spatial component, and a narrative based performative aspect, and in many ways the instigator for the current research project. The installation was regulated by a simple neural network, trained to control the installations response in accordance to the presence or absence of human agents inside and around it. The behaviour of the system, as it was commanded by the neural network displayed three main complex reactions to its inputs, namely *imprisonment*, *departure*, and *return*, as corresponding to the three states of Plato's allegory. The following figures display the initial 3d designs of the work, and the figures to follow the actual implementation.





Narrative conceptualisation was a determinant factor in this project, as it provided the necessary descriptions that would allow the transformation of a technological artefact into a work of art. The narrative interpretations also during the creation of the project affected its form as well as its interaction profile. It may be considered as an unconscious mapping between three domains, one being the narratological, another being the technological and the other one of the contemporary new-media art presentation. The latter was the blending domain that allowed the manifestation of the final blended work to appear as an explicit manifestation of contemporary art.

## 11.2 Appendix 2: Narrativisation and the Elementary Form of Meaning

### 11.2.1 Narrativisation , the Process of Meaning Production

It is now appropriate to consider the process of narrativization as being a fundamental process towards attributing meaning to content, as the structuralist project suggests. In the scope of this chapter Greimas' work acts as a point of departure for an explication of the meaning production operations. The following chapters overview the main axes of Greimas' model, as well as pointing out some of its basic presuppositions. These presuppositions refer to deductions concerning the nature of meaning, and allowed Greimas to provide a coherent model. These are still areas of discussion in semiotics (and semantics), concerning their validity. Nevertheless Greimas' model may be an adequate point of departure, providing fundamental groundwork, while Part III of this research suggests a reformation of his main theses (in terms of Catastrophe Theory), dealing with these gaps in Greimas' conceptualisation .

Greimas' model identifies four stages of narrativisation ,

- An immanent level of fundamental grammar is the first level, at which the notion of narrativisation is introduced as being contained in this fundamental grammar, all values here are acquired constitutionally;
- moving from fundamental grammars to a surface narrative grammar is the second level, where notions such “doing”, “wanting to do”, and “being able to do” are introduced. Greimas considers these terms the basis of *narrative utterance*;
- the third level is found in the process of the development of surface grammar. At this level, narrative's *polemical* form is instituted, as is the notion of *performance* (considered as an archetypic narrative unit);



- the fourth level relates to the further development of surface grammar, where structures of exchange and the archetypes of *transfer* are introduced. This level allows for an explication of narrative structure based on a semiotic groundwork obtained by a “performance series”. This additional development of surface narrative grammars allows for a topological manner in representing narrative phenomena.

As is evident, maintaining the model’s equivalence between these different levels of narrativisation is of crucial importance (a *catastrophe theoretic* mathematised translation of the model as presented in Part III maintains this equivalence). This aspect of the analysis makes the deep structures apparent, through attributing their manifestation explicitly to the logical combinatorics of the initial model alone. The process as described in the following is one of mediation, and concerns:

1. the narrativisation of the taxonomies;
2. narrative utterances;
3. performance as basic narrative units, and
4. performance series.

The first level of narrativisation concerns the elementary structure of signification, and the logical implications of its basic semic categorial content. This level (it is one of immanence) needs to precede its manifestations by some form of linguistic substance, a term including non-linguistic substances, such as musical, painting, cinematic. Additionally it needs to display a discursive character, meaning that a characteristic of composition forms its essence. Such a circumstance may then be considered as a minimal condition of narrativity. The satisfaction of this condition suggests that this level is constructed of units much larger and complex than is utterance.

This indeed is reflected in the articulated character of the basic model demonstrating its ability to be narrativised. The model's logical status, though elemental, delineates the conditions for grasping any meaning, accomplished by laying out an elementary system of relations such as contraries, contradictions, implications and presuppositions. That which the constitutive model structures is significations, rendering the model semantic and allowing for an understanding of a primary level of narrativisation, by explicating the relationship and links between semantic and syntax at this deep level.

This model appears achronic, a taxonomic structure. The relationships between its constituents suggest no orientation. There is, however, the possibility of presenting the model in a dynamic fashion. By treating the relations of the model as operations rather than as relations, the morphological character of the model becomes syntactic. Another way of portraying these operations is that of transformation; at this point the notion of syntactic doing may be introduced in the analysis. The fact of syntactic doing presupposes a subject, therefore, that which attributes dynamicism to the model. The three types of relations are viewed now as operations, or rather as transformations of content that is negated and affirmed within the bounds of this semantic microuniverse as Greimas describes it. Narrativity emerges if orientation is attributed to these transformations of content.

The antropomorphic representation of the above operations is the primary characteristic of the next level of narrativity, what Greimas calls the surface narrative level. The term "anthropomorphic" indicates the interpretation of the above operations in terms of 'doing'. This announces the addition of the classeme 'human' into the semantic universe defined by the basic semes, thus affirmations and negations, disjunctions and conjunctions may be translated into syntactic doing. The addition of the human classeme thus explicates the

operation of *doing*. The syntactic operations of disjunctions and conjunctions, negations and affirmations, are reformulated in the sense of their perception as a (syntactic) action performed by a subject. For Greimas, all of the *doing* operations of human activity (performing an action, or accounting for an action performed) are activated as they become objects of communication encoded into a transmitted message. This schema presupposes a sender and a receiver of the message, circulating the object of communication. This kind of mediation is what enables the utterances to become narrative utterances, and the surface grammar to become narrative grammar.

The above syllogism suggests that any deep grammar is able to be narrativised and become a narrative schema with a minimal canonic form of the syntactical doing described. It appears then in the form of a process that expresses or establishes a function. Also, in order for this deduction to hold, homogeneity is presupposed between the syntactic operations and syntactic doing, as well as the syntactic doing and the doing of an actant. Once this condition for an isotopy is met, narrative utterances may develop and carry through the narrative program.

The third level of narrativisation introduces the concept of resistance of action as well as the concept of performance of the actant, the polemical schema of narrative. The polemical representation transforms the basic schema (the semi-otic square) into an anthropomorphic one, and the logico-syntactic relations are transformed into dominations and attributions in the confrontation between a subject and an anti-subject. The succession of narrative utterances in the form of *confrontation* → *domination* → *attribution* is named *performance*. Attribution in this narrative utterance series may be considered as the surface level equivalence of the logical affirmation of the deep grammar.

Greimas' final addition was to engage the syntactic operational series iden-

tified as performance in a structure of *exchange*. In that sense *attributive* utterances imply the *deprivation* of the object of desire from another subject. Thus, there arises a syntagmatic series of performances, an expanded model of *attribution*, where *deprivation* is the surface equivalent of disjunctions and *attribution* of conjunctions. This completes the narrative program, into a formal narrative schema.

In addition, in this reformulation the program becomes topological since the object of value is transposed between initial and final places of transfer. Allowing a topological translation of operations considers objects of value transferred by doing; in this translation the operations of the semiotic square (contradiction, contrariety, and presupposition) appear as a circular transmission of values. Taking into account the operators along with the operations, as happens in the exchange schema, then the circulation of values represents the transfer of an operator's capacity of doing.

The separation of the topological syntax into a syntax of operations and a syntax of operators is in correspondence with the separation between *doing* and *wanting to do* (including all of its modalities), which in turn corresponds to the separations of narrative utterances into descriptive and modal utterances. In other words, there appear two performance series where acquisitions reference the transfers of either object values or modal values. The performance series of modal values transfers is what activates the syntactic trajectory, since the modalities of *wanting to do*, *knowing how to do*, and *being able to do* must be set in order for the object values to circulate. The narrative unity modal values are evoked to form, that which constitutes the performance series of doing. The combination of the series (transfers of object values and transfers of modal values) present a complete narrative contract.

### 11.2.2 The Elementary Structure of Signification

Assuming that the basic interrogations of structuralism hold suggests that semiotic systems assume a form of organisation based on the dual nature of their constituents. While they are distinct and explicit, they are part of a whole of which they are essential components. This trait is attributed to the need of the human mind to make things intelligible and meaningful (Greimas, Rastier:1968, 87). It does so by engaging in the process of starting with simple elements, and complexifying their nature by forming assemblages through constraints and conscious choices as the process evolves.

What makes Greimas' narrative grammar a valuable contribution is

[T]he way it constructs, degree by degree, the necessary condition for narrativity, starting from a logical model which is the least complex possible. (Ricoeur, Collins and Perron:1989, 581)

The analysis then is focused on how the meaning kernels embedded in basic units (semantic, phonological, or linguistic<sup>91</sup>) start from a simple and primal form, and through a creative process proceed to a complex form that is explicit to symbolic content manifestations of the real world, enabling meaningful communication. The entanglement amongst these basic units and their complex forms, led Greimas to assume a more complex primary structure than a binary relationship suggests, in order to account for signification.

The course to intelligibility (finding '*thingness*' in the reality continuum<sup>92</sup>) starts from immanence and intrinsic relations, and finally expresses into man-

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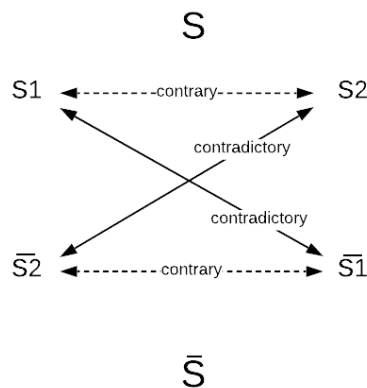
<sup>91</sup>Each one of these content categories presupposes an arbitrary relation between units of different materiality and no apparent connection, i.e., phonological units bring forth an arbitrary connection between a pheme and a mental representation.

<sup>92</sup>There is nothing suggesting explicit literary axioms in this creative process, but rather "it draws from the same sources as the whole of meaningful human activity" (Greimas, Rastier:1968, 86). Greimas' and Rastier's purpose, using literature as a vehicle, is to address general anthropological questions, and in this way identifies the semiotic analysis of literary objects, as an expression of the literary phenomenon (which as an observed manifested phenomenon is strictly tied to human activity and behaviour).

ifestation and external interactions. There are three basic stages identified by Greimas in the process of structure formation:

- The first stage concerns *deep structures*, which define the fundamental conditions of the existence of semiotic objects, and possess a definable logical status.
- the second stage concerns *superficial structures*, the constituents of a grammar capable of arranging content into discursive forms, independent of the expression which exposes them, and
- the third stage, which is concerned with *manifested structures*, producing semantic investments and organised signification.

