PRINCIPLES OF METADESIGN

Processes and Levels of Co-Creation in the New Design Space

by

ELISA GIACCARDI

A thesis submitted to the University of Plymouth

in partial fulfilment for the degree of

DOCTOR OF PHILOSOPHY

CAiiA-STAR

School of Computing

Faculty of Technology

August 2003

This work is dedicated
to all those who supported me
with love and trust.

Abstract

PRINCIPLES OF METADESIGN

Elisa Giaccardi

In the light of the material and cultural conditions of the present world and within the context of current design theories, this research aims to provide an understanding of Metadesign as emerging design culture, and to integrate and advance its conceptual framework and principles through a transdisciplinary dialogue with the aesthetics and practice of Net Art.

By rejecting the notion of Metadesign as an established design approach and practice, the creation of an etymological hypothesis based on the meanings of the prefix "-meta" (*behind, together, between*) becomes possible. Following this historical and cultural path, the research describes theories, frameworks and practices of Metadesign that have occurred in art, culture and media since the 1980s, in fields, such as, graphic design, industrial design, software engineering, information design, interaction design, biotechnological design, telecommunication art, experimental aesthetics, and architecture.

The comparison and integration of all these approaches and viewpoints allows the identification of some design trends. More significantly, however, such an analysis enables the deconstruction of clusters of concepts and the production of a map of coherent elements. The anticipatory, participatory and sociotechnical issues raised

by the emerging and interconnected concepts that underlie Metadesign can be articulated and summarized in a three-fold path based on the initial epistemological hypothesis. This can be characterized by three specific terms: 1) *behind* (designing design); 2) *with* (designing together); 3) *between/among* (designing the "in-between").

Interactive Art practitioners and theorists, both at an aesthetic and practical level, also share concerns about interaction, participation and co-creation. Compared to more financially oriented fields, Interactive Art, and collaborative practices of Net Art specifically, have been able to answer to the new material and existential condition outlined by interconnectivity with a more dismantling experimentalism. The insights and advances they have produced in relation to the embodied and intersubjective dimension of human experience and creativity are still to be fully explored. Such insights can significantly fortify the three-fold path elaborated by this research, particularly the third fold, which is concerned with the design of the "in-between".

Focusing on collaborative systems for graphical interaction, as more suitable to the goal of understanding basic embodied and intersubjective processes of co-creation, the research identifies and analyses three projects of Net Art as case studies (Générateur Poï étique, Open Studio, SITO Synergy Gridcosm). The results of these case studies provide an understanding of the experience of co-creation, a grasp of motivational paths to co-creation, and a description of the features of the computational environment which can sustain co-creation.

The results provided by the Net Art case studies are combined with the map of concepts provided by the integration of all the approaches and viewpoints on Metadesign. This cross examination is then wholly summarized in a set of general design principles, according to the three-fold path elaborated by this research.

In conclusion, it is suggested that a new design space can be identified and calls for a reflexive and shared practice of design. This new concept of design space and practice enables people to manage collaboratively, or better co-creatively, the construction of their environment and their relationships with the world. This thesis attempts to define such knowledge as a "sociotechnological know-how", based on enactive capability and ethical responsibility.

Contents

List of Tables and Illustrations 14

List of Large Format Illustrations 16

Acknowledgements 18

Author's Declaration 20

Introduction 25

1. The Problem of a New Design Space 30

    1.1. Overview of the Problem 31

    1.2. Dematerialization and Metamorphosis of Materials 33

    1.3. Networked Computing and Interconnectivity 42

    1.4. Boundaries and Scope of Design 49

    1.5. Defining a New Design Space 61

2. Metadesign as Emerging Design Culture 68

    2.1. Etymology 69

        2.1.1. Origins of the Prefix "meta-" 70

        2.1.2. General Use of the Prefix "meta-" 70

            2.1.2.1. "meta-" as a Higher Order Level 71

            2.1.2.2. "meta-" as a Source of Transformation 72

    2.2. Theories of Metadesign in Art and Cultural Debate 74

        2.2.1. Metadesign and the Communication Revolution 74

        2.2.2. Metadesign and the New Ecology of Networks 85

        2.2.3. Metadesign and the Technomorphisation of Society 90

        2.2.4. Metadesign and the Design of Living Systems 94

2.3. Conceptual Frameworks and Practices of Metadesign 105
2.3.1. Metadesign as Design of a Design Process 105
2.3.2. Metadesign as Design of a Generative Principle 109
2.3.3. Metadesign as Collaborative Design 113
2.3.3.1. Applied Experimental Aesthetics 114
2.3.3.2. Lifelong Learning and Design 118
2.3.4. Metadesign as Organization of Flows 130
2.3.4.1. Diagramming the "Space of Accidents" 130
2.3.4.2. Constructing the Electronic Space 133
2.4. Integration of Approaches and Viewpoints 143
2.4.1. Metadesign: An Overview 143
2.4.1.1. Summary of Definitions 144
2.4.1.2. Model of Design vs. Mode of Existence 150
2.4.1.3. Determinism vs. Constructivism 151
2.4.1.4. Dimensions of Intentionality 151
2.4.2. Elements for an Integrated Conceptual Framework 152
2.4.2.1. Structures 153
2.4.2.2. Modes 154
2.4.2.3. Bodies 156
2.4.2.4. Environment 156
2.4.3. Raised Issues 158
2.4.3.1. Anticipatory Issues 158
2.4.3.2. Participatory Issues 165
2.4.3.3. Sociotechnical Issues 171
3. Building a Bridge Between Net Art and Metadesign 179

3.1. Instances and Paths of Co-Creation in Art 180
3.1.1. Relational Development of Form and Meaning in Contemporary Art 180
3.1.1.1. Dematerialization and Performative Order 181
3.1.1.2. Form as Collaborative Relationship 183
3.1.1.3. Meaning as Intersubjective Event 185
3.1.2. Participation and Interaction 187
3.1.2.1. Cultural Conditions 188
3.1.2.2. Artwork as "Open Work" 188
3.1.2.3. Artwork as Interactive Work 190
3.1.2.4. The Net Condition 192
3.2. The Lesson of Net Art 195
3.2.1. A Definition of Net Art 195
3.2.2. Mov.1: Interactive Exchange 199
3.2.3. Mov.2: Morphogenesis 203
3.2.4. Mov.3: Emergence of Meaning 204
3.2.5. Collaboration as Co-Creation 206
3.3. Metadesign and Net Art: Working Hypothesis 208
3.3.1. A Shared Design Experimentalism 208
3.3.2. Further Analogies, and Some Differences 210
3.3.3. What We Can Learn from Net Art? 212
4. Methodology 215
4.1. General Methodology 215
4.1.1. Between Art and Design: a Transdisciplinary Approach 215
4.1.2. The 'Construction' of the Problem 219

4.1.3. Constant Comparison Method 220

4.2. Case Studies Design 223

4.2.1. Case Study Research Strategy and Theory Building 223

4.2.2. Integration of First-, Second-, and Third-Person Descriptions 224

4.2.2.1. First-, Second-, and Third-Person Position 225

4.2.2.2. Qualitative and Quantitative Data 231

4.2.2.3. Triangulating Data and Methods 235

4.2.2.4. Method and Deconstruction 235

4.2.3. Description of Applied Methods 236

4.2.3.1. Common Features 236

4.2.3.2. Abaque de Régnier 237

4.2.3.3. Attractors and Pathways 240

4.2.3.4. A Phenomenological Analysis of Visual Activity 241

4.2.3.5. A Phenomenological Analysis of Verbal Chatting 245

5. Scope of the Case Studies 249

5.1. Net Art Projects 250

5.1.1. Générateur Poï étique 251

5.1.1.1. History 251

5.1.1.2. Concept 253

5.1.1.3. Functioning 257

5.1.2. Open Studio 262

5.1.2.1. History 262

5.1.2.2. Concept 264

5.1.2.3. Functioning 267

5.1.3. SITO Synergy Gridcosm 270

5.1.3.1. History 271

5.1.3.2. Concept 275

5.1.3.3. Functioning 278

5.2. Setting, Sessions, and Players 282

6. Results of the Case Studies 284

6.1. Collaboration and Co-Creation 284

6.1.1. Mosaic of Individual Perceptions 285

6.1.2. Attitudes of Participants 287

6.1.3. Permutations 288

6.1.3.1. Favourable Consensus: Co-Creation 288

6.1.3.2. Unfavourable Consensus: Co-Creation 291

6.1.3.3. Dissensus A: Relationships, Feelings, and Goals 294

6.1.3.4. Dissensus B: Creative Environment 294

6.1.3.5. Anomalous Positions and First Insights 296

6.2. Relationships, Feelings, and Goals 298

6.2.1. Categories, Keywords and Attractors 299

6.2.1.1. Relationship Quality 301

6.2.1.2. Relationship Factors 301

6.2.1.3. Goals 302

6.2.1.4. Feelings 302

6.2.1.5. Context 303

6.2.1.6. Motivations 303

6.2.1.7. Habits 304

6.2.2. Emotional-Existential Path 304

6.2.3. Explorative Path 305

6.2.4. Productive Path 307

6.2.5. Frequency of Participation 307

6.3. Creative Environment 310

6.3.1. A Phenomenological Analysis of Visual Activity 310

6.3.1.1. Emerging Mediators 312

6.3.1.1.1. Space 312

6.3.1.1.2. Colour 317

6.3.1.1.3. Visual Elements 321

6.3.1.1.4. Textual Elements 327

6.3.1.1.5. Time 329

6.3.2. A Phenomenological Analysis of Verbal Activity 331

6.3.2.1. Emerging Functions 332

6.3.2.1.1. Functions of Verbal Chatting in GP 332

6.3.2.1.2. Functions of Verbal Chatting in OP 334

6.3.2.1.3. Functions of Verbal Communication in SITO 335

6.4. Summary of Results 337

7. Advancing Metadesign 338

7.1. A Three-fold Design Space 339

7.1.1. *Behind*: Designing Design 340

7.1.2. *With*: Designing Together 342

7.1.3. *Between*: Designing the In-Between 344

7.2. Towards a Sociotechnological Know-How 347

Conclusions 353

Abbreviations used 359

Appendix I: Questionnaire n. 1 360

Appendix II: Questionnaire n. 2 362

Appendix III: List of Respondents 363

Appendix IV: Large Format Illustrations 366

Bibliography 392

List of Tables and Illustrations

Figure 1. A comparison between bioethics and bio-ethics.	104
Figure 2. Definitions of Metadesign.	144
Figure 3. Facets of Metadesign.	158
Figure 4. Constant comparison method.	222
Figure 5. Relation between first-, second-, third-positions.	227
Figure 6. Integration of first-, second-, and third-person descriptions in the present case study research strategy.	229
Figure 7. From subjectivist to objectivist approaches.	233
Figure 8. Complementary Explorative Data Analysis (CEDA).	234
Figure 9. The Abaque de Régnier scale.	238
Figure 10. Jakobson's Constitutive Factors Model (1960).	246
Figure 11. Illustration of the setting of local images in GP.	258
Figure 12. The Générateur Poï étique interface.	260
Figure 13. Open Studio canvas.	268
Figure 14. Open Studio interface.	269
Figure 15. A completed level, and the next completed level in the Gridcosm project.	280
Figure 16. Working progress in the Gridcosm project.	281
Figure 17. Closure and openness in Générateur Poï étique.	313
Figure 18. Dialogue and aggression in Open Studio (canvas resetting).	314
Figure 19. Closure and openness in GP (space configuration).	315
Figure 20. Dialogue and aggression in OS.	316

Figure 21. Dynamic and static fields in OS. 318

Figure 22. Spatial correlation of colours in GP. 319

Figure 23. Colours as dynamic "boundary objects" in GP. 320

Figure 24. Colours as dynamic "boundary objects" in OS. 321

Figure 25. Visual elements as dynamic "boundary objects" in GP. 322

Figure 26. Visual elements as dynamic "boundary objects" in OS. 323

Figure 27. Visual elements as a form of expression in GP. 323

Figure 28. Visual elements as a form of expression in OS. 324

Figure 29. Embodiment by facial expression in GP and OS. 325

Figure 30. Embodiment by simulated movements in GP. 326

Figure 31. Embodiment by drawing actions in OS. 327

Figure 32. Textual elements as emotional expression in GP and OS. 327

Figure 33. Opinions and comments in OS and GP. 328

Figure 34. Claiming shifts in the current emotional tone in OS and GP. 328

Figure 35. Verbal communications in GP. 329

Figure 36. Verbal communications in OS. 329

Figure 37. Shared imaginary in OS. 330

Figure 38. Narrative sequences in GP. 330

Figure 39.Further narrative sequences in GP. 331

Figure 40. Example of an emotive cluster in GP. 333

Figure 41. Example of a conative cluster in GP. 334

Figure 42. Example of an emotive messages exchange in OS. 335

Figure 43. Example of a referential messages exchange in OS. 335

List of Large Format Illustrations

Illustration I. POIETIC GENERATOR: Mosaic of individual perceptions. 367

Illustration II. OPEN STUDIO: Mosaic of individual perceptions. 368

Illustration III. SITO: Mosaic of individual perceptions. 369

Illustration IV. POIETIC GENERATOR: Attitudes of participants. 370

Illustration V. OPEN STUDIO: Attitudes of participants. 371

Illustration VI. SITO: Attitudes of participants. 372

Illustration VII. POIETIC GENERATOR: Favourable and unfavourable consensus. 373

Illustration VIII. OPEN STUDIO: Favourable and unfavourable consensus. 374

Illustration IX. SITO: Favourable and unfavourable consensus. 375

Illustration X. POIETIC GENERATOR: Unfavourable consensus in relation to the theme "Place". 376

Illustration XI. OPEN STUDIO: Unfavourable consensus in relation to the theme "Place". 376

Illustration XII. SITO: Unfavourable consensus in relation to "Place". 376

Illustration XIII. POIETIC GENERATOR: Anomalous positions. 377

Illustration XIV. OPEN STUDIO: Anomalous positions. 378

Illustration XV. SITO: Anomalous positions. 379

Illustration XVI. POIETIC GENERATOR: Emotional-existential path. 380

Illustration XVII. POIETIC GENERATOR: Explorative path. 381

Illustration XVIII. POIETIC GENERATOR: Productive path. 382

Illustration XIX. OPEN STUDIO: Emotional-existential path. 383

Illustration XX - OPEN STUDIO: Explorative path. 384

Illustration XXI. SITO: Emotional-existential path. 385

Illustration XXII. SITO: Explorative path. 386

Illustration XXIII. SITO: Productive path. 387

Illustration XXIV. General emotional-existential path. 388

Illustration XXV. General explorative path. 389

Illustration XXVI. General productive path. 390

Illustration XXVII. Frequency of participation. 391

Acknowledgments

I would like to thank my supervisors: Prof. Roy Ascott, Mr. Chris Speed, and Dr. Peter Jagodzinski. I would like to thank Roy for giving me the inspiration and courage to think freely and creatively. I would like to thank Chris for his friendship and constant support. I would like to thank Peter for his invaluable suggestions. Finally I would like to thank also my colleagues of the CAiiA-STAR, for all the intense and enlightening discussions we had during our seminars around the world.

I would like to thank Prof. Gerhard Fischer, my external advisor, and all the people at L3D Centre of the University of Boulder Colorado. In particular I would like to thank Gerhard, which gave me the opportunity to better frame and substantiate my research, and the work of which has inspired some of the thoughts of this study.

I would like to thank the artists for their availability and generosity, and all those that supported my data collection: Olivier Auber, Andy Deck, Ed Stastny, Lenara Verle, and Maya Kalogera. In particular I would like to thank Olivier Auber for his long and sincere friendship, and Olivier Croisier for the online setting of the Abaque de Régnier script. Finally I would like to thank my external contacts for their information and opinions, and of course all those that took part in my sessions.

I would like also to thank Dr. Ugo Bacchella and all my colleagues at the Fondazione Fitzcarraldo in Turin for trusting me along all these years, and giving me the opportunity to afford this personal enterprise.

Finally I would like to thank my dears. I would like to thank my mom, my dad, and my brother - my extraordinary family - that always supported my choices with love and confidence. I would like to thank Gianni, which I will not forget for loving and supporting me during all these years, and which will never miss my affection. In particular I would like to thank "my precious" Nathan, that I love infinitely, and whose voice has sustained across the ocean and with loving sweetness the hard months of my writing and revising.

Lastly, I would like to thank Alessandra Seita and Andrea Symons for their help in checking and amending my English.

Author's Declaration

At no time during the registration for the degree of Doctor of Philosophy has the author been registered for any other University award.

This study was financed with the aid of postgraduate scholarships from FORCOM (International Consortium for Education and Communication), in collaboration with School of Communication Sciences, Faculty of Humanities and Philosophy, University of Turin (1998-1999); and School of Communication Sciences, Faculty of Humanities and Philosophy, University of Turin (1999-2000). The final stage of this study was financed with the substantial aid of the scholarship "Ideas for the Future", awarded by the international committee of Prix Italgas by reason of the high interdisciplinarity of the present research in communication technologies (2001-2002).

Research was undertaken as a doctoral candidate in the CAiiA-STAR programme, School of Computing, University of Plymouth under the supervision of Professor Roy Ascott, Mr. Chris Speed and Dr. Peter Jagodzinski. It included a period as visiting researcher within the ENTWINE Research Program at L3D - LifeLong Learning and Design Centre (Institute of Cognitive Science and Computer Science Department) of the University of Colorado at Boulder, USA, under the supervision of Prof. Gerhard Fischer.

Relevant scientific seminars and conferences were regularly attended at which work was often presented; external institutions were visited for consultation purposes and several papers prepared for publication.

Published papers:

- Giaccardi, E. (2003). "Interfaced to the World: Pour Un Nouvel Espace de Design", in *Anomalie: Cahiers d'Arts Numériques: Inter_Faces*, n. 2. Paris: Anomos.
- Giaccardi, E. (2002). "Movements and Passages: The Lesson of Net Art", in BIG TORINO 2002, International Biennal of Young Art, April 19-May 19 2002, Turin.
- Giaccardi, E. (2001). "Interfaced to the World: For a New Design Space", in *Crossings: Electronic Journal of Art and Technology*, v.1, n.2, September 2001, [http://crossings.tcd.ie/issues/1.2/Giaccardi].
- Giaccardi, E. (2001). "Interconnectivity and Relational Embodiment in Art and Design", in *Proceedings of ISEA2000_Révélation: 10th International Symposium on Electronic Art*, 7-10 December 2000, Paris, pp. 7-8.
- Giaccardi, E. (2001). "Transcultural Vision and Epistemological Shift: From Aesthetics to High Tech Society", in G. Marchianò e R. Milani (eds.), *Frontiers of Transculturality in Contemporary Aesthetics*. Torino: Trauben, pp. 507-519.
- Giaccardi, E. (1999). "Interactive Strategies of Network Art. Relationships and Agency", in *Proceedings of CADE '99: Computers in Art & Design Education*, 7-9 April 1999, University of Teesside. Teesside, Middlesbrough: University of Teesside.

Published abstracts:

- Giaccardi, E. (2000). "Relational Embodiment and Metadesign of Consciousness", in *Consciousness Reframed*, University of Wales College, Newport, 23-26 August 2000, p. 17.
- Giaccardi, E. (1998). "Network Art on WWW: The Place of Artwork and the Empty Space of Processes", in *XIVth International Congress of Aesthetics*, 1-5 September 1998, Ljubljana, p. S7.

Presentations and Conferences Attended:

- *Social Creativity International Symposium*, seminar attended at Breckenridge, Colorado, 5-9 June 2002.
- *Interactive Art and Metadesign: Case Studies Results*, presentation given at L3D, LifeLong Learning and Design Centre, University of Colorado at Boulder, 11 September 2002.
- *Interactive Art and Metadesign: Collaboration and Co-Creation*, presentation given at L3D, LifeLong Learning and Design Centre, University of Colorado at Boulder, 15 May 2002.
- *Strategie Interattive di Creazione Collaborativa sul Web*, presentation and workshop given at Cittadellarte/Unidee, Fondazione Pistoletto, Biella, 18 April 2001.
- *E-naissance: New Configurations of Mind, Body, and Space*, conference coordinated on the behalf of CAiiA-STAR and Fondazione Fitzcarraldo at GAM - Galleria Civica d'Arte Moderna e Contemporanea, Torino, 28-29 March 2001. A presentation of my work was given on the occasion of this conference.