The deep elements that habitate the first stage constitute the elementary structure of meaning, which in turn possesses a form defined by a primary opposition. This primary abstract opposition constitutes any type of signification regardless of the semiotic system, and level of signification where meaning appears.



This model of the basic constitution of meaning, allows for its structural interpretation in terms of two junction types (conjunction and disjunction). The disjunctions in the model are of two types, a disjunction of contraries (dotted lines) and a disjunction of contradictories (continuous lines).

When Greimas *et al.* presented this model (Greimas, Rastier:1968), described it as isomorphic to the models based on algebraic groups proposed by Piaget in psychology. The above articulation indicates that this model may be used as a constitutional model of semantically charged (invested) contents, in a wide area of applications.

**The importance of the semiotic square** is established in two aspects of the model. The first aspect is that which logically exhausts the possible operations of opposition, mapping as a schema their combinatorial configurations. The second is that it inscribes within its logical structure, a semantic component, which differs from a ‘pure syntax’ of formal operations as found in purely logical or mathematical constructions.

The semiotic square transforms the ‘absent’ terms into a semantic contrary which as an immanent semantic element (sème) “can only be ‘present’ (even when the signifier is an absence)” (Greimas in Schleifer:1987, 24). In other words the semiotic square includes in its articulation oppositions: not just the absence vs presence of an immanent feature (contradictories), but also those oppositions that exist between affirmative elements on a particular axis of semantic content (contraries).

This redefines unmarked elements of signification in terms of their semantic axis of existence. While contraries suggest the existence of semes on a common semantic axis (defining opposition in terms of presence or absence of a shared feature), contradictories exist between different seme typologies and in terms of the presence or absence of a shared function (e.g. *white vs black* admits both

semes on the semantic axis of ‘particular colours’, while their contradictories *non-white vs non-black* points to the semantic axis of ‘colour’ in terms of being able for one to perceive it or not). The complementary relations are defined in terms of implication (direct presupposition, i.e., ‘colouredness’ presupposes the existence of ‘particular colour’), but also suggest arbitrariness since this implication is not necessarily bound either by common features nor by common functions (‘particular colour’ may also be presupposed by other relative terms such as ‘light’ for instance).

Hence the semiotic square structures and regulates the semantic investments in a semiotic system. Semantic investment when conceived as a relationship and presented as a semantic axis, may be represented as a semantic category and in turn be represented by another semiotic square. These ‘leaps’ allow for the terms of a semic structure to be reconceived altogether, and to appreciate them within different meaning articulations. Moreover this also suggests a different level of meaning, since even the minimal essence of primary semic terms may reveal a complex form. The process of the reconceptualisation of the semic terms in order to reveal their complex nature, and to instil in the model the possibility of transformation is what Greimas refers to as ‘explosion’.

### **11.2.3 Narrative Transposability, Semiotic Status and further Comparative Implications**

The interrogations towards the transposability of narrative could vary and regardless of any persistent urge for formalisation in structuralism, variation brings forth valuable, combinatory deductions from which narratological studies have benefited. At one end rest radical reasonings such as Chatman’s (Chatman:1978, 20), claiming complete detachment of narrative from medium, and that first and foremost narratives are structures. Based on Bremont’s descriptions quoted above, concerning the transpositional qualities of the narrative



message and its contents (the story) he deduces that,

[T]his transposability of the story is the strongest reason for arguing that narratives are indeed structures independent of any medium. (Chatman: 1978, 20)

Chatman seeks answers by turning to the epigenetic, cognitive structuralism of Piaget<sup>93</sup> to acquire a description<sup>94</sup> of structure (that is, narrative structure); rather he defines a domain capable of inhibiting it, to facilitate operations on and transformations of it. Piaget, in turn, identifies genetic and self-regulatory causes to differentiation and structure — as resulting from his epigenetic interrogations, reflected on the notions of reflexive abstraction and self-regulation. Also, claims are made of prior dependence of any linguistic attainment upon cognitive ones, introducing the psychological (and mental constructions) to abstract mathematical research on form<sup>95</sup>. Examples include the Bourbaki group's research into *mother structures*, i.e., algebraic structure [groups], the relational orders of structure [geometrical], and topologies [neighbourhoods and borders]. In that sense, he completed an act of mathematisation by correlating cognitive, developmental, and mental processes and operations, i.e., those involved in the abstraction and development of knowledge about the world<sup>96</sup> abiding by reflexive abstraction and self-regulation, with elementary abstract mathematical forms. This correlation brought forth the next significant question for Piaget as to, whether these three mother structures were natural. Indeed, Piaget established similarities of structures in children's thinking in the pre-operational stage of development to all three types of mother structures (algebraic, rela-

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<sup>93</sup>See Genetic Epistemology.

<sup>94</sup>Piaget draws on the fields of biology and mathematics, amongst others in order to formulate a definition what constitutes form.

<sup>95</sup>Bourbaki research was an instant realisation for Piaget that this was where his mathematical experimental results map on the three elementary forms of structure. See Piaget:1970, p.3-23 on *mother structures*.

<sup>96</sup>According to many of the views expounded in this thesis "abstraction and development of knowledge about a world" is a fundamental operation constituting narrativity.

tional, and topological). They were found to correspond to natural thought operations triggering the child's cognitive and developmental, learning routines. Piaget's mathematical observations and correlations, along with Thom's catastrophe theory, may be considered the first legitimate efforts towards the mathematization of cognitive processes.

Incorporating the Piagetian deductions of Chatman concerning narrative form across different media into what he calls the medium-independence thesis, David Herman in his article *Towards a Transmedial Narratology* (Herman:2004, 51) interrogates the transmediality argument in the form of a thesis (medium-independence), antithesis (medium-dependence) and synthesis (gradient dependence). Thesis, in its most uncompromising expression, advocates the complete transposition of all possible narrative aspects in all possible transmission media, hence complete detachment between narrative and the transmission media. This strong position towards narrative independence from media, according to Herman, has not been prevalent in narrative studies since even its strongest advocates have reached a point of retraction to a more conservative and graduated view of narrative independence. The less radical versions of the thesis, however, acknowledge that certain aspects of narrative are medium independent; they are traced back among the roots of structuralism as found in determinant distinctions<sup>97</sup> between "story" and "discourse", or the *Fabula* and *Sjuzhet*<sup>98</sup>. Several researchers advocate a medium-independence thesis, amongst those, are Barthes, Rimmon-Kenan, Gerard Prince, and Bremond. Barthes in particular makes his arguments in terms of the Saussurean-Hjelmslevian legacy, explaining that one of the aims of structuralism is (or should be) to "master the infinity of

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<sup>97</sup>These distinctions as Rimmon-Kenan points out, may be found in associated mappings and classifications of the field "like the Formalists' 'fabula' v. 'sjuzhet' (e.g., Tomashevsky 1965, p. 66), Todorov's 'histoire' v. 'discours' (1966, p. 126), Chatman's 'story' v. 'discourse' (1978, p. 19), Barthes's 'functions', 'actions', 'narration' (1966, p. 6), and Bal's 'histoire', 'récit', 'texte narratif' (1977, pp. 4–8)" (Rimmon-Kenan:1983, 155)

<sup>98</sup>Each of the first terms of these conceptual pairs are medium independent, the second ones are not.

utterances [paroles] by describing the language [langue] of which they are products and from which they can be generated” (Herman:2004, 51). Since the narrative language is not “the language of articulated language — though very often vehicled by it — narrative units will be substantially independent of linguistic units” (*ibid.*). Rimmon-Kenan adopts a similar narratological disposition that “justifies attempts to disengage a form from the substance of the narrated content, a specific narrative form” (Rimmon-Kenan:1983, 7). The process suggests treating story as “far from [...] raw, undifferentiated material” and “stresses its structured character [...] made of separable components, and hence having the potential of forming networks of internal relations” (*ibid.*). Rimmon-Kenan attributes

[T]he theoretical possibility of abstracting story-form [...] to the intuitive skills of users in processing stories: being able to re-tell them, to recognise variants of the same story, to identify the same story in another medium, and so on [...] this intuition has led almost every narratologist [...] to formulate a claim that an immanent story structure, sometimes called ‘narrativity’, may be isolated at least for the sake of description. (*ibid.*)

Greimas and Porter stood a firm advocate of narrativity and the medium-independence argument that Bermond introduced. For them,

[It]amounted to recognising and accepting the necessity of a fundamental distinction between two levels of representation and analysis: an *apparent* level of narration, at which the manifestations of narration are subject to the specific exigencies of the linguistic substances through which they are expressed and an *immanent level*, constituting a sort of common structural trunk, at which narrativity is situated and organised prior to its manifestations. A common

semiotic level is thus distinct from the linguistic level and is logically prior to it, whatever the language chosen for manifestation. (Greimas and Porter:1977, p. 23)

Piaget similarly identifies this organisation of the immanent level of narrative (its structural domain) to be of cognitive nature, describing it as a mental construct. Greimas reformulates later in his works the above quote, enriching it with the idea of the generative trajectory of discourse by which abstract elements through continuous transformations couple onto concrete elements of the 'real world'. He includes in his analysis socio-psychological, semantic and cognitive determinants (the mental constituents of narrative organisation s), by formulating the concept of (true) enunciation in narrative discourse. He also gives primacy to the cognitive over the linguistic construct, since enunciation "as an act, is necessarily required by the actualised utterance, and therefore logically precedes it" (Greimas *et al.*:1976, 435).

A similar stance towards the substance of narrative (story) and its linguistic manifestation is proposed by Rimmon-Kenan (Rimmon-Kenan:1983, 9), claiming that story is abstracted out of the specific style of the text, the language in which the text is written, and the medium or sign-system (words, cinematic shots, or gestures). Furthermore, in that sense, story may be recognised "as transferable from medium to medium, from language to language, and within the same language" (*ibid.*).

The fact that the above structuralist views on narrative transposability converge in their core with modern cognitive views on narratives and narratology (as presented briefly in the previous chapter) hints that to analyse narrative in terms of its cognitive nature is to consider it as an act of meaningful communication, to the degree that the form of content, and transmission media allow. In that sense, symbolic meaning is the subject of study and requires

an epigenetic approach in order to justify its explicit formations (actualisations and realisations) as brought forth through operations and transformations, and manifested during communicative operations (modalisations) on narrative text. The vehicle for the transference of symbolic meaning across levels of semiosis lies in conceptual metaphors which are not only constituted but also stratified by symbolic units of meaning; they taking, as will be explained, the form of scenic, image-schematic configurations (case frames<sup>99</sup>) upon which we draw during narrative discourse of any type.

#### 11.2.4 Narrative Grammars and Modal Analysis

In narratology transmediality, as a narrative trait unveils during the discursive manifestations of narrative since it is when interpretive processes take place. There is an alignment, therefore, between the transmedial and cognitive narratological project. Aligning the subject of inquiry to correlate these factors may, make even more sense when one considers that, in narrative discourse, that which makes the transposability of the story attainable is the universal process of projecting the paradigms (paradigmatic axis) onto syntax (syntagmatic axis) and the emergence of intermediate levels during *textualisation* of experience<sup>100</sup>.

It is the very same form and interpretive nature of narrative discourse that capacitate the transformation. In the words of Schleifer (1987, 38), "interpretation projects the continuous onto the discontinuous".

Greimas frames narrative discourse (describing a formal cognitive status) in his reasoning concerning utterance and enunciation, while also attributing

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<sup>99</sup>Fillmore's case grammars.

<sup>100</sup>In this research textualisation is considered as the act of creating representations of experience in sign systems. According to Greimas "Textualisation is the set of procedures (making up textual syntax\*) the end product of which is a discursive continuum, constituted prior to the manifestation of discourse in any given semiotic system (and, more precisely, in any given natural language). The text\* thus obtained, provided it is manifested as text, is then a semantic representation\* of the discourse" (Greimas and Courtés:1979, 341) [asterisk \*, found in the original].

the capacity for the involved transformations between paradigmatic and syntagmatic elements (manifesting during discourse in the form of enunciations) within the concept of the generative trajectory (which is the subject of interpretation) arising during discourse. It is a decisive contribution in the context of this research since,

[T]he expansion of the cognitive dimension in narrative discourses then serves as a transition between the figurative and the abstract (between which there is no possibility of continuity). (Greimas et al.:1976, 435)

The transition from abstractions to figures is another choice of words to describe the projection of the abstract static virtual (in the form of things, categories, and paradigms) forms of content to concrete actualised manifestations of them, through formal syntactic (in the form of functions, and operations) relational linear structures (see utterances below), acquiring narrative semantics in the process. To do so, according to Schleifer, involves a process of disengagement from its texts (as in Jakobson's poetic function of language), which "fills [...] the gaps of language to produce discourse" (Schleifer:1987, 38).

Given the above, the type of practical work presented in this research (and new-media artwork in general) may be more naturally classified as interpretative discourse. As a result, analogous cognitive dimensionality and implications concerning new-media artwork creation and interpretation (retelling), similar to those found in trivial narrative analysis, could be expected.

Meaning, according to Greimas, is a form resulting from the union of signifier and signified and may be understood and analysed at two instances, at the time of semiosis, and after semiosis has occurred. The first process — directly correlated with the act that brought forth the semiosis — is described as enunciation, while the second instance, where the result of the semiosis corresponds

to an actualised act/state (a statement) has been named utterance. Utterances are syntactically organised, linear, and constituted by instances of enunciations (true enunciation = a set of formal procedures organising discourse). In the process of appearing actualised as syntactical discourse, utterances allow their validation and classification in order to become discursive paradigms. Through backtracing the transformational operations (syntax) resulting on discursive paradigms, regression is possible to the deeper level of logical implications that brought forth the explicit manifestations.

In addition to narrative arrangement of content (grammatical and logical form of narratives), narrative discourse attains to the organisation of the semantic narrative component. Its form may be traced as distributed figures of semantically invested syntactical structures. The notion of figures corresponds to stable units of content referring to the formulation of the world and experience (Greimas et al.:1976, 434).

If utterances are figures (semantically charged stable reference forms), distributed along syntactical structures, enunciations are instances where transformation from a paradigmatic type (e.g., the phonemes of natural language in phonology), to a “syntactically actualised discourse” (Greimas et al.:1976, 434) takes place.

Greimas presents a notion of linguistics of discourse extended from its sentential bounds in his narrative grammars, assuming a semantic component prior to the logic of syntax. This grammar in its broadest sense is based on an explicit number of principles governing the organisation of its structure; it is subsequent to the rules of combination and the function of its units, attending to the production of narrative objects. This is the core aspiration leading to classifications of actants and narrative elements, in order to:

- provide for the idea of an ‘actor’, a manifested form during discourse,

reflecting in its presence and discursive function the semantics of a figurative form (anthropomorphic etc.), the notion of animation, as well as individuality (and the ability to assume roles);

- classify actants (sender/receiver, subject/object, helper/opponent), which in turn define the categorisation of actors, and
- define narrative roles (a process of modalisation in the generative trajectory).

In general the focus concerns two basic interacting semiotic systems. One relates to narrative grammars, and how semic categories organise into a meaningful whole that is able to be communicated and available to interpretation. The other is concerned with the discursive act itself and the grammars of discourse. Of greatest interest, is found in identifying possibilities and the potential character of the produced meaning, as it results from the interaction between these two systems of semiosis (given particular constraint settings, and during reception of content).

Particularly, the practical aspect of this research is concerned with the use of both abstract and figurative forms (visual, aural, semantic, and symbolic) of content, and how not only their syntactic but also their paradigmatic structural formations may create possibilities of narrative throughout the course of their manifestation during the discursive act.

In that sense enunciations are considered the main determinant for creating the possibilities of narrative, as well as situating manifested narrative content and making it available for interpretation during reception. Enunciations are, too, the vehicle for the transposition of narrative with each retelling and under different settings and constraints.

While the structures and terms discussed in this part could seem static, given their deep nature, formal character and semantic substance, there is an



important dynamic character during interpretation that could be imagined as a trajectory amongst the different levels of signification, finally manifesting as surface structures signifying meaning for the receptor.

The deep elements are, however, limited in number, as are, the constraints and rules of particular dimensionality. Nevertheless, there are potentially infinite possibilities of interpretation during reception, yet what stands out and ultimately predominates during acts of communication is a strong ‘pull’ towards grounding this infinite generativity into (universal) figurations, potentially meaningful to the receptor.

As an artist<sup>101</sup> (or, rather, in order to align my views of my practice with this research, as a (re)producer of semiotic systems able to communicate art thematisation ), my practice, the relevant conceptualisations as well as the chosen actualisations defining content manifestation in my artworks, are widely involved with the intermediate levels of signification and interpretation that codify and shape the manifested material, allowing for individual interpretation that correlates with primary universals and collective experience (or not).

### 11.2.5 A Deep and Surface Level of Narrative Organisation

The notion of a narrative grammar is summarised in Greimas’ article ”Narrative Grammar: Units and Levels” written in 1971. He starts by outlining several firm observations that allow the confirmation of the existence and form of narrative structures, codify various forms of narrative discourse and determine their semiotic status:

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<sup>101</sup>My inspiration and fascination with approaching meaningful formations (and formations of meaning) in terms of morphology, semiosis and reference stems from my background in acousmatic composition. I expose in my article (Giannoukakis:2016, 266) a number of insightful contributions to the function of semiosis, narrativity, and enunciation, in the field of acousmatic composition, as they are reflected in ideas proposed by composers such as Bayle (Catastrophe Theory, sound Image), Wishart (Catastrophe Theory, landscape composition), Young (sound Image), Smalley (spaceform), and Andean (narrativity). See Chapter 3.4 “The sound image in acousmatic composition” (*ibid.*).

- Narrative structures are translinguistic;
- Narrative structures are distinct from linguistic ones;
- They are not to be confused with genre (since the same narrative can be found in different genres);
- Narrative structures function as organising principles for a significant number of discourses, this though does not justify the economy of these discourses. Regressing to the deep "semantic representation" of a discursive sequence a conflict presents itself between narrative and discursive structures; hence, one narrative function may be responsible for a whole paragraph of discourse. The prior observation brings forth the following realisations,
  - Narrative structures are found at a deeper level than are deep linguistic ones
  - Although at the level of discourse narrative structures are identified and verified, they nevertheless enjoy a degree of autonomy concerning linguistic structures.

In order to advance to a narrative grammar based on an abstracted narrative object, the generative method accounts for the infinite shifts in discourse. These are applications of more general semiotic models and not exclusively those that are linguistic in nature. As Greimas points out after Levi-Strauss, "mythemes," "danseemes," "filmemes," "vestemes" (Greimas:1971, 796) may be discussed. The grammar makes explicit the totality of logical courses stemming from the most elementary ones making their articulations predictable and established. Greimas awards the status of deep narrative structure to Levi-Strauss's model since it allows the construction of deep narrative operations (syntax) at an abstract level that regulates the elementary surface units. The logical relations,

in this case, control the surface narrative syntax, which appears modalised and anthropocentric. Modalities such as *to want*, *to be able to*, and *to know*, or communicative functions and functions of *doing*, all of which presuppose the presence of a human agent, display such a feature. The instances of generative course are multiplied because the linguistic level is augmented by the narrative level, thus to the deep and surface linguistic levels the two narrative levels are added. Greimas claims that the main difficulties in interpretation come with the passage from the surface narrative level (where narrative objects are located) to the deep linguistic level where the structures are arranged by narrativity. The principal rhetorical transformations attributing a discursive narrative form are located in this level; furthermore,

- Narrative structures are temporalised and spatialised, while on the surface narrative level are logico-semantic relations
- Linguistic expansion and condensation appear in the fact that a narrative enunciation may be represented by a whole paragraph at the level of discourse.
- Stylistic neutralisation (or distancing) transpires, as is established in metaphoric, metonymic or antiphrastic relations between narrative and discursive sequences.

Greimas generalises Propp's canonical form of the succession of thirty-one narrative functions (invariants of story) and defines narrative as a sequence of enunciations: virtual and actualised instances where projections of paradigms onto syntactical operations occur. He restricts this process, though, by defining two conditions. The first is, that the content of the enunciations needs to be foreseeable and possess a canonical form; the second states that, the relations which it constitutes in sequences, i.e., the syntax that codifies the content ,

must be explicit. As does Tesniere, Greimas recognises the verb as the central nucleus of enunciation.