- *L'Art a l'Ere Post-Biologique*, colloquium attended at Médiathèque de l'École Nationale Supérieure des Beaux-Arts (ENSBA), Paris, 12-13 December 2000. A presentation of my work was given on the occasion of this colloquium.
- *ISEA2000_Révélation: 10th International Symposium on Electronic Art*, conference attended at Paris, 7-10 December 2000. A paper was published on the occasion of this conference.
- *Création et Interactivité du Web*, presentation given at Kawenga Multimedia Centre, Montpellier, 22 June 2000.
- *Interactive Strategies of Creative Collaboration on the Web*, workshop given at SUFCO, Université Paul Valéry Montpellier III, Montpellier.
- *Interfacing the Future: Third Annual Digital Arts Symposium*, symposium attended at The University of Arizona, College of Fine Arts, Tucson, 6-7 April 2000. A presentation of my work was given on the occasion of this symposium.
- *Futurs Émergents: Recontre Arts / Sciences / Nouvelles Technologies*, conference attended at CYPRES, Centre Interculturel de Pratiques Recherches et Echanges Transdisciplinaires, Friche de la Belle de Mai, Marseille, 12 e 14 April 1999. A presentation of my work was given on the occasion of this conference.
- *AVIGNON Numérique / Les Mutalogues*, conference attended at Grenier à Sel, Avignon, 13 April 1999. A presentation of my work was given on the occasion of this conference.
- *CADE '99: Computers in Art & Design Education*, conference attended at University of Teesside, 7-9 April 1999. A paper was published on the occasion of this conference.

- *XIVth International Congress of Aesthetics*, conference attended at Ljubljana, 1-5 September 1998. An abstract was published on the occasion of this conference.

External Contacts (in alphabetical order):

Olivier Auber, A+H Cultural Laboratory, Paris, France.

Andy Deck. Open Studio and School of Visual Art, New York City, USA.

Prof. Derrick de Kerckhove, Director of the McLuhan Program in Culture and Technology, Toronto, Canada.

Kit Galloway, Electronic Café International (ECI), Los Angeles, USA.

Lab[au], Studio of Architecture and Urbanism, Brussels, Belgium.

Lev Manovich, Visual Arts Department, University of California, San Diego, USA.

Ed Stastny, SITO.org, Portland, USA.

Prof. Celestino Soddu, Politecnico di Milano, Generative Design Lab, Department Architecture and Planning, Milano, Italy.

Lenara Verle, Laboratory for Electronic Art & Design, Porto Alegre, Brazil.

Elisa Giaccardi

8 August 2003

Elisa Giaccardi

Introduction

This introductory passage provides an overview of the aims of the research, a brief description of the research strategy that has been adopted, and some notes on the structure and style of the work.

* * *

In the light of the material condition of the present world and within the context of current design theories, this thesis and the supporting research aims to provide an understanding of Metadesign as an emerging design culture, and to integrate and advance its conceptual framework and principles through a transdisciplinary dialogue with the aesthetics and practice of Net Art, which is centred on the idea of co-creation.

The central thesis of this research is that the conceptual and methodological framework resulting from such a study can lead to define a new idea of design that is more suitable to respond to the changes occurring in our material and existential conditions. Rather than proposing a new "model of design" or predetermined disciplinary boundaries that can be found weak in the face of technological or social determinism[1], such a study aims at promoting a "mode of design". This mode can be identified as a set of principles which, organized in different and complementary levels, define a conceptual and methodological "design space". It is a belief of the author that such a "mode of design", embodied in the evolving practices of fluid and interdependent communities, might enable people to manage collaboratively, or better co-creatively, the construction of their environment and their relationships with the world, and lead to overcome the teleological attitude of most design approaches[2].

Beyond the thesis of this work, such a study is expected to provide various theoretical contributions to the field of design studies, which can be articulated in the following statements: a) an understanding of Metadesign as an emerging design culture; b) an integration and advance of the Metadesign conceptual framework in terms of interdependent levels of design; c) the identification of a set of design principles for each level of Metadesign; d) the production of specific design principles as a result of the case study research; e) the development of the idea of "sociotechnological know-how"; and f) the development of an original and coherent transdisciplinary methodology.

Many are the philosophical and scientific implications of this work, which can be placed within the field of design studies. However, an analysis of every link is not necessary, or even possible. In an effort to sustain a transdisciplinarity within the boundaries of art and design, the work develops a fabric of hypothesis connected and

---

[1]It means that they can be informed by autonomous criteria of efficiency and productivity or by social concerns and priorities, which are kept isolated from one another in the belief that is technology to shape human race, or vice versa that are social factors to be in control of technology.

[2]It has to be highlight, as it will be clear in the development of this work, that such a belief relies on neither a traditional socio-technical perspective nor a social constructionist one. The focus is neither on how job satisfaction or productivity or any other performance can be manipulated by jointly optimising the fit between social and technical factors, nor on how the meaning of a technology is created and sustained, and how it affects the development of that technology and the interaction with it. Here technology is seen as "a trigger for structural change", that is to say as an intervention into the active relationship between human agency and organisational structures, which can alter roles and patterns of interaction.

confirmed by means of various disciplines and research strategies (i.e. history, linguistics, aesthetics, phenomenology, case study research). As a result, the deep structure of the work is based on a constant process of zooming in and zooming out, which enables different disciplinary planes and languages to cross and to develop conceptually in a coherent argument. Writing is therefore non-linear, but recursive. Crucial concepts and meaningful relationships recall each other and are connected along a structure that is linear in terms of the organization of chapters, but ideally hypertextual in terms of how writing develops and agglutinate. Each chapter produces specific and intermediate results, which will be composed and integrated in the final chapter.

Following the transdisciplinary methodology that has been adopted and developed in this work, Metadesign and Net Art are considered as two fields of knowledge and practice between which it is possible to build a "bridge". This enables us to focus on a problem that is at once "between the disciplines, across the different disciplines, and beyond all disciplines" (Nicolescu, 1996). The problem of a new design space (non Metadesign per se) is actually "the problem". In this perspective, Metadesign represents only the frame of the work, the fabric with which the research has been built.

The first chapter, examines the problem of producing an idea of design, and a coherent methodological design space, which match and exploit the increased scale and complexity in natural human interaction that is made tangible by technology. This chapter identifies some main factors of change to which design must respond, through a process of rethinking both its boundaries and scope, and consequentely its methodological assumptions. Such factors are identified and described in terms of a supposed "dematerialization" and metamorphosis of materials, and in relation to the mobile and ubiquitous interconnectivity that is produced by the integration of computing power and network connectivity.

In the second chapter, Metadesign is described as a design culture that emerges from the context of current design theories, and as an attempt to respond effectively to the new material and existential conditions of the present world. The chapter aims to produce a framework that takes into account the context and spectrum of theories and practices that form the conceptual fabric and potential of Metadesign. Such an approach destabilises the notion of Metadesign as an established design approach and practice.

In the third chapter, a transdisciplinary dialogue between Metadesign and Net Art is set up on the basis of the evidence of a common concern about the possibility to expand human creative capabilities beyond the respective "disciplinary" boundaries. The chapter stresses how the analysis of the strategies and patterns of interaction and creation that Net Art has been able to inquire and investigate from the very first can contribute to advance Metadesign conceptual framework and principles, particularly in relation to co-creation (meant as an intersubjective process aimed at activating collaborative processes that allow the emergence of creative activities).

In the fourth chapter, the methodology adopted in this work is examined. The chapter describes how theory development and case study research integrate in a coherent methodological framework that is based on a transdisciplinary and phenomenological approach. The chapter stresses how the construction of the problem seems to represent the fundamental methodological issue, which the author epistemologicaly assumes and to which she responds by transdisciplinary logic.

In the fifth chapter, three Net Art projects are presented and motivated as case studies. These are entitled: Générateur Poï étique, Open Studio, and SITO Sinergy Gridcosm. It is important to highlight that these three case studies are not instances of Metadesign, but they allow the identification of specific design principles capable of empowering the practice of Metadesign in relation to the exploitation of networked intersubjective processes.

In the sixth chapter, the results of the case studies are presented and discussed. They provide an understanding of the experience of co-creation, a grasp of the motivational paths to co-creation, and a description of the features of the computational environment that can sustain co-creation. This allows the identification of some specific principles for the design of relational settings and affective bodies (seen as a weak aspect in the practice of Metadesign).

In the seventh chapter, through a process of final and enveloping zooming out, that takes into account the intermediate results of previous chapters, the Metadesign conceptual framework is integrated and advanced in terms of a design space based on three interdependent levels of design. Design principles are identified or newly produced for each of these levels. Such a three-fold design space is finally promoted in the terms of a "mode of design", that is to say as a non-teleological idea of design, called by the author "sociotechnological know-how".

1. The Problem of A New Design Space

Technology modifies our epistemology
and, through it, our ontology
(Longo, "Il Nuovo Golem")[3]

This first chapter describes a need for the development of an idea of design and the definition of a new design space, that match and exploit the increasing changes information technologies produce in our material and existential conditions. The chapter identifies some main factors of change to which design must respond through a process of rethinking its boundaries, scope, and methodological assumptions. Such factors are identified and described in terms of "dematerialization" and metamorphosis of materials, and in relation to the mobile and ubiquitous interconnectivity that is produced by the integration of computing power and network connectivity.

The purpose of this chapter is to define the problem addressed by this thesis, and declare the specific aims of the research.

* * *

The spread of information technologies produces a change in our material and existential conditions, that affects the way we know and we act. That is to say they affect our epistemology, and through that they impinge on our ontological and ethical assumptions. In order to enable people to manage the construction of their

[3]Originally: "La tecnologia modifica la nostra epistemologia e, attraverso di essa, la nostra ontologia".

environment and their relationships collaboratively, or better co-creatively, the boundaries and scope of design must be questioned.

1.1. Overview of the Problem

In the near future computing will be anywhere, everywhere and "within" (Messerschmitt, 1999; Agoston et al., 2000). That is to say computing will be mobile, ubiquitous and embedded (in everyday tools and implements, in our very body). The majority of products and materials of everyday use (from appliances to fabric), as the major part of our everyday environments and contexts (from home to public spaces of work and entertainment) will be intrinsically linked with computing, network connections and artificial intelligence or artificial life forms.

The boundaries of technology will be stretched beyond the definition of networked computing as we know it today, in a way that will force us to re-negotiate our environment. We will live interfaced with an environment in which the borderline between what is artificial and what is natural, between the "self" and the "other", will be negotiable and changeable. Such a constant re-negotiation will be enacted by the conditions of our experience and relations with objects and beings.

In a world of such complexity, how we design our interactions and sociotechnical systems will influence the kind of life we live. Within this scenario, a new culture of design will be of vital importance. What is challenging will be how to design the relational and interactional systems through which to interface with our everyday environment and inhabit the world. Put simply, we must define a new design space.

A kind of de-materialization of objects (Lippard, 1973), a "metamorphosis of materials" into processes (Manzini, 1987; 1988; 1996) has taken place in the field of design as well as in art. The first products having complex relations, be they functional or emotional, were designed and produced at the beginning of the post-industrial civilization (Branzi, 1999). Today, thanks to the new possibilities the Internet discloses and to the emergence of mobile communication services, interaction designers can focus on processes and on the scope of human experience, rather than concentrating on single objects or needs (Agoston et al., 2000; Feenberg, 1995; Thackara, 2000).

Despite this evolution, design still seems to be generally considered and approached as a teleological system (Wood, 2000). The practice of design, instead of developing towards new ways of understanding and planning with the goal of producing more open and evolving systems of interaction, still embodies an anticipatory approach to the design and production of objects and systems. They must respond to criteria of efficiency and control, that is to say that they must be capable to reductively represent and anticipate needs and values in order to fulfil them in the most successful way (Wood, 2000; Feenberg, 1995).

The definition of a new design space is an issue that deals with the processes through which we produce the world we inhabit. It is a shift from a focus on human needs to one on human creative endeavour, from a focus on the user to one on creative action. The orientation towards design emerging from the culture of Metadesign and the experimentalism of Net Art can be seen as an attempt to focus on a transverse "mode" of relationship rather than on a closed "subject" like the user, the community or the human "mode of consciousness". Such orientation can also be seen as an effort to overcome rigid dualisms both in framing and solving problems, and in the forming of new social relationships by emergent artificiality and enhanced interconnectivity. Within this context, to define a new design space means an attempt to shift from a "know-what" attitude to a "know-how" endeavour. It hopefully represents a shift from a culture of design as planning towards a culture of design as seeding or emergence.

1.2. Dematerialization and Metamorphosis of Materials

The term dematerialization is often linked to that of immateriality, and together they express an understanding of the current material conditions of contemporary society, which brings different perspectives and leads to a focus on various design implications. The new status and properties of objects and materials, as well a spreading networked computing infrastructure (as it will be described in the following section), are the factors that contribute to the ongoing change in the nature of our material conditions.

In the interview given on the occasion of the exhibition "Les Immateriaux"[4], Lyotard expresses his interpretation of the relationship between the human and the material in the post-modern era. According to him, all the advances that have been made in the science and arts fields are strictly related to a deepening knowledge of the said objects, even when they are objects of thought. The analyses have decomposed the objects, they have reduced them to human proportion, but they have also shown that they are complex agglomerates of small fragments of energy and particles that are so small it is impossible to measure their size. According to Lyotard, there is only energy and materials cease to exist (from which the term "immaterial" is derived). The traditional definition of the word "materials" refers to an object that resists to a project meant to deviate it from its first finality. In this sense, materials no longer exist. Lyotard speaks of a "general interaction" which replaces the structural principle of a stable substance with an unstable set of relations. In this way, the material disappears as an independent entity and it becomes "the immaterial", an entity whose identity (human or thing) can now reflect different structural poles with the aid of computational techno-sciences (Chaput & Lyotard, 1985; Ferrari & Manzini, 1985).

According to Ferraro and Montagano (Ferraro & Montagano, 1994), telematics has contributed greatly to immaterial culture[5]. With telematics, human activities are freed from the concreteness of a physical space: the shared space becomes a virtual space that leads us deeply into an immaterial culture universe and makes the exchange and relation model prevail on the substance model. It is a space freed from the physical quality of a material substance, which in this case is only a storage support:

> Information cannot be seen nor touched: data goods belong to a different generation of reality [...] they don't have a chemical-physical quality of their own [...] Data, amorphous and at the same time virtually

---

[4]The exhibition "Les Immateriaux" took place at the Centre National Georges Pompidou in 1985, and it was curated by Thierry Chaput and Jean François Lyotard.
[5]Of course in the definition of immaterial culture other factors have to be taken into account: the aesthetization of everyday life, the analysis of the communications society and of the unlimited semiosis, the scientific narration and the epistemological mythopoesis.

> polymorphous, is qualified by the use that is made of it (Ferraro & Montagano, 1994, pp. 19-20)[6].

Ferraro and Montagano describe the immaterial culture brought about by telematics, and they speak of datum, synthesised images and new bodies. As the datum belongs to a different generation of reality, so the synthesis images belong to a different system of representation, which no longer exist in the representation of the object, but in a creative autonomy that originates in numerical calculation. The synthesis images represent an opportunity for the existence of the object and a way to create, transform and manipulate it. In this synthetic universe the formal structure does not mark boundaries as the representative image does. Instead, we see passages, a representation of a phase in the continuous process of the image's transformation. This determines a powerful isomorphism between language and image (Quéau, 1994).

Ferraro and Montagano also note that this transformation creates a mythopoietic condition. In the existential circuits offered, first by radio and television and then by information systems and telematic technologies, new transitory "organisms" are created[7]. They are determined by the interrelationships between subject and object, human being and thing, but they create dramatic distortions in these semantic pairs and lead to the refusal of the Kantian theory of the transcendent subject:

> Subject and object transform and explore each other: the object comes from the subject and, inversely, the collective subject is set on the things and it merges with them (Ferraro & Montagano, 1994, pp. 25)[8].

---

[6]Originally: "L'informazione non si può vedere né toccare: la merce-dato appartiene a una diversa generazione di realtà [...] non possiede una propria qualità chimico-fisica [...] Il dato, amorfo e nel contempo virtualmente polimorfo, viene qualificato dall'uso che se ne fa".
[7]In this regard, see the developments of the cyborg themes and of the morphization processes elaborated by authors such as Donna Haraway and Sandy Stone.
[8]Originally: "Soggetto e oggetto si trasformano e si esplorano reciprocamente: l'oggetto nasce dal soggetto e inversamente il soggetto collettivo si fonda sulle cose e si confonde con esse".

It is from the beginning of the 20th century - with the phenomenological overcoming of the idea of representation in philosophy, epistemology, linguistics and also in art and literature - that the separation between external object and mental representation, born with Kant, is put at issue (Jaros, 2000a; 2001a). However, it is since this century that the non- problematic character of the world and of the objects, and the relationship subject-object begin to be challenged:

> From a phenomenological point of view, the object is built and produced by practice, in a temporality or duration. It is a point of arrival, not of departure, of a path that has to be questioned and reconstructed. [...] Since the object is given by use it is in the contact that the relationship subject-object is created; and every modification of the contact relation deeply modifies our relation with the world (Fiorani, 2001, pp. 30-31)[9].

From an epistemological point of view, the positions regarding the relationships between subject and object range from the idealism of the active subject to the social facticity of the objects. On one side, Martin Heidegger (Heidegger, 1976), some constructive and linguistic theories, such as Noam Chomsky's generative linguistics and the first cybernetics of the 1950s, together with those authors that in the 20th century rethought theories of materiality. An example is Whitehead with his notion of reality as a process made of mutually connected events, and we must also include Merleau-Ponty and Bachelard. On the other side, the social constructivism of the 1980s, ethnomethodology, Maed's interactionist sociology, S. Star and J.

---

[9] Originally: "Dal punto di vista fenomenologico, l'oggetto è costruito, è prodotto dalle pratiche, in una temporalità o durata, è un punto di arrivo non di partenza d'un percorso da interrogare e ricostruire. [...] Proprio perché l'oggetto si dà nell'uso, è nel contatto che si realizza il rapporto di soggetto e oggetto; e ogni modificazione della relazione di contatto modifica profondamente la nostra relazione con il mondo".

Griesemer's notion of "boundary object", based on the idea that the objects build and connect the social worlds.

The middle standpoint, first expressed by Latour[10], sees the object as a knot of relations in a net that connects different and heterogeneous elements and that is composed by both physical and social actors:

> The objects are included in a thick net of intersubjective and interobjective relations and they play an active role in regards to the subject. They act on body, mind, time and space. For this reason, nowadays, the rationale of use, the strategies of appropriation, the personal experiences, the relational networks that the objects allow to create tend to come to the fore and the shaping of the objects is inspired by these networks (Fiorani, 2001, pp. 149-150)[11].

Rather than an ideal or social construction, Latour describes a sociotechnical system which enables the object to build its own context and generate itself alongside the subject in a process of emergence.

In the information age, the objects have become "pure relational structures" inside an artificial world that looks like a continuum made of communication surfaces:

> The western view of a neutral and empty space is replaced by a view in which the space is a complex network of relations between people and things (Fiorani, 2001, p. 184)[12].

---

[10]See particularly: Latour, 1998.
[11]Originally: "Gli oggetti sono inseriti in una fitta rete di relazioni intersoggettive e interoggettive e sono attivi nei confronti del soggetto, agiscono sul corpo, sulla mente, sul tempo e sullo spazio. Per questo, oggi, tendono a venire in primo piano le logiche d'uso, le strategie di appropriazione, i vissuti, le reti relazionali che gli oggetti permettono di creare, e ad esse si ispira anche la loro messa in forma".
[12]Originally: "La visione occidentale di uno spazio neutro e vuoto lascia il posto a una visione in cui lo spazio appare come una complessa rete di relazioni tra le persone e le cose".

As a consequence, competence changes too, since the one related to relationships prevails on the one related to perception and to the direct manipulation of the world.