Thus, an enunciation such as, "Peter hits Paul" may be codified in two ways, either as a subject-object-subject relationship or as an object-function relationship between two subjects. The latter allows consideration of the verb as a function, meaning that it is a semantically invested description of pure relations. In this case, the nominal syntagms are seen as actants coupled by the function, and narrative enunciation as a logical presentation of the form

$$\text{EN (narrative enunciation)} = F(A_1 : A_2)$$

According to the descriptions above, an actant is that which undergoes or performs an act, independent of any other determinations. Tesniere coined the term "actants" and states, "actants are beings or things that participate in a form whatsoever, be it only a walk-on part and in the most passive way" (Greimas, Courtes:1979, 5). Greimas and Courtes further analysed the concept designating actants as a type of syntactical unit, formal in character, preceding "any semantic and/or ideological investment" (Greimas and Courtes:1979, 5) effected prior to the modalisation of the text through communicative practices. The proposal is preferred for analysis over the concept of an 'actor' since actants are neutral entities independent of the ontology of the participant in the action/process (Robichaud:2003, 40).

The convenience of this model is impressive: it takes into account both the actantial syntax of relations between actants (subjects, objects, senders, and receivers), on the one hand, and on the other, the syntax of expansions that organise syntagms which function indifferently either as subjects or objects. The pragmatic intricacies render these narratives as accomplished performances by different actants, as in the example above (*Peter hits Paul*), where the nominal syntagms may function as both subject or object.

Greimas's narrative schema appears as a system of relations between these formal entities.

The generative trajectory transcends through levels of significations comprised of (1) elementary semantic structures, (2) actantial structures, (3) narrative (thematic) structures, and (4) figurative structures, each level increasing complexity. The trajectory signifies the transition from abstract structures to the concrete. For instance, an elementary semantic structure of a category (e.g. life/death) is rearticulated in an elementary narrative structure (conjunction/disjunction), develops into an actantial structure (i.e., the relation [function] between a subject actant and object actant), and this in turn evokes a narrative program (e.g. preservation, loss, or reparation) to form a narrative (thematic) structure. This structure, by attributing to it perceptive, spatial, temporal, actorial determinations, may be considered as a figurative form. In that sense the elementary semantic structure may at this figurative level be either perceived as light/darkness (perceptive), day/night (temporal), in/out (spatial), or good/bad (actorial). Thus the generative process responsible for the development of significations 'ascends' levels, and is traceable back from the observable concrete figurative elements to the basic underlying categorical structures. Following the inverse order, it is possible to regress from light/darkness to conjunction/disjunction, life/death or, even more abstract, to existence/non-existence. Such a transformational process follows the path from content (abstract structures) to expression (figurative formations) and *vice versa*, either for synthesis or analysis. The generative trajectory stratifies content, crossing a series of different levels (Greimas identifies those as intermediate), and signifying wholes from two perspectives, one reflecting the descending path (*onomasiological*), and one the ascending path (*semasiological*). Fontanille asserts that:

[T]he *point of view of the text* is that which follows the trajectory

in the *descending* direction, from concrete organisations to abstract structures. The *point of view of discourse* is that which follows it in the ascending direction, from abstract structures to concrete organisations. (Fontanille:2006, 51) [*italics* are in the original]

The point of view of discourse may be described as generative, starting from the most generic abstract forms (categories), to reach the discursive particularities facilitating semiotic production, and the point of view of the text as hermeneutic guided by intentionalities and modalisation s, evoking semiotic interpretation.

### 11.2.6 Types of Narrative Enunciation

The narrative unit identified at the surface narrative level by Greimas (enunciation) is defined by actants related by a function – a canonic form of the narrative unit to satisfy the first constraint. In order to define a typology, either the number and position of the actants may be modified or the functions relating them may be modalised (semantically invested). The presupposition Greimas makes bestows a logical priority of semantics over syntax since every grammar is constructed<sup>102</sup> by ‘putting together’ a small number of semantic categories. The point of departure from there is to draw a distinction between narrative and non-narrative enunciations. To do so, reference is made to the dichotomy of verbs of action and verbs of states of being (stative). Hence one obtains narrative enunciations of the minimal signification of *doing* and predicative enunciations of the minimal signification of *being*, resulting in two types of enunciations,

$$\text{EN (narrative enunciation)} = F_{\text{doing}}(A_1 : A_2)$$

$$\text{EQ (qualifier enunciation)} = F_{\text{being}}(A)$$

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<sup>102</sup>A constructive approach as opposed to deconstructive methods mainly adopted by post-structuralism.

The semantic investments of *doing* may be specified by defining:

1. *Active doing*, which is at the level of natural language and different from,
2. *Communicative doing*, which is concerned with the transmission of messages or the transfer of objects between subjects

Their narrative counterparts,

1. "Active doing", establishing the relation between actants in terms of *subject* and *object*
2. "Communicative doing", establishing relationships between three actants in the form of, *sender*, *receiver*, and *object*.

The canonic form of narrative enunciation is thus:

$$EN_1 = F_{doing}(S \rightarrow O)$$

$$EN_2 = F_{communication}(D_1 \rightarrow O \rightarrow D_2)$$

There are two kinds of relations between the two types,

1. enunciation EN1 logically precedes EN2, may therefore be interpreted as an object O, as the result of the doing of a subject S is then communicated by the sender D1 to the receiver D2;
2. enunciation EN2 logically precedes EN1, in which a non actualised program of doing O, is transferred as a message from the sender D1 to the receiver D2, which then becomes a subject S and makes it the object of his doing O, and actualise s it.

In the lights of these observations, every narrative object (narrative) may be described as possessing two distinct components:

1. A component referring to event as defined by discursive narrative units of the first type of narrative enunciation describing a subject-object relationship between actants;
2. A component referring to contract manifested in the presence of discursive units of the second type which refers to a sender-object-receiver relationship between actants.

Greimas (Greimas:1971, 801), identifies a sub-class of narrative enunciations whose function is to modalise discursive units (semantic investment by modalities such as *willing, knowing, being able*), for whom the object of interest is another narrative enunciation. Examples include "I would like to tell a story", "I know how to tell a story", and "I can tell a story", where "story" refers to another narrative enunciation<sup>103</sup>. *Modal enunciations* are of primary interest in narrative grammars as they define the actants, characterised so far solely by their functions.

Furthermore, modal enunciations ("want to tell," "know how to do") give information concerning the competence of the actants, while the narrative enunciation that is the object of modal enunciation, give information concerning the performance of the actant. According to Greimas, all surface narrative syntax (including the linguistic actantial), appears as a *modal syntax*.

### 11.2.7 Syntagmatic Organisation

To define a surface narrative syntax, is necessary to provide not only for the minimal units (narrative enunciations) and their constituents (functions and actants), but also a syntagmatic understanding concerning the sequences of narrative enunciations. It must be shown that at the level of discourse, the

<sup>103</sup>"One can also try to define narrative competence as a modal enunciation (act of speech) defined by the syncretism of the three modalities-willing, knowing, being able-and whose object enonce would be an enonce with the function "narrative communication." (Greimas:1971, 802)



identification of *narrative sequences* is possible, and to proceed from that to the segmentation of the narrative discourse.

One way is to account for the *concomitant variations*<sup>104</sup> identifiable in different versions of the same narrative<sup>105</sup>. Another approach is to account for their structural equivalence through comparative methods<sup>106</sup>. Proceeding even further and accounting for the *narrative syntagms*, reveals a deeper level in narrative discourse than of surface narrative syntax.

Greimas gives an example by explicating Propp's narrative syntagm called *ordeal* (or performance) as a sequence of three narrative enunciations,

$$EN_1 = F_{confrontation}(S \text{ vs } \bar{S})$$

$$EN_2 = F_{victory}(S \longrightarrow \bar{S})$$

$$EN_3 = F_{transfer}(\bar{S} \longrightarrow O \longrightarrow S)$$

$S$ , in this case, refers to the *hero* (subject), while  $\bar{S}$  refers to the *villain* (anti-subject), and  $O$  to the object of value.

Chronologically the actions appear as a succession of narrative enunciations  $EN_1 \longrightarrow EN_2 \longrightarrow EN_3$ , but in establishing the logical implications, an inversion of the succession of the enunciations is observed. The acquisition of the object of value by the hero implies the victory of the hero over the villain. Furthermore, it implies previous implications between the subject and the anti-subject. It is thus the logical implications of the narrative enunciations that provide a *narrative syntagm*, and the sequence must be read as follows:

<sup>104</sup>Defining the means by which one phenomenon varies in relation to another implies developing some sort of *causation* principles between the two.

<sup>105</sup>Refer to the analysis of the portfolio artwork "*the Savior*" in Part IV of this thesis.

<sup>106</sup>In the portfolio the process of comparing structural equivalence was extensively used in order to provide a structural harmonisation between content expressed in different media. Associating audio material with visual material, embodied performances with audiovisual material, and instrumental sounds with abstract electronic sounds, at every level and in every aspect of the portfolio's creation was a fundamental aspect of the creation process. This is investigated further on Part IV of this thesis, and with a close inspection of the submitted portfolio, as well as the additional submitted audiovisual material.

$$EN_3 \supset EN_2 \supset EN_1$$

Here, the frequent manifestation of ellipsis in narrative discourse may be understood: the mere presence of the enunciation  $EN_3$  establishes the statuses of the enunciations  $EN_2$  and  $EN_1$ . It is feasible to reduce the whole complex narrative syntagm called performance (ordeal) to the narrative enunciation  $EN_3$ .

Given the above, analysis can provide several options,

- Considering the syntagm (performance) as a minimal narrative, in which case the narrative is a sequence of enunciations bringing forth the transference of the object of value (O being the central focus of the analysis in this case);
- Considering the narrative syntagm in terms of the subjects, in which case it may be inferred that the subject of the performance (hero or villain), having accomplished the performance to some extent, has acquired along the way competence (a doing that presupposes modalities of *knowing how to do, being able to do*). In that sense, the performance is logically doubled, consisting of the acquisition of the modalities of knowing or being able to, which outlines a syntagmatic concatenation of performances, connected through relations of implication. The narrative may be generated following the course marked by these implications, taking any given performance as a point of departure.
- Starting with narrative enunciations which account for the transfer of the object of value, a paradigmatic organisation of narrative is feasible. The resultant narratives, in this case, appear more complex than the previous narratives (S-O type). It is because, the cyclic transference of the object of value in the performance function, implies additional performances of the

subjects of performance for the acquisition of competence. An example is given in Propp's fairytale analysis in which the object of value (the daughter of the king) passes through a complete sequence of transfers before returning to the initial state. The general economy of the narrative (focusing on the components referencing the event) is represented by four narrative enunciations, each with its own fully developed performance:

$$EN_1 = F_{transfer}[D_1 \longrightarrow O \longrightarrow \bar{D}_2]$$

$$EN_2 = F_{transfer}[\bar{D}_2 \longrightarrow O \longrightarrow \bar{D}_1]$$

$$EN_3 = F_{transfer}[\bar{D}_1 \longrightarrow O \longrightarrow D_2]$$

$$EN_4 = F_{transfer}[D_2 \longrightarrow O \longrightarrow D_1]$$

In this case, since the syntactic function and the object of value in the above are invariants, a more economical representation would be:

- Chronologically (narrative discourse),

$$D_1 \longrightarrow \bar{D}_2 \longrightarrow \bar{D}_1 \longrightarrow D_2 \longrightarrow D_1$$

- Alternatively, based on logical implication (surface narrative syntax),

$$D_1 \supset D_2 \supset \bar{D}_1 \supset \bar{D}_2 \supset D_1$$

### 11.2.8 Semio-narrative Structures

Greimas' s discussion of semiotics offer more than the study of the immanent level of narrative and language; it deals with both linguistic and non-linguistic

signification as a subject, a type of ‘linguistics’ of general signification. As ‘linguistics,’ it recognises the double articulation of manifestation and immanence.