There has been a switch from a system made of physical and identifiable objects to a communicative surfaces' continuum. The object becomes interactive, that is to say it becomes an active element, which reacts and modifies its behaviour according to its relation with the user. The interface (which means not only the surface where information can be exchanged but also the deep structure on which the information flows back and forth) becomes a crucial ground, a place where the actual possibility of a "performative development" of the products is defined:

> The surface of the objects becomes, as it happens in living organisms, an interface, a filter, the most suitable place for the exchange of energy and information. It is a threshold, like all the dynamic and interactive surfaces, seriously questioning the subject-object dualism (Fiorani, 2001, p. 199)[13].

The immaterial is therefore not the fading, the disappearance of the matter but the triumph of communication and, as far as materials are concerned, it is the coming to light of an unexpected complexity. It is the image of an ultraplasmable matter and of objects capable of new performances and new forms of relation in a process of dissolution of the boundaries between products and information and between products/information and environment.

---

[13]Originally: "La superficie degli oggetti diventa, come negli organismi viventi, un'interfaccia, un filtro, un luogo privilegiato nello scambio di energia e di informazioni. Costituisce una soglia: tali sono le superfici dinamiche, interattive, che mettono in scacco anche il dualismo soggetto e oggetto".

The materials become what they are able to perform i.e. illuminating, changing their shape[14]. They are not only the structure, a stable contact surface[15], but a complex system. The new materials are then "operators" of a changed relationship between subject and artificial environment, in its turn changed and changing. They are not only multifunctional objects but interactive objects, because they are able to change the relationship between subject and object (Latour, 1998; Deleuze & Guattari, 1994):

> The subject itself changes; the manipulator does not exist anymore but it crumbles and redefines himself inside the communicative interaction. We are facing modifications of the relationship subject/object and human being/thing (Fiorani, 2001, p. 204)[16].

In computer music, for instance, the relationship between author and musical matter, definitely frees the concrete dimension of a source object, and becomes a cognitive relation. The material is dematerialized, turned into energy and under this particular shape it is produced, manipulated and thought of as sound by the ear and the aural imagination of the composer (Duchez, 1995).

Another concept that can be associated to the culture of immateriality (or dematerialization)[17] is the idea of "virtualization". In the context of immaterial

---

[14]An emerging category of materials is the one of "smart materials". "Smart matter" is a loosely defined category of physical materials which are combined with digital systems to create programmable matter that can change in shape, stiffness, colour, reflectivity and even sound. Also know as "responsive technologies". See Tackara, 2001.
[15]We can imagine this contact surface as a membrane that transmits flows and currents rather than containing a mechanism, its function being very similar to that of the skin for the human body.
[16]Originally: "Il soggetto stesso muta, non è più l'artefice manipolatore, ma si sfrangia e si definisce all'interno dell'interazione comunicativa. Siamo dunque in presenza di modificazioni della coppia di soggetto e oggetto e in quella di uomo e cosa".
[17]The word "immateriality", like "dematerialization", even though not properly scientifically correct, marks the leap from the common materiality of objects people are accustomed to. These words are antithetic and temporary, and an analysis of current new materiality and its peculiar nature is necessary to avoid any metaphysical misunderstanding.

culture, "virtualization" can be seen as a process that modifies our experience field because objects are capable of new performances and new forms of relation (Fiorani, 2001). Most significantly, virtualization becomes a process that transforms a modality of being into another (Lévy, 1998; Deleuze & Guattari, 1994) and, thus, a dynamic able to overcome the subject/object dualism (Chaput & Lyotard, 1985; Ferraro & Montagano, 1994; Fiorani, 2001)[18].

In scholastic philosophy the virtual is that which has potential rather than actual existence. The virtual tends toward actualization, without undergoing any form of effective or formal concretization. The tree is virtually present in the seed. Strictly speaking, the virtual should not be compared with the real but the actual, for virtuality and actuality are merely two different ways of being (Lévy, 1998):

> The possible is already fully constituted, but exists in a state of limbo. It can be realized without any change occurring either in its determination or nature. It is a phantom reality, something latent. The possible is exactly like the real, the only thing missing being existence. The realization of a possible is not an act of creation in the fullest sense of the word, for creation implies the innovative production of an idea or form. [...] The virtual should, properly speaking be compared not to the real but the actual. Unlike the possible, which is static and already constituted, the virtual is a kind of problematic complex, the knot of tendencies or forces that accompanies a situation, event, object, or entity, and which invokes a process of resolution: actualisation (Lévy, 1998, pp.24-25).

For this reason virtualization is always heterogenesis, a becoming other, an embrace of alterity.

---

[18] It is worth noticing the difference between "virtualization" as a process and a dynamic configuration (Lévy, 1998; Deleuze & Guattari, 1994), "virtual" as a condition of possibility (Nunes, 1997; Bergson, 1964) and "virtual" as a different order of reality (Heim, 1993).

Actualization is the creation, the invention of a form on the basis of a dynamic configuration of forces and finalities. Actualization involves more than simply assigning reality to a possible or selecting from among a predetermined range of choices. It implies the production of new qualities, a transformation of ideas, a true becoming that feeds the virtual in turn. For example, if running a computer program, a purely logical entity, implies a relationship between the possible and the real, then the interaction between humans and computer systems implies a dialectics between the virtual and the actual.

Virtualization can be defined as the movement of actualization in reverse, and of it the technological object is an agent. According to Lévy, information and knowledge are not "immaterial" because of a different status of matter in the objects that let them move around, but are "deterritorialized" because they are not exclusively attached to a specific substrate. Thus, information and knowledge can be recognised as events produced by a process of virtualization/actualisation[19]. This perspective is particularly interesting when applied to a sociotechnical design concerned with issues of interaction between "things" that are not clearly situated[20], rather than with the ergonomy of products or the marketing of user experience.

---

[19]This focus on the idea of "deterritorialization" rather than "immaterial" resembles and recall "decentralized" perspectives peculiar to oriental thinking (Yoneyama, 1996; 2001).
[20]See issues of Metadesign in 2.4.3.

1.2. Networked Computing and Interconnectivity

In the near future, computing will be 'anywhere,' 'everywhere' and 'within', it will be mobile, ubiquitous and embedded (in everyday tools and implements, in our very body) (Agoston et al. 2001; Messerschmitt, 1999; Thackara, 2001).

Ubiquitous computing was first defined by Mark Weiser at Xerox PARC in 1988. The term addresses the idea of a world in which computing is embedded into the environment so imperceptibly that it integrates seamlessly with everyday life. According to Weiser, we are living in the era of personal computing, but the next one will be the era of ubiquitous computing. Weiser similarly predicts the "age of calm technology" (Weiser & Brown, 1995), an age in which technology recedes into the background of our lives.

The integration of computing power and network connectivity in many common devices has already started (Agoston et al. 2001; Thackara, 2001). Considering the current scientific and technological acceleration, it seems inevitable that most products and materials of everyday use (from appliances to fabrics), and of our everyday environments (from home to public spaces for work and entertainment) will depend on computing, network connections and artificial intelligence or artificial life forms. In a world of inhabitable and wearable computing, made of wireless connections, smart and transparent interfaces and molecular technologies, interconnectivity[21] will bring us towards a reality composed of multiple and connected space/time, materials and entities (Lazzarato, 1996).

According to Messerschmitt, networked computing is a watershed in the history of computing. It represents a seminal addition to the technical infrastructure of mass transportation and telecommunications, two previous technologies that profoundly affected social and cultural institutions. Like its predecessors, networked computing will have a substantial impact on individual lives as well as business, social, and cultural institutions. However, uniquely, networked computing supports virtually any form of information (Messerschmitt, 1999).

Key technological enablers of networked computing are the network, the computer, and its software applications. Technically, networked computing is a collection of related technologies that support a broad range of geographically distributed computer applications. The computing portion enables the storage, retrieval, and processing of tremendous amount of information and also serves as an interface to users. The network enables computers to interact and share this information, much like the telephone allows people to talk (Messerschmitt, 1999)[22].

The introspective and isolated style of past computer use gave way to the expanded possibilities of networked computing:

---

[21]Interconnectivity comes from "interactivity" plus "connectivity". By this word, I mean both the ability to interact with machines, humans, or other entities thanks to the mediation of networked computers, and the dimension of a continuum of connections and potential interactions.
[22]To be more complete we should add that a computing application is a software program that provides direct and specific value to a user or an organization, and a networked application distributed programs across two or more computers, which then collaborate in realizing the application. Lastly, users are the people leveraging the application for their job, to interact or collaborate with other users, or merely to have fun (Messerschmitt, 1999).

> From an individual's perspective, computing has followed a trajectory from an invisible back-office function (centralized computing), to a tool for enhancing personal productivity and entertainment (decentralized computing), to an expanded role in accessing vast global resources, and in interacting and collaborating with others (Messerschmitt, 1999, p. 6).

Like domestic electrification a century ago, highlights Messerschmitt, networked computing will have its greatest impact on productivity and standards of living only after ways will be found to exploit its unique characteristics. Just as electrification followed a clear evolution to mobility (battery-operated flashlights and power tools), ubiquity (electric outlets and appliances in every room), and embeddedness (small electric motors within many products), so networked computing futures predict mobility, ubiquity, and embedding (Messerschmitt, 1999; Agoston et al. 2001; Thackara, 2001). Networked computing will be taken anywhere and still benefit from full network services (mobility, or computing anywhere). It will be unobtrusively sprinkled throughout the physical environment (ubiquity, or computing everywhere), and embedded in most everyday products (embedding, or computing within).

> Networked computing is settling a large sociotechnical system of which computers, networks, and software are only a part, while another part also includes «citizens and workers, procedures, policies, and laws, the flow of material and finished goods, and many other aspects» (Messerschmitt, 1999, p. 9).

According to De Kerckhove, networked computing is determining a new ecology, based on the digitization of all contents and the interconnection of all networks (De Kerckhove, 1997). Three main underlying conditions of this "new ecology of networks" are interactivity, hypertextuality, and connectedness or webness. Together they mean a physical and mental linking of people and contents (or identities and substances) in an increased density of non-linear connections, a condition of increased scale and complexity in natural human interaction that is made explicit and tangible by technology and allows a direct access to a global ecological environment. Technically, such a condition is just at the beginning of its development because:

> The client/server architecture is not an endpoint in the evolution of computing, but a stepping stone. [....] Much more radical departures from the past [...] suggest an amorphous architecture, in which applications can search for interesting subsystems from a wide variety of sources and configure themselves more dynamically (Messerschmitt, 1999, p. 11).

In the new ecological environment of networks, it is interactivity that produces continuity between the technological and the biological domain. Biotechnological interplay is given, according to De Kerckhove and, similar to McLuhan's position, by a continuation or outering of the body through electricity:

> The continuity between the two domains, the technological and the biological, is established by the fact that there is electricity both within and outside the body, just as there is language both within and outside the body (De Kerckhove, 1997, p.144).

Such outering produces a second order of integration of the human extensions and projections beyond the personal limits of the body and the self (for example through avatars and agents). Subsequently, this impacts on our sense of self (Turkle, 1995), identity and personhood boundaries: "Individuals deal not only with abstract expectations concerning their behaviour, but also with a set of virtual selves" (Oravec, 1996, p. 5).

Moreover, a "self" can then be attributed also to autonomous forms of intelligence:

> The more sophisticated the machine or system, the more complex our interaction is likely to be, and hence the more "intelligent" its response will appear. We now recognize that possibility that it is not just humans who interact (De Kerckhove, 1997, p. 47).

Manuel Castells addresses the question from a sociological and economical perspective. Castells states that the technological revolution, centered around information technologies that are giving rise to the "network society", is reshaping the material basis of society and making grow the interdependencies between different domains at an accelerated pace (Castells, 1996).

The information technology revolution is a major, historical event that induces a pattern of discontinuity in the material basis of economy, society, and culture. Like all the technological revolutions it is characterized by "pervasiveness", that is by the penetration of all domains of human activity, "not as an exogenous source of impact, but as the fabric in which such activity is woven" (Castells, 1996, p. 31). Like any new technology which impacts on production, information technology revolution penetrates and modifies power and experience, producing the emergence of historically new forms of social interaction, social control, and social change.

Unlike the industrial revolution, which was oriented toward economic growth, i.e. toward maximizing output, "informationalism" (as Castells calls the paradigm brought about by information technology) is oriented toward technological development itself, i.e. toward the accumulation of knowledge and towards higher levels of complexity in information processing:

> What characterizes the current technological revolution is not the centrality of knowledge and information, but the application of such knowledge and information to knowledge generation and information

processing/communication devices, in a cumulative feedback loop between innovation and the uses of innovation. [...] New information are not simply tools to be applied, but processes to be developed (Castells, 1996, p. 32).

It follows a close relationship between the social processes of creating and manipulating symbols (the culture of society) and the capacity to produce and distribute goods and services (the productive forces):

> For the first time in history, the human mind is a direct productive force, not just a decisive element of the production system (Castells, 1996, p. 32).

This production system has its own, embedded logic, characterized by the capacity to translate all inputs into a common information system. Such a capacity is deconstructing the distinction between humans or machines, a process identified by Mazlish as the "fourth discontinuity" (Mazlish, 1993)[23].

Looking closer at the features of the information technology paradigm, Castells identifies five characteristics. The first is that in the information technology paradigm "information is raw material": "these are technologies to act on information, not just information to act on technology" (Castells, 1996, p. 61). The second characteristic is "the pervasiveness of effects of information technologies". All processes are directly shaped, although certainly not determined. Thirdly is the "networking logic" of any system or set of relationships that uses information technologies:

---

[23]The idea for Bruce Mazlish's The Fourth Discontinuity appeared in a 1967 article he published in Technology and Culture and was developed and honed for over a quarter of a century. At the outset Mazlish tells us that Freud rightly spoke of three major shocks to human pride in the form of the Copernican cosmology, Darwinian evolution and psychoanalysis itself. Mazlish sees in man's fascination

> ...the morphology of the network seems to be well adapted to increasing complexity of interaction and to unpredictable patterns of development arising from the creative power of such interaction (Castells, 1996, p. 61).

The fourth characteristic is that the information technology paradigm is based on "flexibility", that is to say on reconfigurability, reversibility, and fluidity. The final characteristic is the "convergence" of all technologies, no matter how specific, into a highly integrated system.

It is such technological convergence, the sharing of the same logic of information generation, that increasingly extends a growing interdependence between the biological and the computational domain, "both materially and methodologically". Examples are evident in the integrated application of computing power and use of biological materials, and this ongoing convergence can also be found in fields like material science[24], artificial life, artificial intelligence, robotics and many more.

This is producing a deeper transformation in the way we categorise such processes. Nevertheless, it remains impossible to predict the path of this transformation:

> ...[the information technology paradigm] is powerful and imposing in its materiality, but adaptive and open-ended in its historical development. Comprehensiveness, complexity, and networking are its decisive qualities (Castells, 1996, p. 65).

---

with tools and technology a fourth "discontinuity" which similarly challenges humanity's pretension to uniqueness at the end of the twentieth-century.

[24]Material science is the name given to the set of research interests focused on understanding the structure and characteristics of physical materials and developing techniques to create new kinds of materials. It consists of an integration of chemistry, physics, and engineering. Such research area is also called nanotechnology.

1.3. Boundaries and Scope of Design

Within this framework of transformation, design independently deserves attention, not only as a professional practice, but also as a subject of social, cultural, and philosophic investigation. As Buchanan and Margolin point out, design practice cannot be adequately understood apart from the issues and concerns of contemporary material condition and cultural discourse (Buchanan & Margolin, 1995a).

However, broadening the discussion about design poses a double challenge. First, it challenges the authority of practicing designers as the only group qualified to comment on design in contemporary culture. Secondly, it brings into question many established disciplines, which claim special insight into culture without explicitly addressing the role of design (as more than a mere decoration or embellishment of cultural life).

Most significantly, such a discussion requires an understanding of how the notion of design evolved through the last centuries, and how this evolution has been induced and can be oriented by the changes occurred and occurring in the material conditions and cultural assumptions of contemporary society. The shift from a concept of design as static and bound to the object to one dynamic and bound to the dimension of processes represents the main leap from early design theories[25]. The focus has shifted from product to the complex activity of designing as the main challenge to both traditional design approaches and their epistemological assumptions. Ideas of

---

[25]An instance for consideration is the knowledge and skills required to design a cup, or any static object, and those required to design a malleable computational structure that can evolve over time and adapt itself to the activity and needs of the users (i.e. an organizational learning memory).

reality, artificiality, meaning and relational space are at stake in the definition of the place of design, and they produce different orientations about how to broaden and substantiate the discussion.

Unfortunately, according to Margolin, the scrutiny remains riveted to the material products that result from design, rather than on the complex activity of designing itself. It has not yet been fully recognized that design is a central aspect of everyday life in many parts of the world, and that our actions are often channelled into activities or supported by services that are designed for the purposes of work, play, learning, and daily living (Margolin, 1995).

Initially, the concept of design developed by early theorists, was static and inextricably bound to the object, taking its historical origin from the English and French engineering works of the 19th century. A discourse about objects, particularly about how they should look, began with Henry Cole, one of the chief promoters of the British Crystal Palace Exhibition of 1851, continuing through 20th century until quite recently.

This approach to design has been implicitly and explicitly challenged by various theorists, such as Herbert Simon and John Chris Jones, who championed design as a process underling both material and immaterial culture. They proposed a broadening of design's subject matter which embraces all that we might call the artificial and, instead, questioned the meaning of the term design. These ideas were undermined by post-modern criticism, eventually eroding the objective certainties on which a theory and practice of design was built in the first modernity.

In the discourse of the modernists, the locus of meaning was twofold, "form" and "function", for which we might substitute the theoretical terms "aesthetics" and "pragmatics". The reductive slogan "Form follows function" assumed that use was an explicit, unambiguous term, and that there was no contextual relation between object and user, and therefore no negotiation of the meaning of the term object. Later, this belief in the univocality of use and of the conditions under which we can talk about design's meaning was challenged. In the so-called "first modernity" (more or less until the late seventies and the early eighties) reality was considered the stable ground for the attribution of meaning to objects, images and acts. Today, after poststructuralism and deconstructionism, and their critique to the scientific validity of the objective method, this is no longer the case. Any mention of "reality" must be qualified by conditions, just as the use of the term "meaning" must be (Margolin, 1995).

These two contested terms, "meaning" and "reality", severely undermined the certainties on which a theory and practice of design was built in the first modernity. As previously discussed, the same criticism undermined Simon's very idea of artificial as invented, based on the opposition to natural as real or given. A further stage for a new discussion about boundaries and scope of design is created:

> Since we can no longer talk about design as if these terms [meaning and reality, *editor's note*] were not in question, a new discourse is needed, although the way that discourse will develop as a reflection on design practice is not yet clear (Margolin, 1995).

A new perspective can be claimed if we consider design in the wake of Herbert Simon's writing, as the "conception and planning of the artificial" (Buchanan & Margolin, 1995b). Assuming this statement, the scope and boundaries of design are revealed as intimately entwined with our understanding of the artificial. This becomes the central theme to be addressed in the new discourse about design.

> That is to say, in extending the domain within which we conceive and plan, we are widening the boundaries of design practice. To the degree that design makes incursions into realms that were once considered as belonging to nature rather than culture, so does the conceptual scope of design practice widen (Margolin, 1995).

Making clear his frame of reference on what might be conceived a new design space, and how we should deal with it, Margolin criticizes Simon's idea of artificial. Along with Barthes, Foucalt, Baudrillard, Lyotard, and Haraway among others, he contests Simon's characterization of natural science as descriptive, concerned "solely with how things are", in contrast with a science of the artificial as normative in its engagement with human goals, concerned itself with "how things ought to be". However, natural is not an uncontestable term and Margolin, accepting that nothing exists beyond the frame of a socially constructed discourse, undertakes the theoretical positions of the contemporary philosopher Gianni Vattimo. In agreement with Vattimo, he sustains that the true value of nature is in possessing the capacity for "convertibility", in an indefinite "transformability" or "processuality", which makes of it an "exchange-value".

Inspired by the vision expressed by William Gibson in the book "Neuromancer", Margolin delineates a scenario of design triumphant in a world where the real is no longer a point of reference (Margolin, 1995). Simon's postulation of the artificial as an imitation of the natural carries no weight in this context. In the world portrayed by Gibson, and by Margolin, being is convertible into infinite forms, and values of identity are constituted primarily through the manipulation of technology. Here, as in Jean Baudrillard's notion of simulacrum, "meaning" only exists in the operation of "exchange", rather than in a "reality" outside it.

In light of this scenario, Margolin is less worried about the loss of reality and meaning, than about the postmodern disbelief in universals in favour of differences (Lyotard, 1979). His real concern is for the loss of values that all this would represent:

> We first need to question what meaning is in a world where reality is no longer the ground on which values are formed (Margolin, 1995).

As a response to the possibility that meaning becomes a mere strategic and pragmatic concept, lacking an external ethical imperative or a sense of self, he proposes a new sort of meta-narrative. Inspired by Teilhard De Chardin and James Lovelock's spirituality and environmentalism, he addresses the issue of meaning and reality that has arisen from the expansion of the artificial from a moral perspective, keeping a clear distinction between "natural" and artificial".

> What I believe is important in Simon's work, particularly in terms of my own call for a new metanarrative, is his delineation of the natural and the artificial as distinct realms. Although the natural can be transformed into the artificial through human action, and Simon acknowledges that "the world we live in today is much more a man-made, or artificial, world than it is a natural world", the natural is not interchangeable with the artificial (Margolin, 1995).

The acknowledgement of post-modern "difference" has led to a widespread refusal to postulate the world in terms of common values. According to Margolin, without a meta-narrative to provide normative values the boundaries of the artificial and the real will be at the mercy of power and economics[26].

His call for normative values and for a spiritual differentiation between a "self" and an "artificial costruct" expresses an anxious and paternalistic approach to present-day complexity. Margolin defines his proposal of a new meta-narrative as a form of spirituality, conceived as a source for cultivating a sense of what is worthwhile. As manifested in product design and technological devices spirituality is, for Margolin, the attention to human welfare and life enhancement, seen both in relation to the individual self and humanity as a whole. As designers and technologists develop a more caring attitude to how people live independently of the market, they may also generate new products that respond to previously unimagined human activities.

Thus, we must consign the future of design to the attitudes and sense of responsibility of designers, sustained by a global sharing of normative values. Margolin, therefore, does not define a new conceptual and methodological space for design, but merely simplifies contemporary complexity. He attempts to preserve the objective certainties in the distinction between natural and artificial, on the basis of a spiritual difference, which is defined as a source of normative values which design has to be a bearer of.

Like Margolin, Buchanan also addresses the new discourse on design moving away from the idea of a "conception and planning of the artificial". Like Margolin, he

---

[26]According to Margolin, it is sufficient to look at biotechnological design. Biotechnological design transforms biosystems from natural to managed systems and may disengage them from a larger ecological balance which their managers are either unaware of or do not wish to take into account.

recognizes that the subject matter of design is not fixed, and defines such an indeterminate subject matter as a "humanistic enterprise", rather than as a "form of science" concerned with the invention of products:

> The subject matter of design is not fixed; it is constantly undergoing exploration. [...] In general, design is continually evolving, and the range of products or areas where design thinking may be applied continues to expand. [...] Design is a discipline where the conception of subject matter, method, and purpose is an integral part of the activity and of the results. [...] If the subject matter of design is indeterminate - potentially universal in scope, because design may be applied to new and changing situations, limited only by the inventiveness of the designer - then the subject matter of design studies is not products, as such, but the art of conceiving and planning products (Buchanan & Margolin, 1995a, pp. 25-26).

According to Buchanan, design is an inquiry and experimentation in the activity of making. It is essential in a new philosophy of culture, and it replaces the old metaphysics of fixed essences and natures:

> The essential humanism of design lies in the fact that human beings determine what the subject matter, processes, and purposes of design shall be. These are not determined by nature, but by our decisions. In the contemporary world, design is the domain of vividly competing ideas about what it means to be human. [...] The exploration of design is therefore, a contribution to the philosophy of culture in our time (Buchanan & Margolin, 1995a, pp. 55-56).

Unfortunately, Buchanan maintains, the invention of techniques for mass production, in the lapse of time between the Renaissance and the Industrial Revolution, led to a separation between designing (as forethought) and making. Therefore, instead of becoming a unifying discipline directed toward the new productive capabilities of scientific understanding of the modern world, design was diminished in importance and fragmented into the specializations of different types of production, leaving its connection with other human enterprises and bodies of knowledge vague and uncertain. The consequence was a loss of the essentially humanistic dimension of production. In short, Buchanan states, design became a servile activity rather than a liberal art[27].

Like, Margolin's meta-narrative, the "integrative thinking", a phrase coined by Buchanan, is separated from making and policies of making, in the sense that there is among them a "logical sequence". Making is a matter of techniques and methods, whilst design policies are to be integral to debates about economic and social development (Buchanan & Margolin, 1995b). Therefore, the ways in which design operates remain the same. What it changes, in Buchanan's perspective, are the philosophies, values, and arguments that support the ways in which design operates and contribute to our culture with its material and immaterial products.

Buchanan and Margolin address the issue of defining new boundaries and scope of design in the contemporary world with an anticipatory approach. According to such an approach, there is always something external to pre-determine what design can and must be (a meta-narrative or an integrative thinking[28]). From this, methods and techniques derive, and design practices are sustained.

Given these two perspectives, we can move our focus from the conceiving and planning of the product (material or immaterial) to the subject, and to its

---

[27]Efforts towards a reunification were made by Gropius in the Bauhaus, but in the end the focus was set more on the research of a proper methodology of design, understood as specialized techniques or methods, rather than on the formulation of an "integrative thinking" based on systematic disciplines.
[28]Buchanan's integrative thinking is meant as a rhetorical element of forethought, which does not take almost into account the interpretative power of social actors, and their shifting perspectives.

relationship with the product and lastly with the project itself[29]. We can gain a new perspective on the history of contemporary design, and further critical elements of discussion for the setting of a new discourse.

The certainty that chaos and contradictions within the society were destined to disappear with industrial progress, and that this would have led to the creation of a logical, rational, and programmed society was the central belief of modernity. This was completely reversed with the birth of the post-industrial society in the 1970s and the 1980s.

Andrea Branzi gives a perspective centred on the idea of a raising complexity and indeterminateness of the world, and therefore of design. This approach works in contrast to Margolin's study of the loss of meaning and reality produced by the failure of the modernist hypothesis. Guided by a phenomenological analysis of the different cultures of design that followed one another since the 1970s, Branzi argues that the modernist hypothesis did not take into account that industrial development was strictly linked to increased consumption, the multiplication of languages, and to the diversification of models. The market was not unifying forms and technologies, but instead was contaminating and hybridizing any logical unit. The foundation of the future that industry was building was not order but chaos, arising from the complexity of the competition and the globalization of the markets. Complexity and hybridization, instead of order and planning, were becoming the central categories of this new culture, defined by Branzi as the culture of the "hybrid metropolis":

---

[29]This means to focus on the use relationship and on the interaction between user/consumer and

> In the hybrid metropolis, the project was not an act done in order to change the world, but rather it was an act added to the existing reality to make it richer, more complex, to increase the possible choices [...] Passed were the good old days when the products suited everybody, now the stress was on selection and diversity; high or low technology products, but with which is was possible to establish complex, functional and also poetic and literary relations (Branzi, 1999, pp. 138-140)[30].

In the same period, the status of design was further modified by the technological mutation of the materials. The materials were not simply new materials, but were also operators in a relationship between subjects, and an artificial environment that was changing. It was not only a technical issue, but also a philosophical one. It is in those years that the traditional relation of subjection between project and pre-existent materials begins to be reversed. Now the material is created to answer the needs of a specific design, and not the converse (Manzini, 1996).

Another innovation perpetuated by post-industrial design is linked, Branzi states, to the methodological issue dear to modern rationalism, seen as the research for an objective procedure able to grant a planned result through a series of processes and of repeatable modalities. This innovation can be described as:

> The new philosophical assumption lies in the shifting of the focus of the issue from design to subject (Branzi, 1999, pp.159-60)[31].

---

product, rather than on the aesthetic or rhetoric (as Buchanan would say) of the product as such.

[30] Originally: "Nella metropoli ibrida il progetto non era più un gesto che tendeva a modificare il mondo, ma piuttosto un atto che si aggiungeva alla realtà esis tente, per renderla più ricca, più complessa, per aumentare le possibili scelte. [...] I tempi dei vecchi prodotti che andavano bene per tutti erano tramontati, si doveva adesso progettare producendo selezione e diversità: prodotti ad alta o a bassa tecnologia, ma con cui stabilire relazioni complesse, funzionali, ma anche poetiche e letterarie ".

[31] Originally: "Il presupposto filosofico nuovo sta nello spostamento del baricentro dalla questione del progetto alla questione del soggetto".

This is a tendency to provide the individual with the autonomous capacity to activate critical and analytical processes, that enable him/her to start an active relationship with problematic and unpredictable contexts. In the 1990s, this tendency leads to what Branzi calls the "generic metropolis".

Unlike the hybrid metropolis, a generic metropolis is made of places with a "low degree of identity", but a "high level of performance":

> In the generic metropolis the search for an extreme expressivity, deconstructed inside a space made of exceptions, of semiospheres [...] gives way to a relational space, new and empty. The search for new languages has given way to a different conception of design: a design where territory and structures, product and service coincide, according to a concept that we can call relational space (Branzi, 1999, p. 167)[32].

The issue of the relationship that is allowed to take place in such a "relational space" becomes predominant. This rela tional space is an integrated space where the old dimensional categories of the urban, architectural, and product design yield to general evolutive processes. In Branzi's relational space all the places are the same because the stylistic codes linked to specialized functions (living, working, producing, travelling, trading) become fluid, creating a set of places with a low level of identity, but with a great flexibility of use. According to Branzi, the relational space must be seen as a pervasive system of incubators, where indeterminate activities can develop: a space where private and public, production and leisure, home and work are integrated in a kind of territory lacking figurative recognizability, but rich in service potentials.

---

[32]Originally: "Nella metropoli generica la ricerca di una espressività estrema, deflagrante e decostruita, dentro a uno spazio fatto tutto di eccezioni, di semiosfere [...] ha lasciato il posto a uno spazio relazionale, nuovo e vuoto. [...] La ricerca di nuovi linguaggi ha lasciato il posto a una diversa

In this way technological culture also produces a new ethical modality, based on the "capacity to relate with the context through an active and sensitive interface"[33] (Branzi, 1999, p. 177) [34]. This culture comes after the mechanical age, and it is concomitant with the culture of the indeterminate which arises from contemporary scientific thinking and the contribution of Eastern meditative cultures.

According to Branzi, complexity and indeterminateness, not deconstruction, allow us to cross the limits of the metaphor (and therefore the limits of any meta-narrative), and enable us to create new relational conditions. The discovery of the limits of industrial development has, in a way, finally destroyed the modern hope of a linear time, of an endless progress, moved by a never-ending dual and teleological logic[35].

Even Simon, in the third revised edition of "The Sciences and the Artificial", when defining his idea of "social planning", seems to recognize complexity and the methodological sustainability of a non-anticipatory design[36]. Addressing the idea of "social planning", he proposes a "designing without final goals" which is linked to the design of complex systems, implemented on long time spans, and constantly modified during the implementation:

---

concezione del progetto: un progetto dove territorio e strutture, prodotto e servizio coincidono, seguendo un concetto che chiameremo appunto di spazio relazionale".

[33]Originally: "Capacità di relazionarsi con il contesto attraverso un'interfaccia sensibile e attiva".

[34]In the design field we can currently identify two reference cultures, to which different concerns and proposals can be referred. We can distinguish on the one hand postmodern deconstruction and nihilistic thought, and on the other hand complexity sciences and meditative cultures. Margolin and Buchanan, for instance, refer to the former, struggling to redefine new objective certainties. Other designers, like Branzi and Wood, are on the contrary inspired by the latter, and they hope for the setting of new relational conditions and a new ethics.

[35]A clear criticism to a dualistic and teleological logic is developed also by John Wood (see 2.4.3.1.).

[36]For a closer analysis of anticipatory issues, and their connection with Metadesign, see 2.4.3.1.

> The idea of final goals is inconsistent with our limited ability to foretell or determine the future. The real result of our actions is to establish initial conditions for the next succeeding stage of action. What we call "final" goals are in fact criteria for choosing the initial conditions that we will leave to our successors. [...] The aim here is to enable them [...] not just to evaluate alternatives better but especially to experience the world in more and richer ways (Simon, c1996, pp. 163-164).

From another standpoint, Simon's approach to social planning further contributes to overcome the idea of planning as expression of a dualistic and teleological attitude[37]:

> Closely related to the noting that new goals may emerge from creating designs is the idea that one goal of planning may be the design activity itself. The act of envisioning possibilities and elaborating them is itself a pleasurable and valuable experience (Simon, c1996, p. 164).

1.4. Defining a New Design Space

As Tarka clearly points out, an urgency to legitimize design as an autonomous discipline has been evident throughout this century, and it resulted in attempts to resolve the intermediary nature of design into structured programmes and methods. However, as we have seen in the previous section, this project becomes ever more difficult in the networked, postmodern information society, where hybrids and shifts in discourses and practices of design are evident. Shifts from engineering to design, from a functionalist/methodical to a rhetorical/metaphorical mode of operation, and finally, from technical rationality and determinism towards a culturally oriented and constructivist perspective (Tarka, 2002).

---

[37]Even though we cannot forget that teleology (functionality, goal-directedness, adaptation) is central to Simon's concept of artificiality.

In this way technological culture also produces a new ethical modality, based on the "capacity to relate with the context through an active and sensitive interface"[33] (Branzi, 1999, p. 177) [34]. This culture comes after the mechanical age, and it is concomitant with the culture of the indeterminate which arises from contemporary scientific thinking and the contribution of Eastern meditative cultures.

According to Branzi, complexity and indeterminateness, not deconstruction, allow us to cross the limits of the metaphor (and therefore the limits of any meta-narrative), and enable us to create new relational conditions. The discovery of the limits of industrial development has, in a way, finally destroyed the modern hope of a linear time, of an endless progress, moved by a never-ending dual and teleological logic[35].

Even Simon, in the third revised edition of "The Sciences and the Artificial", when defining his idea of "social planning", seems to recognize complexity and the methodological sustainability of a non-anticipatory design[36]. Addressing the idea of "social planning", he proposes a "designing without final goals" which is linked to the design of complex systems, implemented on long time spans, and constantly modified during the implementation:

---

concezione del progetto: un progetto dove territorio e strutture, prodotto e servizio coincidono, seguendo un concetto che chiameremo appunto di spazio relazionale".
[33]Originally: "Capacità di relazionarsi con il contesto attraverso un'interfaccia sensibile e attiva".
[34]In the design field we can currently identify two reference cultures, to which different concerns and proposals can be referred. We can distinguish on the one hand postmodern deconstruction and nihilistic thought, and on the other hand complexity sciences and meditative cultures. Margolin and Buchanan, for instance, refer to the former, struggling to redefine new objective certainties. Other designers, like Branzi and Wood, are on the contrary inspired by the latter, and they hope for the setting of new relational conditions and a new ethics.
[35]A clear criticism to a dualistic and teleological logic is developed also by John Wood (see 2.4.3.1.).
[36]For a closer analysis of anticipatory issues, and their connection with Metadesign, see 2.4.3.1.

As computation becomes ubiquitous, and our environments are enriched with new possibilities for communication and interaction, the field of studies established as human-computer interaction (HCI) confronts the difficult challenge of supporting complex tasks, mediating networked interactions, and managing and exploiting the ever-increasing availability of digital information. What seems more challenging in the development of a global computational fabric is not the task of making information available at the appropriate times and places, but the challenge we have to design relational and interactional systems, through which we can interface our everyday environment and inhabit the world.

According to Hollan and colleagues, research to meet these challenges requires a theoretical foundation that is not only capable of addressing the complex issues involved in effective design of new communication and interaction technologies, but also one that ensures a human-centered focus[39] (Hollan et al., 2002).Human-computer interaction as a field was founded at a time in which human information processing psychology was the dominant theory and it still reflects that lineage. The human information processing approach explicitly took an early conception of the digital computer as the primary metaphorical resource for thinking about cognition. Just as it focused on identifying the characteristics of individual cognition, human-computer interaction, until very recently, has focused almost exclusively on single individuals interacting with applications derived from decomposition of work activities in individual tasks. This theoretical approach has dominated human-

---

[38]The term *poiesis* derives from the Greek verb *poiêin* for "to generate, to create, to produce, to build", and its meaning, as highlighted by Passeron, expresses both the enactive capability and the ethical responsibility for every act of creation, and therefore of civilization (Passeron, 1989).
[39]It is called human-centered an approach to design in which media and technologies serve human purposes and activities. It represents a fundamental shift compared to technology-centered approaches, in which humans are often considered the servants of machine.

computer interaction for over twenty years, playing a significant role in developing a computing infrastructure built around the personal computer and based on the desktop interface metaphor.

Traditional information processing psychology posits a gulf between inside and outside, and then "bridges" this gulf with transduction processes that convert external events into internal symbolic representations. The implication of this for HCI is that the computer and its interface are "outside" of cognition, and they are only brought inside through symbolic transduction (Card et al., 1983). Instead, as Hollan and colleagues point out, what it is needed to enhance HCI and develop a true human-centered approach are research activities not now associated with HCI, theories that view human-computer interaction within larger sociotechnical contexts:

> For human-computer interaction to advance in the new millennium we need to better understand the emerging dynamic of interaction in which the focus task is no longer confined to the desktop but reaches into a complex networked world of information and computer-mediated interactions (Hollan et al., 2002, p. 90).

In a not-too-distant future it is conceivable that we will not think about computers as definable products, but rather as critical parts of many varied information-based tools and artefacts (Weiser, 1991; Norman, 1998; Maxwell, 2002). This approach is intended to create a conceptual shift from thinking about using the computer to performing tasks and activities. Norman's "information appliances", researches on "tangible user interface" (Ishii & Ullmer, 1997; Resnick et al., 1998; Wrensch and Eisenberg, 1998) and wearable computing devices (Mann, 1998) are already expressions of that shift:

> These technologies will be tightly integrated into the totality of our interaction with and experience of the everyday world around us. In a very real sense the environment created by these technologies will become part of the fabric of the environment and an integral part of our phenomenological field [...] In this new and augmented reality our psychological and social development and well-being will be affected by our skill in interacting with it and our ability to differentiate a self-concept from it (Maxwell, 2002, p. 196).

The rapid proliferation of distributed and networked computing, and its convergence with communication technology has generated an expansion of attention that moves beyond the basic usability issues to questions about the sociological, organizational, and cultural impact of computing. From this angle, the work in HCI can be viewed as a progression moving from supporting the basic needs and goals of users toward supporting higher-level human needs and goals with computing technology.

According to Preece and colleagues, interaction design represents the next step to human-computer interaction (Preece at al., 2002). It can be defined as "the design of spaces for human communication and interaction" (Winograd, 1997). Precisely interaction design now means "designing interactive products to support people in their everyday and working lives" (Preece, 2002). That is to say creating user experiences that enhance and extend the way people work, communicate, and interact. Many academic disciplines, design practices, and interdisciplinary fields contribute to interaction design[40], whose main goals are synthesized by Preece and colleagues in "usability" and "user experience"[41]. According to Maxwell's idea of "holistic interaction", for instance, interaction design will need to account for the

---

[40]Among academic fields, there are: psychology, cognitive science, informatics, engineering, social sciences, computer science. Among design practices, we can find: graphic design, product design, industrial design; among interdisciplinary fields: human-computer interaction, computer-supported cooperative work, information systems, human factors, cognitive ergonomics.

individual's cognitive and perceptual capabilities, biological and physical capabilities, emotional needs, personality traits, and situational factors (Maxwell, 2002)[42]. Compared to HCI, interaction design represents therefore a major focus on the entire aspect of user experience (from cognitive to affective), and on conceiving products and services as an integrated whole.

It is clear that both interaction design and a renewed sociotechnical approach to systems design are becoming crucial. But they need to be readdressed in the light of the definition of a new design space, seen as a conceptual framework from where an understanding and a new way of thinking about interaction and design themselves can be derived and translated in methodological principles. The definition of a new design space is an issue of advanced design, dealing with the processes through which we produce the world we inhabit. That is to say it is an issue not only of "experience", but first and foremost of "creativity", or *poiesis*[43] (Passeron, 1989).