Greimas’ *Structural Semantics* examine the manifested organisation of invested contents in terms of the double articulation of actantial analysis, i.e. in terms of actants and functions.

By situating the actants of discourse (narrative semantic units), and the functions between them (syntactical narrative units) on the same level of semi-otic and narrative structures, supersedes the urge to separate immanence and manifestation, competence and performance, deep from surface structures. Greimas describes this the level of actualisation and the level of ‘semio-narrative structure’, constituted by actants (non-figurative narrativity) as opposed to the discursive level constituted by ‘activity’ of discourse (figurative narrativity). Schleifer in his descriptions clarifies that,

[T]he actantial analysis accounts, in its very procedures, for the ‘given’ sense not only of the ‘meaningful wholes’ of discourse I have repeatedly noted, but also of the ‘piecing together’ of meanings, the ‘given’ experience of ‘figuring out’ signification. (Schleifer:1987, 85).

This process of ‘figuring out’ as Schleifer points out, accounts not only for the meaningful relationships but also for the sense of incomprehension —of ‘nonsense’— as triggered by isolated elements of signification, which do not appear to bear an isotopic frame(*ibid.*).It therefore accounts for the possibility of the textualisation of products of non-isotopic signification and non meaningful relationships between semic categories to being textualised.

Greimas suggests a form of mediation at this point enacted by the generative trajectory. The intermediate level of the generative trajectory of discourse is comprised of a ‘deep level’ of virtual meanings appearing on a manifested ‘semio-narrative level’ before the realisation of signification of this level, resulting in

nonsensical actualised disjointed elements; it also provides for the textualisation (realisation of representation in a system of signification) even of the unrelated nonsensical elements. He transcends the manifestation-immanence dichotomy into that of virtuality and the double articulation of manifested signification, *actualisation*<sup>107</sup> and realisation. Actants of subject and object type are, thus, before their junction virtual; they become actualised or realised in accordance to whether their function is that of disjunction (actualising the subject-object actants), or conjunction (realising the subject-object actants). The process of actualisation if produced by a prior realisation corresponds to a *transformation*<sup>108</sup>, which impacts the subject-object disjunction. The following diagram comes from Greimas' proposals,

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<sup>107</sup>According to Greimas "the passage from system to process" (Greimas and Courtes:1979, 9). Language is a virtual system in that sense is actualised in speech and discursive acts. In other words the operations in which "a unit of language is rendered present" (*ibid.*), and is inherent (the actualisation product) in the syntagmatic axis of language.

In narrative semiotics Greimas suggests to use a ternary articulation model for the traditional binary virtual/actual pair, using the virtual/actual/realised which accounts more clearly for narrative structures.

<sup>108</sup>"transformation is categorical (in old French, for example, we go from a twocase declension to its absence) whereas its temporal manifestation is seen as a process, having inchoative, durative, and terminative aspects. In textual analysis, such an interpretation facilitates the recognition of narrative organisations, underlying processual formations." (Greimas and Courtes:1979,19)

<b>generative trajectory</b>			
	syntactic component	fundamental semantics	
<b>seniotic and narrative structures</b>	deep level	fundamental syntax	fundamental semantics
	surface level	surface narrative syntax	narrative semantics
<b>discursive structures</b>	discursive syntax discoursivization actorialization temporalization spatialization		discursive semantics  thematization  figurativization

Thus Greimas' establishment of actants of dual nature, one of integrals of meaning (as discursive elements) and the other of segmented discrete units as found in the semio-narrative level (able to describe substance and thingness), brings to the foreground their transformation during substantification, which is where linguistic analysis (that similarly is equipped to address the double articulation of language) comes in handy. Greimas' actantial analysis introduces a level between the immanence of grammar and the manifestation of meaning.

The notion of transformation is applied in the following part to introduce specific fascinating aspects of the investigation of elementary structures and processes found in minimal meaningful units and their level of operations. The transformation of paradigms (by their projection on syntactical units) into actualised (anthropomorphic) agents of action, resulting in the modalisation of

discourse has already been mentioned. Transformation is the critical process in what Greimas describes as the generative trajectory of discourse, meaning the continuous trajectory between a point of departure (deep structure) to the point of arrival (surface structure) through “a string of transformations distinguished as many stages and headings [...] necessary for the clarity of the explanation” (Greimas and Courtes:1979, 69). Both of these types of structures (deep and surface), are metalinguistic (described as a *scientific metalanguage*, as Schleifer). Their relationship is described in terms of the notion of verticality on an axis represented as the spatial metaphors “deep”<sup>109</sup> and “surface”. In this transformation, static categorial elements map onto processual surface manifestations that are temporal. The model does, however, avoid the temporal constraints that enable the superimposition of structural configurations upon the successive linear form of discourse. This is reflective of both the morphological and syntactical natures of the phenomenology of reality allowing the apprehension of units as well as their disappearance when their relational status in a signifying whole is considered.

During the formation of the generative trajectory, the notion of dynamics is introduced and manifested as the functions/actions of anthropomorphic agents. Temporalisation is featured as deeply coupled to modalisation, complexifying the narrative text, revealing its historical manifestation, and attributing to it a determinative and a durative character.

The amorphous or intangible or incomprehensibly complex becomes sentient, finite, and tangible in actualisation; it acquires form (different from its virtual one) and meaning (including nonsensical meaning).

In transformation, the manifestation of the factive modality in “causing to be” or “causing to do” may be detected, forming the categorial structure of

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<sup>109</sup>Semantically depth suggest a certain quality of signification or the difficulty of deciphering it.

assertions (and negation). Assertion and negation are two basic paradigmatic categories of transformation defined by a contradiction hence the transformation of paradigms to agency and ultimately actorialisation (figurative).

### 11.2.9 Transformation and Structure

Transformation and structure are two terms closely associated. Similar ideas to Greimas' are presented in the introductory chapter of this section, and may be found in Piaget's work *Structuralism* (Piaget:1970), which is concerned with the formalisation of structure.

For him, structure is a "system of transformations" (Piaget:1970, 5) that includes three basic concepts, *wholeness*, *transformation*, and *self-regulation*. *Wholeness* refers to the attainment of structure as an entity that is "bigger" than a mere sum of its parts (Gestaltic view, corresponding to Greimas' *unity of meaning*). *Transformation* refers to the dynamic aspect of structure (as in Heraclitus, corresponding to *modalisation* ); in contrast to being static, it is in constant flux and under certain transformations appears to an observer as invariant. Lastly, *self-regulation* refers to *self-maintenance* and *closure*(*ibid.*) (corresponding to Greimas' generative mediation, selector functions, and closure in manifested forms of content). It may be understood in terms of the internal dynamics holding a structure together as a differentiated form. Structure is here not a passive recipient of external forces, but actively maintains its form from its intrinsic dynamics. Similarly, Rimmon-Kenan, as stated above, describes story-form as a network of interrelated components with internal dynamics, which highlights the observation that talking about form and structure in many aspects is talking about narrative form and structure.

It has already been mentioned earlier in the text, that this approach by Piaget may be thought of as a primary (non-symbolic) attempt towards the mathematisation of these traits of structure, which he carried through using mainly



the mathematical concept of algebraic groups as a model. The self-regulation of structure steered Piaget into thinking in terms of the algebraic notion of a group, in that self-regulation entails both self-maintenance and closure. Piaget's syllogism admits to the following properties given a binary operation on a pair of elements of the group,

- Closure in respect to this binary operation translates to: given the operation  $*$ , for any element  $a$  and  $b$  in the group  $(G)$ ,  $a*b$  belongs to  $G$ ,

$$\alpha \in G \text{ and } \beta \in G \implies \alpha * \beta \in G$$

- $G$  contains an identity (neutral) element  $j$ , that in respect to  $*$ ,

$$\alpha * j = a \text{ and } j * a = a$$

- For each element  $a$  of  $G$  there is an inverse element that satisfies the relationship  $\alpha^{\leftarrow} * a = a * \alpha^{\leftarrow} = j$
- The rule of associativity, for every  $a$ ,  $b$ , and  $c$  elements of  $G$ ,  $(a*b)*c = a*(b*c)$

The inversion operations in groups (and in Piaget's model of structure) are particularly important as far as the self-regulation of structure is concerned.

Since an unfounded result is not an element of the group, it means that each binary operation on a group element is reversible through inversion operations. These reversals regulate the group (or structure) with boundaries (Piaget:1970, 15).

Moreover, although – as Piaget himself recognised – using algebraic groups as a model could be problematic as far as temporalised structures<sup>110</sup> are concerned

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<sup>110</sup>In cognitive or biological structures that unfold in time the notion of operation is not quite applicable since the processes are irreversible. However the idea of symmetry and symmetry groups could provide for a theory of categories, even in network-like structures where the idea of symmetry is more complex.

( as are those resulting from biological or cognitive processes). The main point here, is that transformational operations are essential to the identification of structure.

Symmetry in structures (and partial symmetry in more complex structures) may serve as a point of observation, since it exposes the invariance of an object under certain transformations. The symmetry group comprises all maps (transformations) from the object to itself that preserve its structure. A map as such is called an automorphism.

An example of symmetry would be the operation of reflection (point to point mirroring) under which some objects appear (approximately) symmetrical (the human face, for instance). Symmetry in complex systems is less intuitive, thus in cases, it is convenient to describe a system's complexities in the form of networks. Inversion operations are considerably more complicated in this case, yet they allow the detection of partial symmetrical relations observing the history of automorphisms mapped across time.

Piaget's observations admittedly steer in the right direction, a view shared equally by Thom, Petitot, and Neuman, amongst others, by identifying firstly that "it is neither the elements nor a whole [...] but the relations among elements that count" (Piaget:1970, 10) and, secondly by adopting the algebraic group as an initial prototype model.

Closure of patterns and reversibility in complex dynamic systems has been approached (Neuman:2013, 261-276) through category theory affirming all four transformations above (closure, identity, inversion, and associativity) and giving a minimal definition of structure using groupoids.

In this thesis, network combinatory approaches to structure will not be examined. Instead, the dynamics of complex natural structures and their forms retains the focus, utilising dynamical models in an attempt properly to mathe-

matise the processes bringing them forth, and the operations either sustaining, or collapsing them into new forms.

#### 11.2.10 Brief Remarks

A more traditional structuralist approach draws conclusions from the specified antitheses and differences appearing in the various level of the semiotic analysis between narrative and non-narrative texts, while a deconstructive approach would aim for the exact opposite in seeking to determine the common elements shared by novels, films, dance, philosophy or psychoanalysis — cultural artifacts traditionally perceived as non-narrative texts. Narratology, even from the initial approaches to the project, identifies ‘story’ to be this common denominator found in traditional or non narrative texts. The story appears as a non-linguistic construct that narratological methods abstract from a text or any other sign-system. Approaches to literary narrative analysis, in this case, become a sort of paradigm to be used to unravel the narrative elements in texts not traditionally perceived as being narrative. This type of narrative investigation is no longer exclusively concerned with the restricted scope of narrative poetics; instead, it becomes a method of approaching fundamental operations in any system of signification. It also provides a valid comparative methodology for investigating the relationship between literature and other modes of organising and representing world-experience.

The previous is why ‘story’ in Rimmon-Kenan’s (Rimmon-Kenan:1983, 3) analysis, is directly related to the events and participants in a narrative and is one of the three axes that comprise a narrative. While story represents the succession of events, separate from those are their verbal representation and the act of telling and writing. The story is not directly available to the recipient, and is ”abstracted from their disposition in the text and reconstructed in their chronological order, together with the participants in these events” (*ibid.*) . The

second narrative axis ‘text’<sup>111</sup> is a ”spoken or written discourse which undertakes their [events] telling” (*ibid.*) . In the text events do not necessarily appear in their chronological order; furthermore ”the characteristics of the participants are dispersed throughout, and all the items of the narrative content are filtered through some prism or perspective (‘focaliser’)” (*ibid.*) . The act of narration is an interesting phenomenon: it implies in itself that narrative may be transmitted, and that narrative retellings are part of the narrative itself. Narration also establishes the aspect of an agent (the surface counterpart of the focaliser), carrying through both narrative production and communication. Since in the actual world this agent is the author (responsible for the narrative poetics), in the text itself this process has its counterpart involving ”a fictional narrator transmitting a narrative to a fictional narratee” (*ibid.*) .

It is probably evident by now that there is a purpose to treating story as an abstraction from the text, as a “part of a larger construct, referred to by some as the ‘reconstructed (or ‘represented’) world (or ‘level’) [...] i.e., the fictional ‘reality’ in which the characters of the story are supposed to be living and in which its events are supposed to take place” (Rimmon-Kenan:1983, 7). As noted in the same passage by Rimmon-Kenan, one axis is part of a larger assembly, that of the axis of temporal organisation , the axis whose ”predominance turns a world-representing text into a narrative text” (*ibid.*) . The story is made available through the text which may be seen as the ”anchoring-point” for any discussion regarding narrative since, one aspect of the classification of a narrative text is its narrative content, while it can not be considered as narrative text before it is communicated (narrated).

The organising principles governing these processes were analysed in terms of their deep and surface organisations (an idea originating in ‘transformational

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<sup>111</sup>The reader is again prompted the reader to adopt a wider notion of ‘discourse’ so as to include more than lexical means of communication.

generative grammar'). Whereas a surface structure may be perceived as the abstract syntactic organisation of the observable text or sentence, the deep structure is simpler (and more abstract), lies beneath the surface structure, and may be revealed by retracing backwards through the transformational syntax of a sentence.

A similar investigation into how the infinite variety of stories may be generated from a finite number of basic structures, often concludes to this notion of deep and surface narrative organisation . The narrative's deep and surface structures, as explained, underlie the deep linguistic manifestations of the narrative text. Greimas identifies the surface structure of a story as being syntagmatic, meaning that it is a domain of operations "governed by temporal and causal principles" (Rimmon-Kenan:1983, 12). The deep structures are for Greimas static and paradigmatic, "designed to account for the initial articulations of meaning within a semantic micro-universe" (*ibid.*) . This is the reason that even abstracted from a story, can not be considered in themselves narratives but as logico-semantic associations between elements, facilitating narrativity through modal operations.

The assumption held by the thesis has been that although deep structures may appear achronic and static, in contrast to the surface occurrences, turning towards catastrophic modelling for the schematisation of their generative trajectory to surface structures(Thom, Petitot, and Wildgen) reveals and allows the exploration of the dynamical aspect of deep narrative structures (while keeping their formal stature). Even apparently static forms entail information concerning the dynamics that formed them, the field of inquiry is sufficiently widened as so happens when adopting a cognitive stance.

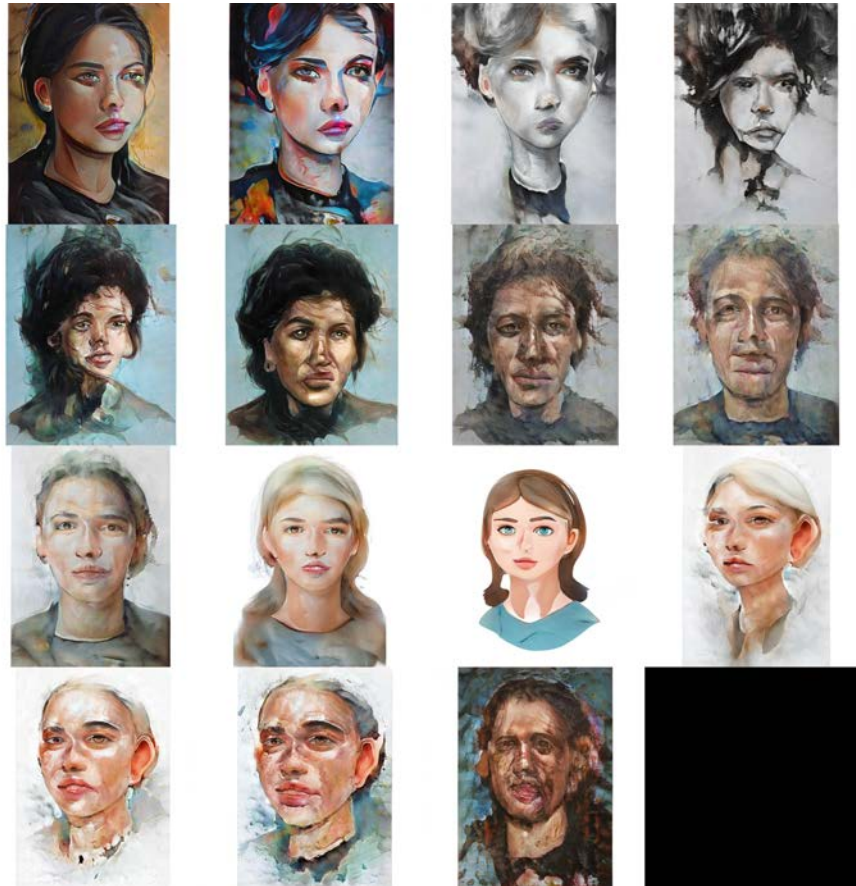
## 11.3 Appendix 3: Sub-symbolic Modelling

### 11.3.1 Sub-symbolic Modelling

has not been the main focus in the context of the current research. Nevertheless the study of morphodynamical models, of which sub-symbolic networks are considered a part of (Petitot:1994, Petitot:2011), led to the study of sub-symbolic algorithms (mainly deep neural networks) as a deeper investigation on the efficacy of morphodynamical models to describe form. Sub-symbolic models are constructed by a large number of units joined together in a pattern. Three types of units usually exist; these are: input units which receive the information to be processed, output units where the results are stored, and a hidden layer of connected units. The basic idea is to create a network similar to that found in the human nervous system. An input unit is activated through an activation value, which is then passed to its connected hidden unit which calculates its own activation value depending on the input it just received. There could be more than one layers of hidden units, and eventually the value reaches an output unit. The signal is found then to propagate through the whole network configuring its activation values. The process of learning is achieved by the adjustment of weights of the activation function and in that sense the network is ‘tuned’ to complete a given task. A simple description of the results of training a neural network is a vector space where each point represents a desired representation of the given task. It is natural to imagine these points of the vector space as attractors determining the flows in such a way that the given overall result is a version of the desired outcome. The learning process stratifies that space into regions that they always represent the required result. A ‘random walk’ in that parameter space would produce all the different but acceptable outcomes as reproduced by the network. Though this process seems explicit, neural networks can be trained in such a way in order to produce results for a variety of tasks.

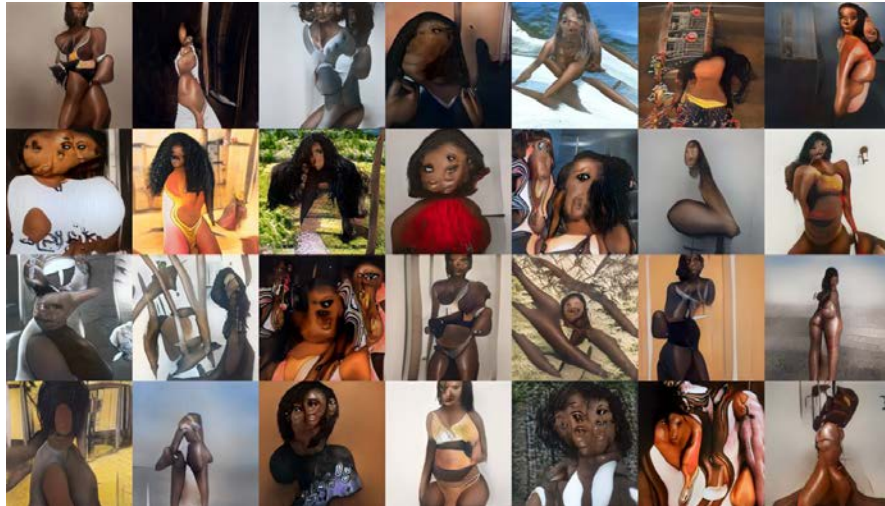
(relevant videos of sub-symbolic models found in Appendix 14)

In this research several models were trained in order to reconstruct images of specific visual forms using Generative Adversarial Networks (GANs). A particular model was trained particularly during the creation of *DEN*, in order to reproduce the visual forms produced by the Bokusho performances. The training set was constructed by capturing several performances of the Bokusho artist. Valuable conclusions are produced by comparing the content that the GANs were trained with the resulting reconstructions.