The definition of a new design space represents a shift from a focus on human needs to one on human creative endeavour, from a focus on the user to one on creative action. The aim of this research is to produce a conceptual framework that promotes new approaches in the design of interactive sociotechnical systems. Net Art acts as both a response to changed material and existential conditions, and an urge to enlarge human creativity and consequently the boundaries of both art and design. The orientation towards design emerging from a culture of Metadesign and the

---

[41]'User experience goals differ from the more objective usability goals in that they are concerned with how users experience an interactive product from their perspective, rather than assessing how useful or productive is from its own perspective (Preece et al., 2002).

[42]According to Maxwell, an important role in this process will be played by end-user programming, that is to say object and component strategies of software development combined with distributed architectures and integration technologies (Myers et al., 2002).

experimentalism of Net Art can be seen as an attempt to focus on a transverse "mode" of relationship rather than on a closed "subject" like the user, the community or the humankind, i.e. a "mode of consciousness". Such orientation can also be seen as an effort to overcome rigid dualisms both in framing and solving problems, and in the forming of new social relationships by emergent artificiality and enhanced interconnectivity. Within this context, to define a new design space means an attempt to shift from a "know-what" attitude to a "know-how" endeavour. It hopefully represents a shift from a culture of design as planning towards a culture of design as seeding (or emergence).

[43]See note 41.

2. Metadesign as Emerging Design Culture

It's a growbag culture that is needed, in which seeding replaces designing
(Roy Ascott, "The Architecture of Cyberception")

This second chapter describes Metadesign as a design culture that emerges from the context of current design theories, and as an attempt to respond effectively to the new material and existential conditions of the present world. Rather than arguing for Metadesign as an established design approach and practice, the chapter aims to produce a framework, which takes into account the context and spectrum of theories, practices, and issues that form the conceptual fabric and potential of Metadesign.

The purpose of this chapter is to compare and integrate all the approaches and viewpoints explicitly related to Metadesign. This will provide a set of design elements and possible orientations that will constitute the terrain on which to ground the theoretical and methodological proposal developed in the final chapter.

* * *

Metadesign (or meta-design) is a term that has been used with reference to art and cultural theories, and design practices since the 1980s. Describing the origins of the term and the history of its adoption, this chapter aims to produce a framework for Metadesign that takes into account the context and the spectrum of theories and practices that form its conceptual fabric.

Rather than arguing for Metadesign as an established design approach and practice, this chapter demonstrates that one single definition of Metadesign does not exist. Since the 1980s the notion of Metadesign has developed along an oscillatory trajectory, whose origins apparently lie in the etymological roots and linguistic inheritance of the prefix "meta-". Following such hypothesis, the chapter describes theories, frameworks and practices of Metadesign that have explicitly adopted this term, such as, software engineering, interface design, information design, industrial design, sociotechnical design, biotechnological design, telecommunication art, experimental aesthetics, and architecture.

The overview and integration of all the theories, frameworks, and practices of Metadesign that have been developed in art, culture, and media, leads us at the conclusion that Metadesign is neither an established discipline nor a coherent theory. It is rather the expression of concerns and intentions that can be led back to an interconnected field of meanings and concepts, composing the fabric of a consistent design culture, and as such an original response to the changes occurring in our material and existential conditions.

2.1. Etymology

The present section describes the etymological roots and linguistic inheritance of the prefix "meta-". It gives an account of its general use and conceptual implications.

2.1.1. Origins of the Prefix "meta-"

The prefix "meta-" comes from Greek. It is present in words of Greek origin and also in terms that have been minted in modern times and refer to technical or specialistic areas of expertise. The Rocci Old Greek dictionary gives three main different meanings for the prefix "meta-": *"behind/after"*, *"between/among"* and *"together with"* (Rocci, 1983). In the course of our cultural history these meanings have produced clusters of ideas and words, whose value and significance are connected to this manifold range of abstractions.

2.1.2. General Use of the Prefix "meta-"

Looking at the general and more common use of the prefix "meta-", two clusters of ideas and words are most significant. One derivative usually indicates a discipline that reflects upon its nature and limits (i.e. meta-mathematics or meta-linguistics), or an object or entity that is on a position or level of higher order (i.e. metacentro[44] or metaldeide[45]). The other derivative cluster carries values of change, transformation, and alteration (i.e. metamorphosis or metabolism).

What is interesting to notice is how both these meanings, and all those produced by the etymological roots of the prefix "meta-" have found in the term Metadesign a field of oscillatory significance. This is due to the fact that Metadesign is neither an established discipline nor a coherent theory, but instead, according to the hypothesis

---

[44]Metacentro is the point over which the barycentre of a boat cannot rise without making the boat loose stability and overturn.
[45]Metaldeide is a polymer more complex than the one whose name the prefix is added to.

of this work, the expression of assumptions and concerns that can be led back to the same field of meanings, and that are often interconnected.

A first instance of this interconnection is provided by the term "metadata", as applied in computer science. This example is particularly relevant, because more recent developments in Metadesign consider the computational substratum, on which our environment is increasingly grounded , as one of the main conditions to which they aim to respond to and exploit.

2.1.2.1. "meta-" As a Higher Order Level

In computer science, "meta-" is a common prefix whose use has turned to mean "about". For instance, metadata are data that describe other data (data about data), because they are ideally "behind" those data. On the basis of the same assumption, a meta-language is a language used to describe other languages, a metafile is a file that contains other files, and the mark <META> is a tag used in HTML to describe the contents of a web page (Webopaedia, http://webopedia.internet.com).

This use suggests the idea of a "fellow traveller". When the prefix "meta-" is adopted in computer science, it does not properly specify regular data or files, but a kind of fellow traveller that support data or files from the sidelines. According to Cathro: "an element of metadata describes an information resource, or helps to provide access to an information resource" (Cathro, 1997, p.1).

In recent years there has been a focus on metadata in relation to those information resources that can be accessed through the World Wide Web. Within this context the term is commonly adopted in order to refer to any data used to aid the identification, description and location of networked electronic resources (Cathro, 1997). Even though many different metadata definitions and formats exist, all of them refer to the intrinsic idea of something "behind" something else. This use of the prefix "meta-" expresses concepts of higher order level and reflects the same abstraction expressed by terms like meta-mathematics or meta-linguistics, that are, as mentioned above, disciplines aimed to describe or formalize the "object" of their study.

2.1.2.2. "meta-" As a Source of Transformation

The prefix "meta-" can also be adopted in computer science to focus on the capability for metadata to generate data objects, as well as being their description and enabling them to become accessible. This focus leads to the idea of metadata as a source of transformation, and highlights another main facet in the semantics of the prefix "meta-".

Metadata-based architecture, for instance, can support the customisation of data objects (Hicks et al., 1999). Knowledge workers can personalize their information space and customize the information items with which they work, by exploiting the characteristic of metadata to enable the customisation of data objects in a way that places no restrictions on where data objects are stored or by which system they are managed.

A properly generative approach to metadata is suggested when more ontological questions are addressed. Metadata enable navigation "within" or "among" complex data sets, but they can also serve to define "transformation rules" applied to data sets, and translate data sets from one code into another (Dietrich, 2000). There are no limits to how two or more data particles can relate to each other and be aggregate in data sets, so there are no limits to how code can be invented and be applied to any data sets. The capability of code to be applied to several data sets, and to produce different results determines the generative power of metadata.

This generative power of computing is artistically exploited in generative aesthetics. In Generative Art[46], for instance, the code is taken as a "concept" (like in Conceptual Art), and the "concept" (or formal instructions) is the actual material of the work. According to Tom Trevor and Geoff Cox, organizers and curators of "Generator"[47], the physical appearance or outcome becomes therefore incidental to the execution of a "plan" or notation: "as with literature, the work is primarily concerned with the uses of language, and thus not bound to objects or sites" (Trevor and Cox, 2002).

The use of the prefix "meta-" described in this section expresses ideas of change and transformation, and raises issues as diverse as information customisation and the generative power of computing.

---

[46]A clear definition of generative art is given by Tom Trevor and Geoff Cox in the curatorial statement of the exhibition "Generator", 14-19 November 2002, SPACEX at the Liverpool Biennial, http://www.generative.net/generator/: "Generative Art is a term generally used to refer to any practice where the artist creates a process, such as a set of natural language rules, a computer program, a machine, or other procedural invention, which is then set into motion with some degree of autonomy, contributing to or resulting in a completed work of art. After the initial parameters have been set the process of production is unsupervised, and, as such, 'self-organising' and 'time-based'".

2.2. Theories of Metadesign in Art and Cultural Debate

Within the art and cultural debate the idea of Metadesign was primarily approached in relation to the emergence of digital networks and biotechnologies. These frames of reference have represented two distinct backgrounds for the debate about Metadesign. The first connects telecommunication art and net art, and deals with the changes that occur in the way in which people communicate and interact. The second is grounded in the dispute between the postmodern criticism of Paul Virilio and the epistemological arguments of the biologist Humberto Maturana, and deals with the emerging possibility of designing living systems. It then finds a further development in the field of bioethics.

Both these contexts express a shared perspective about the potential convergence between art and design in addressing the challenges brought about by digital networks and biotechnologies. Within both these contexts it was art that triggered the debate, and a common element is represented by the concern on the ethical implications of design.

2.2.1. Metadesign and the Communication Revolution

Moving from a post-modern concern about communication and its connection to art, Gene Youngblood[48] writes about Metadesign in 1986. In this paper, written on the

---

[47] "Generator", 14-19 November 2002, SPACEX at the Liverpool Biennial, http://www.generative.net/generator/.

[48] Gene Youngblood is a theorist of electronic media arts, and a scholar in the history and theory of experimental film and video art.

occasion of the Ars Electronica Festival[49], in a year that opinions about computer culture became reflexive and proactive (Leopoldseder et al., 1999), he explicitly uses the term Metadesign. He addresses it, arguing Metadesign to be the only reasonable strategy in order to instigate a revolution in the communication world (Youngblood, 1986).

Art, communication, and politics

According to Youngblood, Metadesign deals with "the creation of context rather than content". He maintains that telecommunications networks and computer programmes are instances of Metadesign, and they constitute a chance of change. They represent a chance for freedom and creativity, because: "control of context is the control of meaning, and without control of meaning there can be neither freedom nor creativity" (Youngblood, 1984). They represent also a chance for learning, as this is an experiential process like creativity is (Youngblood, 1984).

In his method of addressing Metadesign, Youngblood shares with postmodern thinkers the criticism of an idea of communication as trade and consumption of information as a process of information acquisition and distribution, induced by computerization and separated from the process that can inform human culture (Lyotard, 1979). Thus, he argues that only Metadesign can give rise to new social situations, and provide access to alternative experiences. Taking up the original positions of the Avant-garde, Metadesign can lead to redefine art and develop autonomous "reality-communities", conceived as social groups of politically significant magnitude that constitute themselves as communities through telecommunication networks. Such

[49] Since the 1980s the Ars Electronica Festival at Linz (Austria) is one of the most important venue for

communities are not defined by geography, but by consciousness, ideology and desire (Youngblood, 1986), and therefore they are able to control and manage their own context with considerable political consequences.

Metadesign, according to Youngblood, can reconcile art and politics, since it empowers art to be politically effective. Even if metadesigners work within the cultural context, and they don't bring forward political issues, the act of empowering electronic communities to control meaning and context is a revolutionary act.

An extra-aesthetic strategy

According to Youngblood's perspective, Metadesign is essentially an extra-aesthetic and supracultural strategy. It is a mode of setting actions capable of creating environments in which people may control the context of their cultural and aesthetic production. The power of Metadesign, as a strategy, relies on exploiting the essence of communication revolution. Such an essence, according to Youngblood, is not about technology, but about possible relations among people (Youngblood, 1984).

From here an ethical imperative for artists is derived. Telecommunications represent a hope of effectively addressing the profound social and political challenges of our time.

The rise of electronic networks

Youngblood's perspective on Metadesign finds a place within the intellectual debate on post-modernism, and its criticism of notions of communication as information-

---

artists and theorists involved in cyberarts (look at http://www.aec.at).

driven and sanitized. But it finds a place also within the artistic debate produced by the rise of electronic networks.

As many artists at that time, he sees in electronic networks the possibility for an overcoming of the broadcasting style, and of a centralized and hierarchical mass culture:

> At a time when creative conversations are essential on a massive scale for human dignity and survival, our society is dominated by a centralized, one-way, mass audience communication system that can only speak a world that is already understood to be the world, can only address problems already understood to be problems, can only furnish models of behaviour that are compatible with the world as it is already perceived by most people most of the time (Youngblood, 1984, p. 8).

Conversation, not transmission, is the paradigm for any generative phenomena, the pre-requisite for any creativity, and it requires a two-way channel of interaction. It is what Youngblood calls "creative conversation".

The ethical imperative

The theme of overcoming linearity in communication as a system of transmission is an issue that was highly debated within the community of the artists involved in early telecommunications experimentations (Popper, 1993). The discussion focused not only on themes of accessibility and distribution of information, but rather on the possibility for autonomous activities of content creation and emergence, which can be made achievable by computational and networked processes within purposefully conceived environments ("metasystems").

Furnishing communities with alternative models for the development and exploitation of networked technologies, as a central instrument for the social construction of their own reality, becomes an ethical imperative. Most telecommunication art projects, at the beginning of the 1980s, are instead more concerned with broadcasting contents rather than allowing new contents to be produced or to emerge (Gidney, 1983):

> ...they have been either routine applications of satellites for teleconferencing, or the equally standard use of computer, videotex and facsimile networks for "exchange of work, information, and ideas", or they have been broadcast events that delivered personality-oriented Art Star performances to cable TV subscribers or audiences gathered in museum auditoriums (Youngblood, 1984, p. 1).

Connections

Youngblood's idea of "creative conversation" is connected to the study of the new forms of creativity enabled by computational processes and network activities that developed particularly between the 1970s and the 1980s. Instances of such investigations can be found in the statements of artists like Michel Bret and Roy Ascott. In the field of computer art, Michel Bret strongly maintains the difference between computer and traditional tools (Popper, 1993). He claims that traditional tools allowed visual artists to work on objects only, whereas computers now lead them inside the processes and sources of creativity. In his defence of a processual art, Bret considers new technologies as something more than new tools. Roy Ascott, a pioneer in the field of telematic art, also argues that new technologies establish new relations between human beings within the creative process, and implicitly create a new visual language (Ascott, 1988; 1991).

However, before the arrival of computer and digital networks the aesthetical object had been already replaced by tensions of immaterial fields, and by biological and vital energies (mental, muscular, emotional), or artificial and mechanic ones (electric or electronic) within the field of communication art. This substitution transforms our space-time perception from one focused on a distinction between "subject" and "object" into one no longer defined by a rigid opposition "self" - "other", because "subject" and "object" become part of the same flow of energy.

Youngblood's idea of Metadesign is hence the result not only of an understanding of the new sociotechnical conditions brought about by networked computing, but it is also part in the ongoing artistic debate about how to deal with, and how to exploit these new sociotechnical conditions.

The experience of Mobile Image

The electronic environments, collaboratively designed by Kit Galloway and Sherrie Rabinowitz in Mobile Image, and as co-founders of Electronic Cafe International (ECI)[50], are an instance of Metadesign (Youngblood, 1984). Looking at them it is possible to point out some further issues and themes of Metadesign.

"Environmental design"

In order to trigger a communication revolution, architectures of electronic space are necessary to establish the contours of desire and determine possible relations among

[50]The Electronic Cafe International Network was a laboratory for telecollaborative arts and sciences. It was founded in 1984, and born as a project originally commissioned by the Los Angeles Museum of Contemporary Art for the 1984 Olympic Arts Festival in Los Angeles. The original projects was a real-time, multimedia computer/video network and public image bank that interconnected five different ethnic neighbourhoods in Los Angeles for seven weeks during the Olympics in July and August 1984. The laboratory closed in 2000. For documentation, look at http://main.ecafe.com/index2.html.

people (Youngblood, 1984). According to Galloway and Rabinowitz this is a matter of "environmental design":

> We see communication and information systems as environments people live in. So we look at the aesthetics of that environment, the shaping of the space. The way you shape a space determines what can happen to the information in it (Youngblood, 1984, p. 2).

Human scale and cultural continuity

Another theme is introduced by the issues of human scale and cultural continuity. According to Youngblood, none of the current technological developments or consequences is on the human scale any more. In order to lend human scale to phenomena that work outside those boundaries, Galloway and Rabinowitz employ large-scale technologies "to sculpt space/time". This attempt is associated with that of warranting cultural continuity, by "re-entering" rituals and myths in purely technological progress. Say Galloway and Rabinowitz:

> The movement is towards the control of a meaningful context, creating environments not just to support art, but that create the possibility for new scales of creativity across all disciplines and boundaries. [...] Consider: co-creating non-imperialistic, multi-cultural or domestic agendas for community or global scale aesthetic endeavours. Consider: the continuous re-invention of non-hierarchical telecom networks that will allow people to bypass cultural gatekeepers and power brokers. We must accept these kinds of challenges and recognize what can be gained by solving them (Galloway and Rabinowitz, 1984, p. 1).

Role of the artist (or metadesigner)

Another relevant theme is the role of artist. Artists (or metadesigners) are conceived as systems integrators, who work innovatively at the edge of art and must therefore actively interface a multiplicity of tools, services and institutions to realize the non-standard goals of their enterprise. They work as facilitators, establishing collaborative relationships. The counterpart of this theme is the "participatory approach" that artists must apply as an element of their design methodology.

The theme of systems integration was particularly relevant in Electronic Café, which represents the integration not only of hardware and software systems, but most importantly also of social systems, members of the ethnic neighbourhoods that Electronic Café intended to connect, and that collectively designed the virtual environment they were to occupy. The members of these communities (or social systems) included artists, educators, children, computer buffs, and host restaurateurs. Galloway and Rabinowitz began meeting them seven months in advance in order to "seed" the network and build it in a manner which was open to participation. According to both Youngblood, and to Galloway and Rabinowitz, this participatory approach was as much the point of Electronic Café as it was the network itself.

Autonomous-reality communities

The last theme concerns the idea of "autonomous reality-communities". They are conceived as social groups of politically significant magnitude that constitute themselves as communities through telecommunication networks:

> ...when computer is introduced as a component of a conversational network the power of social organizing is entered; a perpetual universe is created, independent of transmission, and a new class of political entity becomes possible - autonomous reality-communities that are historically continuous and environmentally pervasive, accessible through any computer terminal anywhere in the world (Youngblood, 1984, p. 8).

The idea of a sociotechnical system, like the one developed by Electronic Café through the participatory design of the virtual environment people were going to occupy, concerns this issue.

The Electronic Café project

The Electronic Café was considered a "metadesign", optimised to cultivate creative conversations and to support autonomous communities. It was a telecommunications system characterized as an accessible, flexible, end-user modifiable (in terms of files, archives, and environment), pervasive, anonymous, and visual components based system. Youngblood describes it thus:

> They [created] a structure that allowed its users the greatest possible freedom to design and control their own information environments, to construct their own realities. Such a system [had] to include as many modes of communication as possible to support the maximum richness, variety and texture of cultural expression; at the same time, it [had] to facilitate the most natural and simple forms of human interaction, requiring of the user no special knowledge or skills; finally, it [had] to operate as a "public utility" whose terminals were all in public places so that personal equipment would not be required and transactions could be anonymous - the information environment as commons rather than commodity, equally accessible to everyone (Youngblood, 1984, p. 9).

Consisting of a multimedia telecommunications system that included a user-created database and image bank, Electronic Café was far richer in possible modes of expression and interaction than any communication system that had ever been available to the public at that time. Incorporating fully interactive computer text, handwriting, drawing, animation and slow-scan video, with the ability to interactively combine these elements, it leapt a decade ahead in the anticipated convergence of data and image networks. The software used, originally developed by Lee Felsenstein and his colleagues for the electronic bulletin board Community

Memory, allowed each user to have full interactive access to the database, including the ability to contribute to it on an equal basis[51].