Several forms produced by a random-walk on the parameter space of a trained

neural network (GAN), the model was trained on a dataset of human face paintings. The clean and pre-processed data set here produces a clean output from the training model.



Several forms produced by a random-walk on the parameter space of a trained neural network (GAN), the model was trained on a dataset of dark coloured females. Three thousand random instagram photos were ‘scrapped’ using appropriate hashtags (#).





The efficiency of the representation depends upon the success of the training process. Several outputs clearly reference the human form even when the data set is not large enough and properly pre-processed.



Depending on the success of the training process the random-walk may produce several form artefacts. The degree of accuracy mainly depends on the quality of the data set.



If the data set contains significant number of diverse material the output of the model may produce irrelevant to the desired form artefacts. Artistically this is desired in several occasions.

It may be appropriate to understand the above images as the results of a 'trained' to explicit forms vector parameter space. The training of the space is accomplished in accordance to desired, explicit data sets. The forms produced may be conceived as the attractor stratifications of this vector space when excited with random vector inputs (the 'random-walk').

It is considered important to mention here, once more, that connectionist models of sub-symbolic processes are considered a particular type of morpho-

dynamical models and a further elaboration of the Thomian views on cognitive modelling. According to Smolensky (1988) “sub-symbolic systems are dynamical systems with certain kinds of differential equations governing their dynamics”. Thus, may be understood that the domain of connectionist models is not formal and symbolic, but a domain of dynamical systems, expressed through the qualitative assessment of differential equations. In that sense the further investigation of sub-symbolic networks under a pure morphodynamical prism is one of the future research aspirations the current project may produce, since it may provide insights on the functions of the obscure structure of these ‘cryptic’ models.

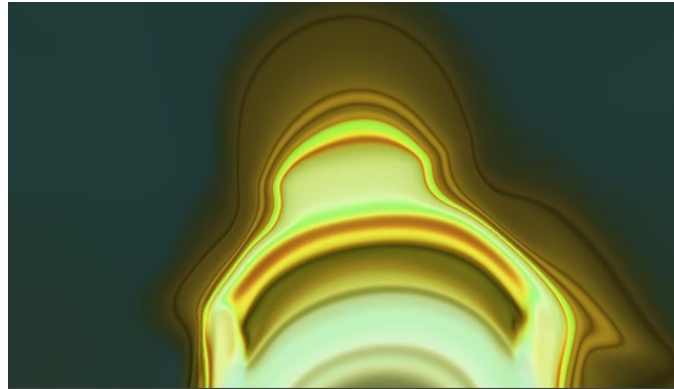
Another example is demonstrated (Appendix 14) of applying the morphology extracted from a neural network layer into pixel mappings (using *OpenGL* code); it is visualised and projected onto the screen-space as a surface narrative component representing the important features detected by the layers on the content. This means that the morphology of the selection mechanism is not a static, independent, and detached form (although it is explicit and abstract), but one that is in turn explicitly regulated by the morphology of the concrete manifestation of the content. Since this author’s work with neural networks is still in a premature experimental phase, it is not submitted in the portfolio, demonstrations though are found in the following videos inside the Appendix 14 folder.

Additionally an observation to be made here concerns the similarities of the morphology of neural network layers, to that of elliptic umbilic (and complex) elementary catastrophes<sup>112</sup>morphologies. This similarity may be justified in accepting that detecting elementary forms, such as those described by Thom, constitute a focus around which sub-symbolic models (neural networks) are

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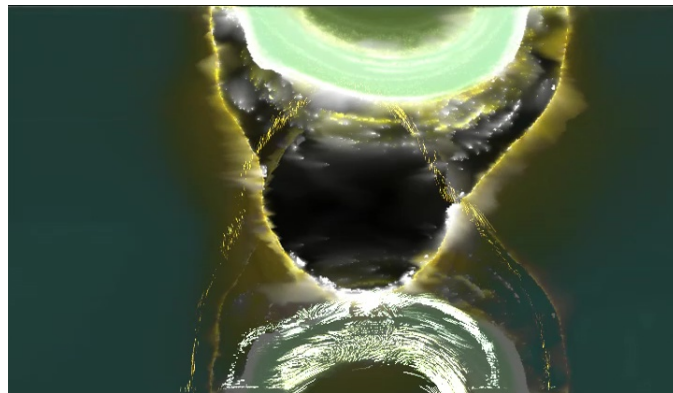
<sup>112</sup>Also I note the inclinations in principle found in the concept of gradient descent in neural networks, with modelling dynamic evolution of systems according to the Maxwell convention.

designed about. An initial assumption may be made that the abstraction layers are inclined to represent superimposed layers of primary morphologies, as are the selection mechanisms for the constituents of the layers, of the elementary catastrophes or, at the very least, are qualitatively described by them.



Neural network

layer, opengl visualisation



The neural

network regulation function as narrative content

## 11.4 Appendix 4: Analysis of *Patah* additional commentary

### 11.4.1 Analysis of *Patah* Further Observations

This section will, further elaborate on the analysis of a visual music composition *Patah* by Diego Garro. The initial analysis is part of the article published in *Organised Sound* in 2016 (Giannoukakis:2016). This approach attempted the morphodynamical classification of the composition for the extraction of a narrative form and regression to the deep narrative level from the surface observations. The primary attention was directed towards the relations between the material and their role in the formulation of a surface narrative logic in the composition.

This composition is significantly making use of abstracted forms to meaningfully communicate its content. The use of the highly abstracted form though is balanced, primarily in the aural domain, by the use of the voice and utterance in a strategic for the composition manner. These situations in the composition introduce in this abstract artwork the semic class ‘human’ and offer a domain of intimacy in the interaction of the recipient with the material. Thus, it is the aural component in the composition that carries the concept of animate agents of action, while the visual in its referential form appears to be primarily locative in nature.

The catastrophic schematisation of the piece inscribes its structural identity as displayed in the score that follows the progressions in *Patah* (Figure 116).

The current thesis, presents an elaboration based on the catastrophic modelling of semio-narrative structures, particularly the semiotic square, as was addressed in the second part of this thesis.

The starting point is the catastrophic schematic score. The score utilises catastrophe semantic archetypal morphologies (Thom:1975, Wildgen:1982) to