The visual component of the environment determined first the transcendence of barriers of literacy and language; second, the projection of personality into electronic space with far greater resonance than is possible through alphanumeric transactions alone. Moreover, the presence in the network of visual artists enriched the vocabulary accessible to all users. As a result, users were exposed to refined aesthetic sensibilities in a direct, experiential manner, that is to say by being in the world in the same way. "It's a kind of spontaneous encounter that can't be engineered or marketed", Rabinowitz observes (Youngblood, 1984).

An interview with Kit Galloway

In a recent interview[52], Kit Galloway says he is indebted to Gene Youngblood in providing him and Sherry Rabinowitz with a language that can help to distinguish their trajectory and intentions as "new practitioners" in the time that went from the mid-1970s to the conclusion of the Electronic Cafe International Network in 2000:

> We can delight on our contribution to the definitions of metadesigner. However, we ourselves, who are notorious for our disinterest in the discourse among artists, would not be so presumptuous to call ourselves metadesigner. We're just early practitioners that have been too impatient to wait around to be informed decades later (Galloway, personal communication).

---

[51]The Electronic Cafe '84 Network included: The Gumbo House, Crenshaw, CA., (South Central LA); Ana Maria Restaurant, (East LA); The 8th Street Restaurant, (Korea Town) LA; Gunter's Cafe, (beach area) Venice, CA., The Museum Of Contemporary Art (The Temporary Contemporary), Downtown LA.

[52]All the following quotes are from the interview given by Kit Galloway to the author in an email dated 22 October 2002.

In fact they started to call themselves "Avantpreneurs", to mean one who attempts to creatively animate, model, and approximate desirable contexts before commercial entrepreneurs come in and serve everything up to paying customers, consumers, or end-users. By being immersed into the larger context of the public spheres, and informed by the intrinsic implications of technology as an encapsulating and encompassing environment/context, their aesthetic inquiry challenged a discourse with the more relevant context creators within industry.

According to Galloway, what metadesigners try to do is "to keep challenging and changing the context until its utility as a context serves humanity for the maximized good" (ibid). We are either producers or consumers, he says. However, when we are consumers, we are hardly in the position to be architects of how we want our world to evolve. So we need to create an open systems environment that people can evolve from being consumers and end-users to becoming architects of their own destiny: "we need to move from a top-down fossil fuels economy of consumers to a bottom-up hydrogen economy of producers/consumers" (ibid).

This is the role of artists in a society determined by technology:

> Yes, this is an expanded and augmented role distinguishable from the traditional role of simply going about revealing beauty, and requires an activist role in order not to reduce the role of the artists to one that simply crates ornaments and precious object for the controlling context of its time (Galloway, personal communication).

Nonetheless, Galloway confesses to have experienced a sense of frustration during this period of net artists and cyberart educators, which reflect on the last ten years "as if everything has been going great thanks to the discovery and convergence of interactive art and the net" (ibid). He claims:

> Now artists and the new discourse have discovered, celebrate, and ponder the loss of the body, the death of the author, the role of the participant in completing the "work". [...] Now, artists aspire to leave their baggage and hitch up their post-modern version of a prairie schooner to join the virtual land rush into unclaimed territory inclusive of every trajectory they can identify. [...] Yet the results of this research proves that the art world was incapable of envisioning little more that a technological potential for disseminating conventional art product, art as content, or the artist as subject (ibid).

His hope is that in the future, when a truly new generation of metadesigners will emerge, much will happen without any knowledge or concerns about art and its legacy:

> An important aspect of what might be called the avant-garde will disappear underground in order to accomplish important work, and will choose when and if they want to reveal themselves. Important work will not be found in art shows and art galleries (ibid).

2.2.2. Metadesign and the New Ecology of Networks

The idea of Metadesign is addressed again in the middle of the 1990s, in conjunction with the establishing of the World Wide Web as new communication protocol for the Internet, and the emerging phenomena of online art and virtual communities. On the occasion of early exhibitions of interactive art like Ars Futura and Arslab, Derrick De Kerckhove, Marshall McLuhan scholar and director of the McLuhan Programme in Toronto, argued that Metadesign is one of the major characteristics of online art that lies within the territory of interactivity (De Kerckhove, 1995a). His definition of Metadesign is:

> Metadesign [...] is the kind of design that puts the tools rather than the object of design in your hands. The better interactive systems are not those which define the process, but those which define the conditions for the process of interaction (De Kerckhove, 1995a, p. 107).

Webness, Metadesign, and online art

In De Kerckhove's argument, Metadesign is associated with another major characteristic of the emerging form of art that he names "Network Art" (later generally referred to as Net Art), and that he defines as an artform using the Net itself as a prime material (De Kerckhove, 1995a). This other major characteristic, from which Metadesign derives, is called Webness, and according to De Kerckhove it means that "the artform uses the Net for its interactive properties rather than simply as a vehicle for promoting content" (De Kerckhove, 1995a, p. 106).

Artistic and social potential of the Web

Following De Kerckhove's standpoint about online art, the jury of the Prix Ars Electronica[53], always attentive to the relations among art, culture and society at large, established Webness and (implicitly) Metadesign as a worthy quality for ".net projects" in 1995.

De Kerckhove's ideas deeply influenced the debate over the artistic and social potentials of the Web, and contributed to its spreading. Metadesign is here addressed by De Kerckhove in relation to art, and art is seen as a counter-force able to balance the destabilizing effects of new technologies on culture, and also to counterbalance

[53]Prix Ars Electronica is linked to the annual Ars Electronica Festival. It is an international competition that awards honorable art project in the fields of cyberarts (from interactive art to net art, computer animation, and digital music).

market forces, which tend to prevail whenever technological innovation reaches the point beyond which it cannot be controlled by any social entity any longer (De Kerckhove, 1995a; 1996, 2000). While other studies have led to less humanistic and more "machinic" results (dismantling the centrality of human agency or the linear equation drawn between art and its beneficial effects on society), nonetheless the idea of Webness and Metadesign have permeated, directly or indirectly, most of the practices based on computer networking meant to explore interactive processes of creation.

From art to business

But Derrick De Kerckhove's definition of Metadesign matches also some issues of dematerialization at stake in the passage from "object" to "process" within the design field (see 1.2.). This passage seems to be brought to completion by the Internet, and in the business field it produces new relations between firm, client, and new services.

In developments of the concept of Metadesign beyond those of his first essay in 1995, De Kerckhove shifts from the analysis of the potentialities of online art, and the virtual communities that can stem from it, to the study of new design models made available by the new economy of networks. Starting from the acknowledgment of a transition from an age of broadcast technologies to one characterised by a networked global environment, and speculating about a possible and desirable ecology of networks, De Kerckhove asks himself whether Metadesign can face this new scenario and the drying up, in his view, of the vanguard strength of artistic experimentation (De Kerckhove, personal communication)[54].

From Metadesign to Cyberdesign

Cyberdesign becomes synonymous with Metadesign when applied to the business sector (De Kerckhove, 1995b; 2001). Rather than focusing on the potential that Metadesign holds opening up socio-technological systems, De Kerckhove seems to focus on the concrete design possibilities provided to the user by current networked technologies. In De Kerckhove's more recent essays, Metadesign is seen as a utopia that is fading away with the weakening of the artistic experimentation's boost, whereas cyberdesign represents what new technologies can offer to the user.

The universal access now provided through the Internet shifts the control of information and communication from the commercial producer/broadcaster to the user or "prosumer"[55]. The author predicts that ordinary people will go from passive receptivity ("couch potatoes") to power positions whereby they become "couch guerillas", producing content specific to their needs. In this new context the changing value system becomes one that is supportive, collaborative and interactive. The prosumer, empowered at the desktop level, customizes his or her world using cyberdesign, that is to say accessing and influencing consumer markets across the boards (De Kerckhove, 1995b).

---

[54]All the following personal communications are from the emails exchanged by Derrick De Kerckhove with the author during the course of 2002.

[55]Alvin Toffler first used the term "prosumer" in his book "The Third Wave" in 1980. Here he foresees a new future consumer that is involved in the design and manufacturing of products on the basis of individual specifications. According to Toffler, this kind of products personalisation would overturn the role and idea of the client in the process of production.

The concern of De Kerckhove is that only by designing our technologies, instead of letting them design us, we will be able to avert social catastrophe.

Prosumer, end-user and mass customisation

Representing, in this sense, a network model of design, Metadesign allows the end-user to take charge of the final design:

> Interactivity has also changed the processes by which we design content. While design used to be the prerogative of the producer imposing his or her vision on the service or the product to be sold (the "broadcast" model of design), the availability of new hardware and software tools to assist individuals in designing their own products is pushing the limits of design to the level of "meta-design". Meta-design is the design of tools, parameters, and operating conditions that allow the end-user to take charge of the final design. This is the "network model" of design. In a truly interactive environment, the advantages of meta-design are handed over the end-user, with support and coaching from the provider. (De Kerckhove, 1997, p. 10).

According to De Kerckhove Metadesign (here "meta-design") is a non-linear and non-hierarchical design model that puts the focus on the end-user. To Youngblood, it lies in a software and hardware technological substratum represented by computing networking, and in both cases it constitutes an alternative to broadcasting models[56]. De Kerckhove also makes equal the material plan of designing and producing artefacts and the cultural plan of generating contents, but unlike Youngblood, Galloway and Rabinowitz he parcels up the community in a myriad of end-users. According to De Kerckhove the possibility for end-users to customize their final world lies mostly on computer-assisted tools that allow them to have complete control on the most important design decisions in every area and sector, thus becoming partner

---

[56]It constitutes an alternative to broadcasting models both in communication (Youngblood) and design (De Kerckhove).

in industry (De Kerckhove, 1997). This is a view of Metadesign as mass customization, which means, as De Kerckhove argues in an interview to Blake Harris, that the user has infinite flexibility of tailoring the product, and that the client becomes the product in some ways (Harris, 1996). Metadesign allows the client to be a partner, and according to De Kerckhove the idea of partnering with a client is the future of network business.

In a new ecology of networks Metadesign is supported by three underlying conditions: "interactivity", "hypertextuality", and "webness" or "connectedness"[57] (De Kerckhove, 1997). These conditions are the premises for Metadesign as a powerful alternative to broadcasting models and approaches in art, communication, and design as Youngblood, Galloway, and Rabinowitz also maintain. Differently from these theorists, the idea of Metadesign seems to be actualized by De Kerckhove in the form of an end-user tailoring and mass customisation based on the ideal and possible partnership between users and business enabled by networked technologies.

2.2.3. Metadesign and the Technomorphisation of Society

Paul Virilio refers to Metadesign with a negative inference (Virilio, 1995), as the way the media have invaded our minds and mental schemes. He thinks of Metadesign as a neurological form of design, a kind of framing of the brain by information processing directed at human consciousness and perception. According to Virilio, Metadesign

[57]"Interactivity" is the physical linking of people or communication-based industries; "hypertextuality" is the linking of contents or knowledge-based industries; "webness" or "connectedness" is the mental linking of people or the industries of networks.

regenerates the impulses of neural transmissions in a living subject and thus creates cognitive ergonomics.

An effect of technomorphisation

According to Virilio Metadesign is a deeply embedded effect of "technomorphisation" of society, and it means the reorganisation of the organic according to the model of intelligent machines. In agreement with Kuhn (Kuhn, 1962), Virilio argues that human evolution has entered into the biological paradigm. But according to his perspective this means a phase of human evolution deterministically driven by the technomorphisation of the organic. He argues that human beings no longer develop through natural processes, but that the human body is being adapted to the absolute speed of electromagnetic waves by means of technological parameters. According to Virilio all sorts of information processing technologies constantly frame our brains, and each technology tries to design a new and consistent interpretatory pattern for the brain. He calls this process of adaptation to electronic media as "metadesign".

His use of the term Metadesign apparently does not share any conceptual link with Youngblood's and De Kerckhove's positions. Moving from a different and more apocalyptic understanding of postindustrial practices and changes induced by new technologies, his use of the word recalls the etymological root according to which "meta-" is linked to the idea of a higher level order, hidden and invisible.

Inside and outside

With respect to Youngblood and De Kerckhove, Virilio contributes to the issue by connecting Metadesign to emerging biotechnologies. Addressing Metadesign from this perspective, he leads to a merged notion of "inside" and "outside" in relation to buildings, bodies and communication spaces.

According to Virilio, nanotechnological developments[58], and more generally the phenomenon of hybridisation of natural and artificial elements, all contribute today to the Metadesign of human beings. He argues that postindustrial design is more closely related to a process of "miniaturization" resulting in a kind of colonization of organs by bio- and nanotechnologies (Virilio, 1995), than to a process of dematerialization.

Granularity and malleability

According to Virilio, Metadesign is neither a cultural strategy nor a possible design methodology, but rather it has to do with the emergence of information as a physical factor of matter, which made it possible for cybernetics to realise the ultimate fragmentation of space and time, and thereby of human existence.

Metadesign deals with information granularity and malleability, and with processes that make information become the only relief of reality, its only content. From Virilio's standpoint Metadesign is simply an effect, a process we passively endure as a consequence of "dromology"[59] and in the form of a "disappearance"[60], rather than being a way to critically and creatively redefine our ontological and social fabric.

---

[58]They consist in the integration of chemistry, physics, and engineering.
[59]"Dromology" is the science and study of speed. Here it is a synonym for the speed and acceleration produced by information technologies.
[60]According to Virilio, reaching speeds that are faster than the speed of light, civilization enters to the territory of beyond the line that defines. It is a "disappearance" of horizon, meant as a visual metaphor for the balance of human with its environment, that questions the very nature of visibility as invisibility.

A deterministic approach

Moving from a personal and critical belief on postmodern man's inertia (Virilio, 1995), Virilio fears the deterministic consequences Metadesign (in his own conception) can have on human bodies and existence, and on human society at large. According to his theory there is no possibility of controlling the conditions of our enactive processes because what lies at the heart of the organization and transformation of the contemporary world are not human beings, but the logic of an increasing acceleration.

This perspective leads to a negative understanding of Metadesign. Metadesign does not allow new social or commercial relationships between people, but it alters our brain and our body forcing us to match the rhythm of information. It is not a chance for a reconstruction of meaning, but a physiological reconstruction on which human beings have no control. According to Virilio, Metadesign is a new form of design that is:

> ...no longer concerned with giving form to the structure or infrastructure of an "industrial" object. It now wants to regenerate the impulses of the neurotransmitters of the living "subject" (Virilio, 1995, p. 105).

According to him, Metadesign is the design of the subject instead of the object, or the design of the subject as if it was an object. It is a sort of "human design": "the training of conditioned reflexes, the metadesign of our conceptual and perceptual faculties" (Virilio, 1995, p. 113). By means of Metadesign:

> ...the reign of the computer will at last catch up with the patient's body, underneath his clothes, his uniform, thereby achieving a new type of "underclothing" in which the smartening up of our nervous system

> will supersede the design of the consumer object of the waning industrial age (Virilio, 1995, p. 113).

According to Virilio, the question of what will happen to design, or more precisely to postindustrial Metadesign finds its answer in this technical and post-evolutionary fundamentalism.

Although the relevance of the political implications of Virilio's approach to Metadesign, seen as "the latest figure in a process of domestication which, having genetically altered animal species and socially conditioned human populations, now heralds the age of personal components" (Virilio, 1995, p. 100), his basic assumptions were to be harshly criticized by Humberto Maturana.

2.2.4. Metadesign and the Design of Living Systems

Humberto Maturana's criticism

A few years later, the neurobiologist Humberto Maturana vehemently opposed Virilio's position on Metadesign (Maturana, 1997a; 1997b). According to Maturana, there is no doubt that, as structure determined systems, we exist through our structural dynamics. There is no doubt that, in the same way as dynamic structure determined systems, we exist in a continuous structural change and that our structure can be manipulated intentionally in order to obtain some voluntary consequence in our living. In this sense it is true that we are machines, molecular machines, but our human existence, our human identity, does not reside in our structure[61]. According to Maturana, we exist as human beings or as systemic entities

---

[61]This statement is valid for any machine, because a machine exists as a totality in a relational space.

in a relational space under continuous structural change. Furthermore, we are human beings only as long as we participate in the systemic dynamics in which we grow, and we remain human beings for the fact that we live inside a human society.

Thus, Maturana argues that we cannot be genetically predetermined. Disagreeing with Virilio, he states that biological evolution is not entering a new phase with the growth of technology and science. He believes that the evolution of human beings is following an increasingly defined course depending on what we choose to do, in spite of what we produce through science and technology.

A creative opportunity

Maturana's criticism of Virilio's deterministic approach to biological evolution and human design, contributes to Metadesign by producing the concept of a biological and social "being-in-between" ("meta-" as *among/between*). Like Youngblood and De Kerckhove, Maturana views Metadesign as a creative opportunity, and not as an inevitable effect:

> Many people seem to think that evolution is changing its nature so that technology is becoming the guiding force in the flow of the cosmic change in relation to us. I do not hold this view. I do not look at progress, science or technology as if they were values in themselves, nor do I think that biological or cosmic evolution is changing its nature or character (Maturana, 1997a, p.1).

His position is scientifically grounded, and profoundly ethical:

> The question we must face is not about the relation of biology with technology, or about the relation between art and technology, nor about the relation between knowledge and reality, nor even about whether or not metadesign shapes our brain. I think that the question that we must face at this moment of our history is about our desires and

> about whether we want or not to be responsible of our desires (Maturana, 1997a, p.1).

A relational space

The rejection of Virilio's predeterminism is based on the acknowledgement that in a living autopoietic system [62] there is no causal relation among domains of existence. That is to say, between the domain of composition of living autopoietic systems and the medium where they arise and exist as totalities in recursive interactions. This relationship is mutually generative, whereas Virilio's definition of such relations are linear and causal:

> What the observer sees, is that the structural changes in the domain of composition (anatomy and physiology) of a living system result in changes in its dynamic configuration as a totality, and therefore in changes in the manner in which it interacts with the medium, and that interactions of the living system with the medium trigger in it structural changes in its composition which result in turn in changes in the configuration of the living system as a totality (Maturana, 1997a, p.2).

It is not a causal relation between the "bodyhood" of a living system and its manner of operating as a totality, but a flow that dynamically interlaces different domains of existence and through which, as a form of recursive interaction, they modulate, but do not determine each other. Says Maturana: "all systems that interact with a living system constitute its medium", and "all systems in recursive interactions change together congruently" (Maturana, 1997a, p.3).

Language, emotion, and culture

---

[62]See (Maturana, H. R., & Varela, F. J.,1987). According to Maturana and Varela, a living system is a molecular autopoietic system. As a molecular system a living system is open to the flow of matter and energy. As an autopoietic system a living system is a system closed in its dynamics of states in the sense that it is alive only while all its structural changes are structural changes that conserve its autopoiesis.

This link is also true for human beings as living systems. Language and emotions, at an even basic level, are for people their manner of existence as human beings. Emotions are the domain of our relational behaviours. This means that when we change emotion we go from one class of relational behaviours to another. The consensual braiding of language and emotions is called by Maturana "conversation" (Maturana, 1997a), and forms what is considered to be the basis of human culture.

Maturana maintains that it is true that we are "structurally coupled" to our medium through historical dynamics of coherent structural changes. As human beings we are "structurally coupled" to the culture in which we live and in which we realize ourselves as human beings. He also recognizes that it is true that in this way we become transformed in our bodyhoods. This process takes place in the course of history, according to the human identity that arises and is conserved in that culture. However, he also highlights that as human beings that live through conversation we are "reflective beings". Here we can pinpoint Maturana's criticism about our specificity as human beings and our capacity of choice. He argues:

> ...as we become aware we may choose the course that our living follows according to our aesthetic preferences, and live in one way or another according to the human identity we wish to conserve (Maturana, 1997a, p.4).

An interesting element of criticism to the postmodern inertia lamented by Virilio is in the passage where Maturana points out:

> ...we use different technologies as different domains of operational coherences according to what we want to obtain with our doings, that is, we use different technologies according to our preferences or desires (Maturana, 1997a, p.5).

If we look back in the past, we can see that the technological advances our ancestors made were related to changes in their desires, taste, or aesthetic preferences, regardless of how their manner of living was later altered. If we want to grasp the meaning of our cultural existence, first we have to understand the emotional motivations of our actions. Otherwise, we will be trapped in the belief that human conflicts and problems are only rational and that they could be solved merely through reason, a source of disorder. Says Maturana:

> ...since our emotions specify the relational domain in which we are at any instant, it is our emotioning what defines the course of our individual living as well as the course of our cultural history, not our reason (Maturana, 1997a, p.10).

The technological issue

Therefore the question is not how far our nervous system can be stretched, or whether robots could be autopoietic systems. Because of the dynamic nature of the structural coupling between a body and its medium, every new dimension of structural interaction that couples with the flow of structural changes of the nervous system can become a new sensory dimension, and expand the behavioural space of the organism.

Thus, according to Maturana:

> ...technology can be lived as an instrument for effective intentional action, or as a value that justifies or gives orientation to a manner of living in which all is subordinated to the pleasure lived through doing it (Maturana, 1997a, p.9).

Biotechnology has neither expanded our understanding of living systems as systems, nor has it expanded our understanding of ourselves as human beings. Maturana argues that biotechnology has interlaced with the belief in a "reductionistic genetic determination", and with a "mercantile culture" that permeates all dimensions of our psychic existence and it obscures our view of ourselves as living systems. According to Maturana, Virilio shares the same belief and so do any who consider that a type of deterministic human design is possible.

The issue of reality

As far as the issue of reality is concerned, we must be aware, says Maturana, that it is the notion of reality that is changing, and not our relationship to it. On this basis, Maturana maintains that a flow of shifting human realities is possible, because it does not matter how our biological living is conserved as long as it is conserved. In this way, transformations in the basic reality in which we exist are made possible because changes in the structural coupling evolved through design. We are now able to artificially stimulate new dimensions of interactions for an organism. In fact:

> ...reality is not energy, not information, however powerful these notions may appear to us in the explanation of our experiences. We explain our experiences with our experiences and with the coherences of our experiences. That is, we explain our living with our living, and in that sense we human beings are constitutively the fundament for all that exists, or may exist in our domains of cognition (Maturana, 1997a, p.11).

Reality is then the domain of our cognition and our choices in a relational dimension that is never of a deterministic and linear kind, but always relational and generative. In this dimension the role played by our emotions, what Maturana calls "emotioning", is fundamental for our choices and our evolution as human beings.

Aesthetic experience and creative act

According to Maturana it is not a matter of technology or reality. All depends on what we want, on "what we choose to do in front of the pleasures and fears that we live in our enjoyment or distaste of that which we produce through science and technology" (Maturana, 1997a, p.10).

Maturana states that it is instead an aesthetic issue. Aesthetic experience, conceived as relational experience, intertwines with our social existence and our technological present at all times. Different technologies open and close different relational dimensions, offering different possibilities for social and non-social coexistence and, to artists, different possibilities to create the relational experience that he or she may want to evoke.

> In all cases, though, whatever he or she does, the artists will be a participant creator of some virtual reality that may or not become a grounding reality in the course of human history. The artist is not unique in this, of course. We all human beings, and regardless of whether we are aware of this or not, are co-creators in flow of the changing realities that we live (Maturana, 1997a, p.13).

It is a design process in which not only artists, but all human beings are, in some way, consciously involved.

> The medium is always a domain of possibilities that can be used with great or little knowledge of what can be done with it, but it is always a matter of dedication and aesthetics whether or not to use it at will (Maturana, 1997a, p.13).

In conclusion, Maturana argues that we frequently speak as if the course that human history is following was independent from us as individual human beings, and as if powerful forces carried us beyond our control. To the contrary, Maturana states that reality arises through our "emotioning", and if we want change we need a "cultural change", a dynamic "work of art" in the domain of human existence. According to Maturana, whether this is utopia or not, all that matters is that we act responsibly and creatively. Dismantling Virilio's assumptions, on the one hand Maturana lays epistemological foundations for Metadesign and for any study concerned with "human design". On the other hand he implicitly opens the domain of Metadesign to the manner of our very existence.

Further contributions

The concept of Metadesign as addressed by Maturana comes back in recent argumentations about biotechnology and bioethics. Considering the transformations that emerging biotechnologies seem to determine in our basic notions of "body", "nature", and "humanity", it follows that a bioethics capable of accommodating such transformations should itself be adaptive and flexible. It should address the question of ethics in relation to the design of living systems rooting the question, as Maturana suggests, in the dynamic embodiment of human subjects as both subjects and objects of design processes (Thacker, 2002).

According to Maturana anything can be designed, once the structure of a system is understood. But this is not an issue of technologization, argues Thacker, rather is an issue of integrating ethics with design, or better "bioethics" with "metadesign". As maintained by Maturana and Thacker the question of ethics, e.g. "what do we want for ourselves?", seems to be indissociable from the question of design, e.g. "what can we make?". In this sense Metadesign involves a reflexive thinking about design, meant here as a bioethical endeavour:

> Maturana's point in bringing up the concept of metadesign is a broader, technoepistemological one: that "we" living systems need to consider human ethics in relation to technology and design activities (Thacker, 2002, p. 10).

Maturana's arguments about Metadesign are a challenge not only to rethink technology, but also to rethink human-technology relations themselves. The question is: can the thinking about design also require us to think about design outside of traditional human-tool categories? In relation to living systems, can design be thought outside of anthropomorphism?

Biomedia, bioethics, and metadesign

The idea of "biomedia" developed by Thacker is more radical than Maturana's view about technology. According to Maturana, the recursive of technology folding back on the human is technology reconfiguring the human. In biomedia, by contrast, technology does not "do" anything to the human, but rather it is seen to exist in the biological itself.

At the level of both cultural discourse and policies, the traditional background of bioethics is related to the idea of a general or specific law. Critiquing Kantian bioethics, Thacker's discussion moves beyond questions of how moral actions can be universally valid, whilst still paying attention to the specificities of particular situations. According to Kant, the "ethical" component of the categorical imperative resides in neither subjectivity nor embodiment, but rather in the capacity of reason to be actuated in a will that is expressed in the "ought" of the imperative. On the other hand, if we look at Deleuze's Spinozism, Thacker says, we can develop a different approach to bioethics, and outline a long-term polyvalent "opening" of possibilities for ethical thinking. In this way ethics can become much more than the prescription of protocols, and becomes an inquiry into the meaning of the human.

For bioethics, ethics is inextricably linked to morality, to moral law. If bodies are discrete, quantified objects (the medicalized, patient body, the anatomical body, the body constituted by its parts or by DNA), then the ethics will be one in which treatments, manipulations, and controls of those object-bodies will be prescribed. Bio-ethics (with the hyphen) is instead an "ethology", an account of how bodies affect and are affected by other bodies:

> In Deleuze's Spinozism, bodies are primarily defined according to their affects (their capacity to affect, their capacity to be affected). First, we shift from approaching bodies as objects, to approaching bodies as relations. Second, we shift from assuming bodies to be congruent with subjects, anatomies with persons, and move towards considering bodies as "relations of composition" or "relation of decomposition" (Thacker, 2002; pp. 5-6).

The following table establishes a comparison between bioethics and bio-ethics, highlighting their differences:

Figure 1. A comparison between bioethics and bio-ethics (Thacker, 2002).

Kantian / bioethical	Deleuzian-Spinozist / bio-ethical
The individual (the juridical subject)	Modes of individuation (cell, person, society)
"Body" (medical-anatomical; physical; mechanistic; anthropomorphic)	"Body" (relations of motion/rest, speed/slowness; capacity to affect/to be affected)
Subject/object (mind/body); juridical model (accountability; rational decisioning)	Parallelism (power relations); affective model (embodied interactionisms; "know-how")
Ethics + morality	Ethics vs. morality
Good/Evil	Good/bad
Moral law (categorical imperative)	Ethology (modes of existence)
Universal, necessary, causal (Kant)	Immanent, relational, contingent (Spinoza)
Security, prevention, negativity (military-juridical)	Flexibility, adaptation, activity (communitarian)
Individual vs. society (investment)	Affection and "other" bodies (divestment)
Laws, policy, protocols, principles	Practices, knowledges, guidelines, "plan"
Values	Modalities
State/nation (governmentality)	Multiplicities/collectivities (critique)
Human-centered	Nonhuman-oriented
Design-as-instrumental (engineering before design; ethics as afterthought)	Design-as-ethical (ethics as immanent in design and engineering)
How can ethics be prescribed? (the law)	How can ethics become immanent? (practice)
What qualifies as ethical action? Categories	Where does ethics occur? Event

Thacker claims for a future "ethics of transformation" that is socially and politically meaningful, and that takes a bottom-up perspective based on the Deleuzian-Spinozist bio-ethical approach. Such "ethics of transformation" would displace the over-emphasis on human subject, and look instead at "modes of individuation" that include bodies of all kinds: molecular, organismic, subjective, intersubjective, conceptual, institutional, social, emotional, and ethological.

From this perspective Metadesign is not a mode of praxis, because this would assume that there is an ethical model and that ethical paradigms are established on a fixed relation between theory and practice. Rather Metadesign is a critical and creative investigation into the possibilities of human transformation.

2.3. Conceptual Frameworks and Practices of Metadesign

In the practical field the idea of Metadesign has been approached in relation to the potential of information technologies, and the emergence of digital networks and nanotechnologies. In this context Metadesign is variously translated, and applied to different design fields and with different objectives.

2.3.1. Metadesign as Design of a Design Process

The term Metadesign, employed in graphic design and industrial design[63], is primarily connected to the idea of working on a meta-level (see 2.1.2.1). The use of the term is linked to the changes in the design techniques and processes that are basically associated to the passage from graphic and industrial design to interface and interaction design (Stiff, 1993).

In fact, according to Lev Manovich, the term Metadesign can suggest the passage from an earlier period, when graphic designers were dealing with fixed and defined information which needed to be designed, to today's interface designers and interaction designers, that work instead on a meta level and "design general structures which can be used with arbitrary information" (Lev Manovich, personal communication[64]).

Discrete ontology of computer dataspace and objects

This transition is a result of computer software, which replaces the traditional process of creating objects from nothing. According to Manovich, the ontology of computer dataspace as a whole, and the individual objects in this space are atomistic on every possible level:

> The digital image is made up from pixels and layers; the virtual 3-D space is made from simple polygons; the Web page is made up from separate objects represented by HTML statements; the objects on the Web are connected by hyperlinks [...that separate data from its structure...] (Manovich, 1999).

Objects generation and manipulation

Since a computational object has a discrete structure, parts of the object can be easily accessed, modified, substituted by other parts, etc. Therefore the new task of the interface designer is to create an efficient structure and tools that allow working with arbitrary information, i.e. information that is always changing and growing (Manovich, 1999). According to Manovich, it is in this way that the principles of New Typography and modernist design have become principles of Metadesign, meant here as "the creation of tools which are employed by a user herself to organize the information on-the-fly" (Manovich, 1999)[65].

---

[63]Here it is easy to recall the design firm MetaDesign, founded in Berlin in 1979 by the graphic designer and typographer Erik Spiekermann.
[64]Email dated 31 October 2002.

Diagramming

According to Lars Spuybroek (Spuybroek & Sik, 2002), another way of looking at the changes produced by computing is in the shift from preliminary techniques like sketching and modelling towards non-visual techniques like diagramming. These techniques are based not on optical abstractions of forms that have to be realized later, but on "informational visualisation techniques that place themselves at the interior of a process instead of the exterior of a sensed form" (Spuybroek & Sik, 2002, p. 243). According to Spuybroek, these techniques can be conceived as a form of Metadesign.

At a formal level. an instance of these techniques and of a new sensitivity to design is the development of the idea of computational aesthetics and "reactive graphics", as explored by John Maeda and his colleagues at the Computational Aesthetics Group at MIT:

> Because the traditions of art and design presuppose a material with a single fixed state, our critical instinct is to reduce anything with variability to a single instance. [...] As our understanding of and appreciation for programmatic forms grow, we will regard [any] act of digital paralysis as [...] offensive (Maeda, 2000, p.64).

However, at an industrial level, Metadesign basically means designing with 'templates', another way to describe the act of designing the way of designing itself. According to Spuybroek, Metadesign is an informational system, a networked system of decisions that make the thing "that thing" without actually designing it:

---

[65]According to Manovich examples of these tools are nested folders and nested menus, the outline display options of word processing applications, or the zoom and pan controls which can operate on any data.

> Basically it means a whole opening up of designing One Thing to a whole family or Range of Things. Later, in the future, we can design our own shoes, our clothes, our own chairs (like we now can design our own websites) - and the question of 'How?' is answered by diagramming and metadesign [...]. You would make your own variations, and of course these variations would happen within the digitised continuum, meaning that the information of your own design would immediately be transmittable to a production machine that assembles all the parts, and sends it over to your house (Spuybroek & Sik, 2002, p. 243).

Distributed design and mass customisation

Following this perspective, a laboratory like the Systems Realization Laboratory of the School of Mechanical Engineering at the Georgia Institute of Technology in Atlanta (http://www.srl.gatech.edu/) (SRL) is focused on researching and developing new principles and tools to support services of mass customisation and processes of distributed design.

SRL designers look at how manufacturers can offer people customized products on demand by using the Internet and designing product families appropriate for mass customisation, and also how manufacturers can create such products more quickly. Mass customisation means to them a "service industry" where people temporarily lease products and services, and not the "product industry" of today where people buy and own products. For SRL designers one of the main issues of distributed design is therefore coordinating people and organizations that are not physically co-located, but geographically distributed, and that use the Internet and other information technology resources to design and manufacture products and services.

Design process as set of decisions and planning

SRL designers therefore consider Metadesign as the "design of a design process". In the context of the DSP Technique developed and adopted by SRL, Metadesign is the first of two phases in which product specific decisions themselves are not made or even pursued. At this stage it is the design process that is to be implemented which is itself designed[66] (Bras and Mistree, 1991).

The conceptual framework of the DSP Technique is Decision-Based Design, a SRL foundational paradigm which is rooted in the belief that the principal role of an engineer, when designing an artefact, is to make decisions. Within this framework Metadesign is a meta-level process of designing systems that includes partitioning the system for functions, that is to say partitioning the design process into a set of decisions, and planning the sequence in which these decisions will be made by using a domain independent method to process domain dependent information.

2.3.2. Metadesign as Design of Generative Principles

Celestino Soddu adopted the term Metadesign in 1989 (Soddu, 1989). His approach is fundamentally aesthetic, and according to him the designer is the producer of the idea, while the consumer is the one who chooses the instance of an object. He uses the term Metadesign with an operational approach (Celestino Soddu, personal communication)[67]: by means of a dedicated software he realizes a series of unique different events (architectures, towns, industrial objects, artworks), all unpredictable, but all strictly belonging to the same metaproject (or metadesign). Through his work he aims to design the idea as "idea-product", and Metadesign is a tool to realize these kinds of "executable ideas". Using a fractal logical frame, he has written software like Argenia, aimed to generate industrial design by rapid

[66]The DSP Technique consists of two phases: Meta-design (Phase I) and Design (Phase II).

prototyping, and Basilica, a software that enables the realization of physical architecture models by automatic solidifying and thickness generation for rapid prototyping machine.

According to Soddu and Colabella, one of Soddu's major collaborators before the industrial era, every object was unique, unrepeatable and strongly connected to the identity of its maker or user. This bond, together with the uniqueness and irreducible nature of the object, invested it with a quality that went beyond the intrinsic value embodied in the material and in the execution. For the object, the result was an extremely slow obsolescence. In the two centuries of the industrial era objects were produced instead as indistinguishable multiples, and rendered equal by the phenomenon of mass-production(Soddu and Colabella, 1997).

In the information era industrial design will no longer be the idea and realization of an object, but the idea of a species of objects and their industrial generation (Soddu, 1999). As each form is only one of possible parallel consequences of an idea, the design act becomes transforming , rather than forming. It becomes the design of a morphogenetic and generative code, conceived as:

> ...not a sequence, a database of events, of forms, but a definition of behaviour pattern: the transformations from what exists to the complexity of contemporary objects in a state of becoming (Soddu, 1999).

From this perspective Metadesign is an important concept in modern design practice, and specifically within the generative design paradigm. It is conceived as the act of

---

[67]Email dated 6 April 2002

designing a system or species of design, instead of a design instance. The designer, or metadesigner, is the creator of the idea, and the consumer the one that chooses one of its possible realizations. The essence of the creative capability of the designer, or artist, is in the idea, or the generative code, that aims to be recognizable.

More recently Soddu developed a specific expression for his design methodology, called Argenic Design, which is meant as a form of Metadesign, an operative metaproject, or a computer program that uses artificial intelligence to explicate the idea[68].According to Soddu, in order to build a generative project it is necessary to put together two logics: the paradigm that defines roles and relationships inside possible events, and the laws of transformation, constituted by the algorithms that explain our idea of these possible events as an evolution of the present:

> Paradigm and algorithms of transformation define in fact the "how" to operate and not the "what" to do or to choose (Soddu, 2000b).

Between transforming and choosing forms, Soddu traces the borderline between designers and clients, between who designs and who chooses the instance of an object. In this way, Soddu does not question the role of designer. His view of the user is that of a sophisticated consumer population. His work is as a way of overcoming the myth of the optimisation of functions, and a way of addressing the possibility of linking the object to different human individuals and to their diversified needs, increasing the identity and the uniqueness of each human individual (Soddu, 2000a).

---

[68]He calls this methodology also morphogenetic design, generative design, or evolutionary design.

For example, an industry can buy a morphogenetic idea-project of lamps and use the endless sequence of generated 3D models to produce lamps which are always different. The customer can choose his unique object by activating, through the Internet, the generative tool and sending his request to the company. Likewise, a Mayor can customise the idea-project of evolution for his town, and use it to control the future identity of his local environment. This recognises the possibility of selling the idea-product, performed as generative project, or artificial DNA (Soddu, 2000a).

Michael Pontecorvo also shares this approach to Metadesign as generative design (Pontecorvo, 2000). According to him, the discovery and development of new models for consumer-centered product design will centre on the implications of applying interactive generative design techniques to product design and development. This approach towards design redefines the consumer's role in the design and development process. It holds the possibility for detailed and structure feedback to the designer, and a more rapid and subtle product refinement than traditional marketplace and consumer research techniques.

According to Pontecorvo and many other participants of the Generative Art Conference[69], the issues of consumer participatory design, mass customisation, adaptive products and appliances, agile manufacturing and product previsualization will certainly determine a new product paradigm.

[69]The Generative Art Conference is an international meeting held every year in Milan and organized by Celestino Soddu. It gathers designers and artists interested in generative issues. In the editions 1999 and 2000, the notion of Metadesign was debated by many participants.

In this context Metadesign is seen as the design of the generative principle of forms, something more abstract than the actual form, but able to reflect the artist or designer more deeply (Mauro Annunziato, personal communication)[70]. Nevertheless, according to many artists participating in the Generative Art Conference, Metadesign must aim to produce the design instance as a byproduct of the interaction, rather than simply enabling design instances to evolve. This, argues Annunziato, is why many artists prefer to work on the emergence of forms, relations, aesthetics, and finally of the project itself, i.e. on the generative processes based on principles of self-organization. Artists increasingly shun the term "metadesign" (in the terms defined by Soddu) because it suggests something designed a priori, and in some way fixed to the initial project.

In the generative context the limit of Metadesign, as it has so far been defined and explored, is that it does not enable fluid, open relations. According to Soddu's definition, it is a reticular system of relations enclosed in the original idea, and it does not allow a creative exchange between designer and consumer.

2.3.3. Metadesign as Collaborative Design

In this section are grouped conceptual frameworks and practices that focus on the participative role of the user in the process of design. Here the participative, collaborative, or "co-authoring" role of the user is seen as a fundamental requirement for an effective and meaningful design.

---

[70] Email dated 24 May 2001. Mauro Annunziato is a generative artist based in Italy.

2.3.3.1. Applied experimental aesthetics

At the beginning of the 1990s, Yevgeny N. Lazarev and his colleagues Nina P. Valkova, Yuri A. Grabovenko, Leonid S. Kolpashchikov, and Valere I. Mikhailenko at the Mukhina College of Art and Design, Department of Programme Design, in St. Petersburg developed their own idea of Metadesign as a result of reflection on the emerging relationships between art, technology, and science (Galeyev, 1994), and as an aesthetical experimentation applied to industrial design.