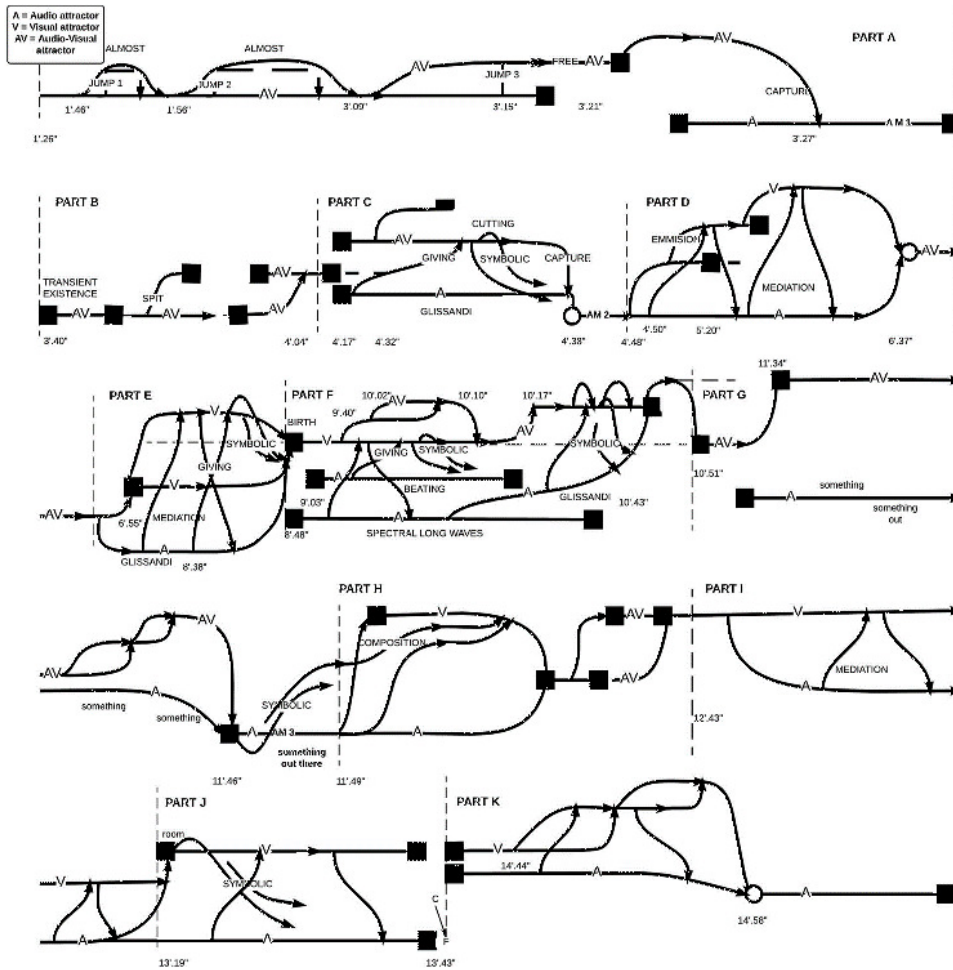


Figure 116: Score of the catastrophic schematisation of Patah

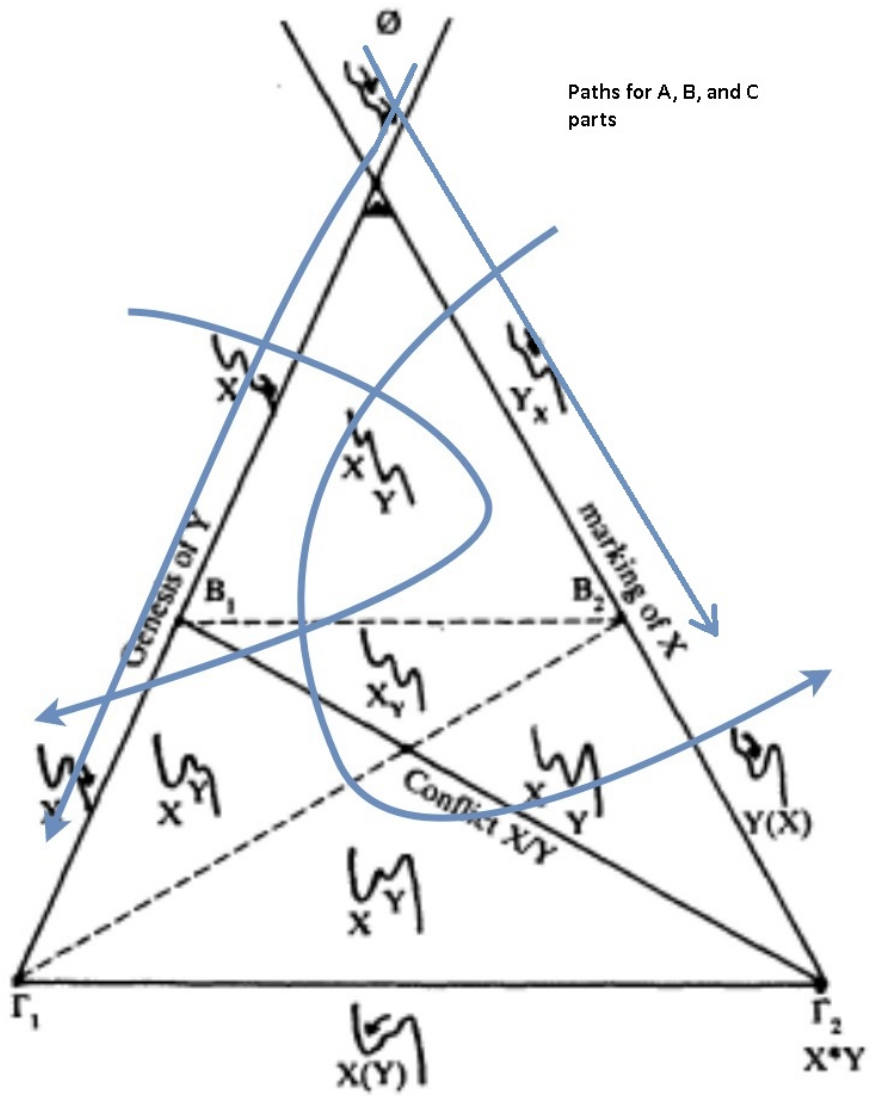


Figure 117: Patah paths on the Swallowtail geometry



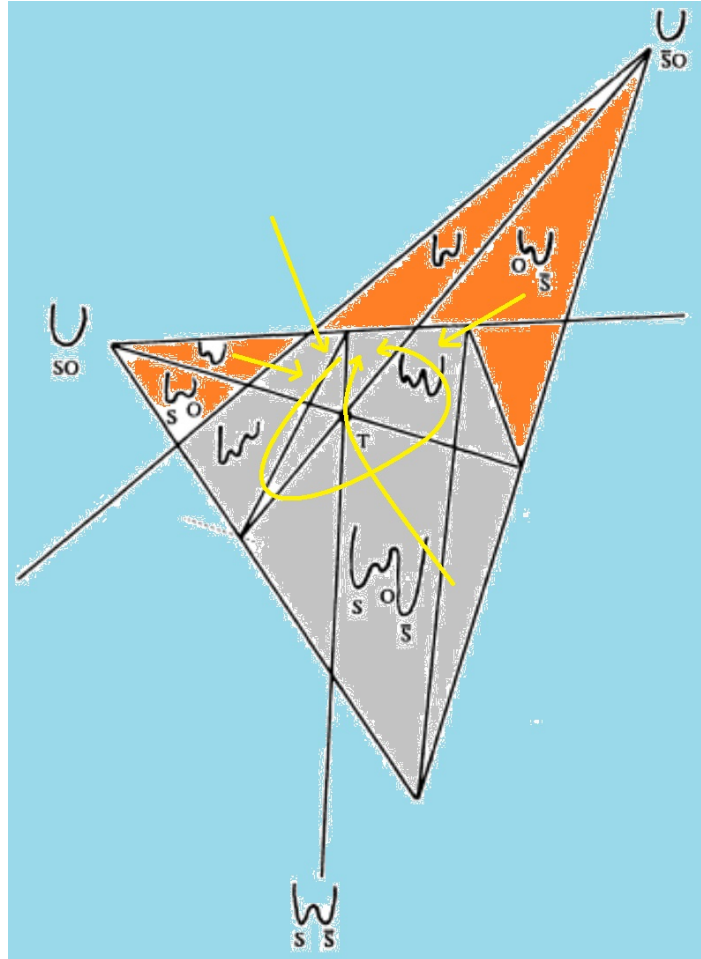


Figure 118: Patah parts on a Butterfly

describe the content of the piece in terms of the progression of its morphological and dynamical relations and operations. Rigid typologies and the symbolic categorisation of the material are avoided. Instead, archetypal morphologies are utilised for the descriptions, as loose categorisations, sufficiently abstract to consider them as deep structures and nevertheless exclusive in their manifestations.

Some initial observations first,

- The score demonstrates that the most complex morphologies in the composition, correspond to the complex elementary archetype of *transfer*;
- The archetype of transfer (as explained in Part III of the thesis) corresponds with and can successfully be explained by the topology of the double Butterfly catastrophe;
- This catastrophe entails others of more basic morphologies (for instance the Cusp), corresponding to a lower number of narrative actants;
- The alternation of the number of actants can happen only by passivation of the active actants in a scene or by the creation (initiation, emission, etc.) of new ones. These processes also correspond to *EC*'s;
- In the schematisation adopted for the score, the edges of the symbols correspond to actants, which in turn correspond to domains on the topology of the catastrophe. The lines correspond to the processes and operations;
- The progression amongst the different parts of the composition, corresponds to paths traceable on the topology of the Butterfly;
- Each path is subject to the different determinations dominant in each domain. Crossing strata polarise (hence in surface terms modalise) the trajectories, rendering them subject to human interpretation.

With that in mind, these paths on the geometry of the catastrophe will be demonstrated.

The geometry of the Swallowtail suffices to account for the complexities between actants interactions for most of the composition. The character of the work itself is based on the fundamental ‘conflict’ upon perceiving abstract elements as opposed to concrete referential ones. The composer explores explicitly and elaborately the intermediary trajectories (seen as a compositional strategy), between the abstracted visual or audio references, and their concrete counterparts, using continuous and ‘crafty’ transformations on the material and its syntax. For a more detailed analysis of the work, and for descriptions of the parts and what each entails, see the analysis included in Giannoukakis:2016.

The elemental narrative schema to be applied here is indeed the polemical schema, which is at times complexified. The alternation between abstract and concrete material in the composition also point to deixis as a primary force in driving and progressing the narrative in the piece. Hence the use of the Swallowtail catastrophe in this analysis.

In the piece elements may be observed that appear distinct, i.e. separated from a background. There are also ‘empty’ spaces and complex (indistinguishable) morphologies (*non-forms*, says Thom), which will be placed at the other end of a semic category containing the proper forms and their ‘opposites’. In between coincide the forms resulting from Garro’s competent transformations on the material. They are the elements carrying through the privative oppositions  $X/\emptyset, Y/\emptyset$  in the composition.

Eleven parts in the piece correspond to eleven paths on the Swallowtail geometry, as will now be described.

The first three parts of the composition (A, B, and C) are constituted by basal interactions between the attractors. There is a succession amongst them,

resulting in the dominance of one at the expense of another. The polemical nature of narrative is predominant here. The paths, in this case, deal with the genesis of attractors and the annihilation of their antagonists, the establishment of dominance between the attractors: a fact that is also true of the conflict between abstract and referential material, since this struggle through the A, B, and C parts leads to a strong statement of the dominance of the audio attractor to its articulated and referential nature of utterance, part C point AM2, now revealed for the first time.

The interactions after that (referential) ‘conclusion’ at the end of part C (AM2), become significantly complexified. The dynamics become slower, exposing the ‘internal’ complexity of this componential composition. The slow dynamics imply changes in the external parameter space, and not internal changes, as if external factors are fueling this process. It has been stated in the article that in the parts exhibiting this type of dynamics, there are situations where the ‘energy’ of the visual component seems to accumulate and arise. That accumulation, as outlined in Giannoukakis:2016, is attributed to the aural counterpart which appears to be slowly energising the visual component. The accumulation of energy usually cocludes to some sort of eruptions or sudden dissipations, resulting to the appearance or dissapperance of attractor respectively. The sudden changes are internal changes of state resulting by the constant affect of the external parameter space to the system.

The proposed schema, for this part and corresponding to parts D, E, and F in the score is the ternary structure of the transmission of a message (Sender-Object-Receiver)(Wildgen:1982), this in turn, corresponding to the interactions between local actants in the elementary Butterfly structure. They are more symmetrical than those in the first three parts. The paths here seem to cross the central domains of the geometry, where the determinations render all three

actants active. They move from areas of conflict (orange) where the determinations also modalise behaviours on the surface level. More importantly, though, through reciprocal presupposition similar to that in parts A, B, and C they create virtual relations that are later actualised in the ternary structure manifesting on the central domain marked in grey. This summary has offered merely an overview suggesting possible directions in which the proposed catastrophic narrative analysis could be expanded. However, Garro further performs transformations and successions of those states, compactifying the morphology of the interactions in part G up to a significant moment (marked AM3), returning to the slow (smoother) dynamics of the Butterfly for parts H, I, and J, until the last part, the conclusion. Giannoukakis (2016) deals in finer detail with the analysis of the composition.

Delving into the details of these morphologies would be a thematic in itself, while the point of this part of the thesis is to demonstrate further the flexible nature of catastrophic models.

## **11.5 Multimedia Appendices: Appendices 5 to 19**

Videos and high resolution images (Appendices 5-19) may be accessed at:

<https://drive.google.com/drive/folders/1AxnJuf5A1NMBGiMfWONqtJJwRWgxWNLU?usp=sharing>