Disappearance of the world of objects

The researchers of the Mukhina College of Art and Design believed that the electronic microminiaturization of the 1990s was going to produce the disappearance of the world of objects and, therefore, a technoculture in which the relationship between human beings and things would no longer be objective. This change in the worlds of objects and in the organization of human values was going to affect the nature of industrial design, making the self-modelling of human beings a necessity (Lazarev, 1994).

Industrial design and anthropodesigners

According to these theorists, industrial designers would have needed a new profession, that they called "anthropodesigner" (Lazarev, 1994). In order to teach "anthropodesigners" to create a human dimension in industrial design, Lazarev and his colleagues had been researching and developing a specific trend in applied experimental aesthetics since the mid-80s. They named this trend concerned with human values as Metadesign.

Metadesigners and metaconsumers as co-authors

According to Lazarev and his colleagues the characteristics of Metadesign are different from traditional design. The principal difference lies in the fact that the main objective of a metadesigner is the organization of the individual's own attributes, intrapersonal manifestations, and human relations, rather than the production of objects and values ready to be consumed. According to Lazarev:

> In a conventional relationship between designer and consumer, the consumer places orders; a metaconsumer works on par with a metadesigner as "co-author" (Lazarev, 1994, p. 423).

Another difference between Metadesign and traditional design arises from the specificity of the language, which grows as a result of the use of non-traditional modelling methods.

Metadesign reaches beyond the familiar static and plastic media, traditionally used in model construction and this is its third unusual characteristic. Metadesign models, in fact, use dynamic elements that are physically "undulatory" in nature (i.e. light, sound, vibrations and movement) as well as bio-ionized, "animated" materials that permit the imitation of natural phenomena such as compression, flexibility, shock-absorption and growth.

Art-image modelling

According to Lazarev and his colleagues, the aim of Metadesign is to produce objects on the basis of aesthetical modelling methods. These methods allow consumers to become "co-authors" of their own values, their essence, manifestations, and relations.

According to them, this is possible by interacting with an art-image form capable of modelling the essence, manifestations, and relations of people:

> Through interacting with arts such as music, poetry and, perhaps, theatre, metadesign will permit the formation of artistic models of the spirit, environmental interface and human image (Lazarev, 1994, p. 423).

Art-image forms

The models, or art-images, produced by the researchers of the Mukhina College of Art and Design symbolise their understanding of Metadesign and the role of the metadesigner.

"Artefor" (1987), derived from the terms "art" and "forward", is a model that bears the concept of the innovative specialist. Here, this model is understood as methodologist, an ideologist of Metadesign:

> ...a personality that actually creates conditions and realities never seen before (Lazarev, 1994, p. 424).

According to Lazarev, this is something that is strictly related to the mission of art.

"Emotium" (1988) is an attempt to model the specific means and ways humans relate to their surroundings, and most importantly to other people. Emotium is a kind of spiritual cyborg or bioelectronic totem, useful as a way to relax or remove stress. When communicating with a person, the Emotium will change its shape, colour, luminosity, sound, and vibration, depending on the psycho-emotions and senses of an individual. If Artefor is the metadesign model of an individual, Emotium is the metadesign model of the active relationship between an individual and other people.

"Homo-Mobile" (1989) is a metadesign model of an individual's interaction with his or her environment and culture, through the technostructure. Homo-Mobile is a three-dimensional kinetic sculpture symbolizing the transformational links between the individual, the technoworld, and the environmental culture. It reflects the multidimensional nature of the human being and displays the creative and cultural possibilities of the metadesign trend.

Design and human creativity

This approach, like many other approaches to Metadesign, questions the relationship between designer and consumer and addresses intersubjective and emotional issues. Nevertheless, it is still a production of art-image forms, an expression of concepts as symbolic object forms, as symbolic intervention. According to Lazarev and his colleagues, working in a time prior to the coming of digital networks and distributed computing, Metadesign is a concept translated as a specific trend of art-image modelling applied to industrial design.

However,

> The specific perspectives of metadesign are hard to define since it is quite a new phenomenon. But one can already see an exceptional vitality in this trend, whether it remains within the domain of design or transforms into a phenomenon of human creativity that has never existed or been possible before (Lazarev, 1994, p. 425).

2.3.3.2. Lifelong Learning and Design

Today the term Metadesign has been adopted and developed within a complex and articulated conceptual framework at the Center for LifeLong Learning and Design (L3D). The activity of L3D, that joins the Department of Computer Science and the Institute of Cognitive Science at the University of Boulder, Colorado (http://www.cs.colorado.edu/-l3d/), ranges from the design of computer systems to the research on the social environments, where such systems and devices can be embedded and promoted:

> We see the users of our computer systems (as well the learners of our courses and the members of our communities) as designers. We also talk about the social aspects of meta-design, implying that meta-designers design social situations for design, as well technologies (Jonathan Ostwald, personal communication).

Sociotechnical concerns

> Adding new media and new technologies to existing practices will not change the consumer mindset of learners and workers. [...] The future of how we live, think, create, work, learn, and collaborate is not out there to be "discovered" - it has to be invented and designed. [...] A new culture does not arrive by itself and cannot be discovered as being out there [...] it requires the interdisciplinary collaboration among different social groups [...]. The socio-technical design of computational environments requires the social inclusion and active participation of the users as active contributors (Fischer, 2003)

The director of L3D, Gerhard Fischer, is concerned with the meaning and implications of design as a process (Henderson & Kyng, 1991), and the need to transcend the "consumer mindset" of contemporary culture. Fischer conceives Meta-Design[71] as an

---

[71] I will adopt in this paragraph the spelling adopted at L3D.

issue of how to create new media and environments that allow users "to act as designers and be creative" by providing them with social and technical support.

Highlighting the nature and capabilities of computational media, Fischer states that the fundamental challenge for them is to contribute to the invention and design of cultures in which humans can express themselves and engage in personally meaningful activities:

> Cultures are substantially defined by their media and tools for thinking, working, learning, and collaborating. New media change (1) the structure and contents of our interests, (2) the nature of our cognitive and collaborative tools, and (3) the social environment in which thoughts originate and evolve, and mindsets develop (Fischer, 2002).

Because the framework adopted for their design will be ubiquous for society, computational media have a special role and power, and their design necessarily must be a sociotechnical design.

From this perspective, computational support mechanisms are prerequisites, but they are not sufficient to motivate people to become part of a "design culture" and to invent and design their future. This is why meta-designers have to deal with both the social and the technical context, and with a range of different design activities, which define the role of the individual and the nature of the community in a fluid manner:

> Meta-designers - are developers who are concerned to create the social and technical context that will enable users to be active and creative. [...] They are responsible to design basic scheme and mechanisms that are implemented by the developer, customized by the power-user, used by the end-user, accessed by the consumer (Fischer, 2002).

This, according to Fischer, is also why we must embed a model of lifelong learning[72] in our mindsets, cultures, physical environments, and technologies for communication and collaboration.

Design methodology

At the L3D Centre Meta-Design is a design methodology characterized by activities, processes, and objectives focused on:

1. The design of the *technical infrastructure*, based on seeds and mechanisms (customisability, end-user modifiability, and end-user programming) that allow stakeholders to evolve the seed at use time [...];

2. The design of a *learning environment and work organization* that allows stakeholders to migrate from passive consumers to end-users, users, and power users;

3. The design of the *socio-technical environment* in which stakeholders are recognized and rewarded by their contribution and can accumulate social capital (Fischer, 2002).

The potential of the malleable nature of software

According to Fischer and Scharff, one of the major potentials of information technology is giving people the option to become designers by changing and enhancing a software system. One major contribution that information technology can lend to the world is "to deeply understand and exploit the potential of the malleable nature of software" (Fischer & Scharff, 2000).

---

[72]This model postulates that learning does not end when one leaves school. Lifelong learning is more than 'adult education', it is closer to meaningful and personalized work, and to a continued growth and exploration.

This potential is even more considerable, because the boundary between the design of physical structures and the design of social systems dissolves almost completely in the design of software systems, if we regard them as embedded systems, (Fischer et al., 2002).

The programmable design environments realized at L3D are based on the objective to make software more "soft". They empower end-users to act as designers by changing and extending the behaviour of a given application without substantial reprogramming. A granular, malleable, and modifiable computational system are the prerequisites that enable the system and the users to evolve together. The system must respond during use time to situations and problems that could not be foreseen at design time.

Design time and use time

As actions are situated (Suchman, 1987), so design needs are situated (Henderson & Kyng, 1991). In all design processes, two basic and distinct stages can be differentiated: "design time" and "use time" (Fischer, 2003). At design time system developers, with or without user involvement, create environments and tools. During application , users use them.

With computational media these two stages can intertwine and the system can manipulate contextual factors and evolve over time:

> At *design time*, system developers create environments and tools including help systems, guided tour, forms, and so on, and they have to make decisions for users [...] for situational contexts and for tasks that they can only anticipate. For print media, a fixed context is decided at design time, whereas for computational media, the behaviour of a

> system at *use time* can take advantage of contextual factors [...] *only known at use time* (Fischer et al., 2002).

The need for open and evolvable systems

As problems cannot be entirely anticipated at design time, users during application will discover gaps between their problems and the support that a system can provide them (Nardi, 1993; Fischer, 1999). A closed system will inevitably be unable to cope with change and with the possibly unlimited extensions that might arise in the design process. This is because the fundamental failing of a closed approach is that activities and issues may arise which cannot be reproduced or predicted by the system (Fischer & Scharff, 2000). Instead, an open system provides opportunities for significant changes to the system at all levels of complexity, allowing emergent problem solving in the context of collaborative design.

Enhancement and evolution of the system by those who encounter problems at user level must be a "first-class design activity" (Fischer, 1999). Software systems must be designed for evolution, they cannot be completely designed prior to use and they must evolve at the hands of the users. This implies not only the possibility for users to create customisations, extensions, and applications within a given domain, but also allows them to modify the current domain when necessary (Fischer & Scharff, 2000).

Of course domain specificity allows environments to provide greater support in solving problems within a given context, but limits the scope of the context that can be explored. At the same time, increasing the facilities for extensions allows users to modify an environment to fit a new context, but also produces an ever-increasing gap between the context in which the design is taking place and the ability of a system to reproduce that context. For this reason, it is important to create environments that allow the user to move smoothly between "specificity" and "openness".

Co-evolution: the SER Process Model

From the perspective of traditional software engineering, a domain model is a precise representation of specification and implementation concepts that define the domain. In a design perspective, a domain model is the set of objects and behaviours contained in a domain-oriented system, but users can change these objects and behaviours and, therefore, the domain model can evolve over time. The Seeding, Evolutionary Growth, Reseeding (SER) Process Model developed at L3D (Fischer & Ostwald, 2002; Fischer 1998) is a framework for understanding both the social and technical processes necessary to support domain construction. The model is based on co-evolutionary principles that allow entities to change over time, in such a way that changes in one entity sympathetically affect changes in the other[73].

In the SER model, system developers and users develop an initial "seed". This seed is designed to be extended, and must be able to grow through use. It is constructed to support collaborative design at use time: "[a] seed is an initial collection of domain knowledge that is designed to evolve at use time" (Fischer, 2002). As the seed is used, it goes through a period of "evolutionary growth", in which designers make incremental modifications to the system. Eventually, they will need to perform a significant reconceptualization of the system or "reseeding". This cycle of evolution and reseeding is perpetuated as people actively use the system to solve problems.

The system evolves over a sustained period, continually alternating between moments of activity and unplanned evolution, and stages of deliberate (re)structuring and enhancement (Fischer, 2003).

Underdesign

The Seeding, Evolutionary Growth, and Reseeding Process Model supports Meta-Design by allowing and encouraging designers "to explicitly underdesign and underprescribe at design time and to provide constructs and environments for design support and situated interpretations and actions at use time" (Fischer & Scharff, 2000).

From a sociotechnical perspective this creates an environment in which users change because they learn, and in which systems change because users become co-developers and engage in end-user modification and programming (Fischer, 2002).From a specific design perspective this means that system developers "underdesign"[74] systems so that unexpected uses of the artefact at use time can be accommodated: "underdesign [...] does not create solutions, but it creates environments in which "owners of problems" in situated settings can create solutions themselves" (Fischer, 2002).

Meta-designers can be therefore be considered as designers that, at design time, do not create final solutions, but design environments which can be changed and modified by domain designers at use time (Fischer & Scharff, 2000).

---

[73]An instance of these processes is the co-evolution of problem framing and problem solving, or the co-evolution of an individual artefact and domain knowledge.
[74]See Brand, 1995.

Informed participation and unselfconscious culture of design

As previously mentioned, computational support mechanisms are necessary prerequisites, but they are not sufficient conditions to motivate people to become part of a "design culture". L3D's goal is to create computational environments that can support a non-binary approach to the possible design roles of user, and are intrinsically exciting and motivating (Illich, 1973).

Unfortunately, according to Fischer, a large proportion of new media content is designed to respond to humans merely as consumers. Even though personalized information has become more common recently, giving viewers more control over the information presented, still users mostly consume information, and produce a limited quantity of new information (Fischer & Scharff, 2000). Accessing existing information and knowledge is a very limiting concept, even though it is often seen as the major advance of new media (Arias et al., 1999).

According to Fischer, users should be able to transcend beyond the information given:

> A fundamental challenge for the next generation of computational media and new technologies is not to deliver pre-digested information to individuals, but to provide the opportunity and resources for social debate, discussion, and collaborative knowledge construction (Fischer, 2002).

This idea is expressed by the concept of "informed participation", an evolutionary approach to problem solving that needs to be based on systems allowing: (1) users to learn from the system; (2) users to act as innovators, co-developers, and designers adapting and evolving the systems, (3) support for organizational learning in order to share these adaptations among users.

Such a change in mindset and approach should lead to a culture of design in which the failure or inadequacy of a system leads directly and unselfconsciously to an action to change or improve it (Alexander, 1964). In this perspective:

> Meta-design allows users to extend the results of self-conscious design activities at design time with unself-conscious design at use time (Fischer & Scharff, 2000).

Motivations

In the early days of computing, moving from a consumer mindset, humans were considered servants of computers. For example, some interdisciplinary studies, like human factors (Norman, 1988), often considered humans to be system components with specific characteristics such as limited attention span, faulty memory, and easy distractibility along with other "undesirable" characteristics. From a designer's perspective, systems need to be useful, not simply usable:

> Design for usability must include design for coping with novelty, design for improvisation, and design for adaptation (Fischer, 2002).

Alternatively, users will not recognise a need to extend a system until an activity in which they engage illustrates a limitation of the system. This failing must be one great enough that the user is sufficiently motivated to abandon the present task to make the necessary modifications. Their contribution will depend on the perceived benefit of contributing, which involves the effort needed to make changes and the utility received for effecting changes (Fischer & Scharff, 2000).

Perceived and actual rewards may include a feeling of being in control, being able to solve or contribute to the solution of a problem, mastering a tool in greater depth, making an ego-satisfying contribution to the group, or enjoying the feeling of good citizenship within a community. Other basic motivations can also be passion, engagement, enjoyment in complex and creative work, challenge, pleasure, a sensation of complete concentration and absorption, and "flow" activities (Csikszentmihalyi, 1990).

Another way of interpreting motivations to participate in collaborative activities is to refer to ideas like "social capital" and "gift culture", according to which increased social status is determined by what you control, rather than by what you give away. The collaboration, thus, depends on a social and economic system which values altruism (Fischer et al., 2002;: Putnam, 2000; Raymond, 1999).

According to Fischer, the opportunity for humans "to be and act as designers" should be accessible to all individuals and groups (Fischer, 1999). Merely providing computational support alone is not sufficient to create a design culture because individuals will decide on the worthiness and utility of doing something by relating the perceived value of an activity to the perceived effort of participation.

Social creativity

Despite this difficulty, the role of interaction and collaboration among individuals is considered crucial (Engelbart, 1995). According to Fischer, creative activity grows out of the relationship between an individual and the world of his or her work, and out of the ties between an individual and other human beings (Fischer, 1999, p. 117).

The "symmetry of ignorance" between users is considered a creative opportunity (Rittel, 1984). In fact, problems usually require more knowledge than any single person can possess, and the knowledge relevant to a problem is often distributed among people with different perspectives and background knowledge.

By creating spaces and places that serve as "boundary objects"[75], different cultures can meet and exploit the potential of social creativity. They can use the externalizations provided by boundary objects to capture distinct domains of human knowledge, and increase through negotiating and critiquing processes their socially shared cognition and practice (Resnick et al., 1991; Norman, 1993).

Design environments: the EDC

The explicit goal of computer systems designed at L3D, like DODEs, Envisionment and Discovery Collaboratory (EDC), or Pit-A-Board[76], is to support Meta-Design by allowing all participants to move from access to informed participation within an open and evolvable system. This system gives the participant creative control over any problems, and allows them to invest the world with their own meanings.

EDC is a second generation environment that integrates physical and computational components to encourage and facilitate informed participation by all users in the design process, supporting both face-to-face and distributed collaboration (Arias et al., 2000). It is composed using a computationally enhanced table, called "action space". Currently realized as a touch-sensitive surface, this "action space" allows

---

[75]For instance the information repositories and organizational memories designed at L3D, are created in a way that they are no longer impenetrable, "write-only" stores, but actively integrated into the work processes and social practices of the community that constructs them (Fischer, 1999).
[76]Look at http://www.cs.colorado.edu/-l3d/ for further technical details about each single project.

users to manipulate the computational simulation projected on the surface by interacting with the physical objects placed on the table. In the "action space" users manipulate a shared, tangible representation of a problem being constructed. The table is flanked by a second computer that drives the vertical touch-sensitive computational whiteboard, serving as the EDC's "reflection space", where information relevant to the problem is collected, presented, and extended. The reflection and action spaces of the two computers are connected using the Web as a communication medium. The dissemination of constructed knowledge is afforded through the EDC's WWW linkages between the action and the reflection spaces. The entire physical space, through the immersion of people into the representations of the problem-solving task, creates a prototype of an integrated, sociotechnical human-computer system.

The "action space" of the EDC is built using AgentSheets (Repenning et al., 2000), a software environment for creating simulations and domain-oriented environments. The "reflection space" in EDC is supported by DynaSites (Ostwald, 2001), which allows users to create extensible, web-based information spaces.

The EDC presents a theory-based architecture and process model with three layers: (1) a domain-independent framework and architecture for integrated physical and computational environments that support shared understanding through collaborative design; (2) application domains (i.e. urban planning); (3) specific applications to contextualize an application domain in a concrete situation (i.e. transportation planning in the city of Boulder).

A development of EDC, Pit-A-Board (Participate-in-the-Action Board) allows also: (a) parallel interactions, rather than a single thread of interaction; (b) multiple "points of control" that allow the association of various "modes" with various physical objects in the system; and (c) direct sensing of objects placed upon the board.

2.3.4. Metadesign as Organization of Flows

In this section are grouped conceptual frameworks and practices that focus on the potential of Metadesign to organize informational flows, and construct new typologies of space. Metadesign is here conceived as architecture of connectivity and topology both for real and electronic space.

2.3.4.1. Diagramming the "Space of Accidents"

According to Lars Spuybroek[77], and as previously mentioned in section 2.3.1, diagramming is the most important innovation in architecture for the last ten to fifteen years. It meant a shift away from preliminary techniques like sketching and modelling towards non-visual techniques. These techniques are based not on optical abstractions of forms that have to be realized later, but on "informational visualization techniques that place themselves at the interior of a process instead of the exterior of a sensed form" (Spuybroek & Sik, 2002, p. 243).

[77]Lars Spuybroek is an architect involved, since the early nineties, in researching the relationship between architecture, media, and computing.

A system of relations

According to Spuybroek, it is not clear yet what diagramming means, but he argues that, on a techno-cultural level, it means a move towards metadesign, conceived as an informational system, i.e. a networked system of decisions that make a thing "that thing" without actually designing. As is the case today in graphic design and industrial design, we can say that there is a metadesign for a Nike shoe or for a Swatch watch (Spuybroek & Sik, 2002).

In Spuybroek's diagrammatic techniques specifically, he builds machines almost always on the computer. It is a sort of "virtual whole", a matrix where all relations are set but not fixed, and where all the information is processed over time. If a change is made to one thing in this system of relations, that change is reflected in the system as a whole.

Unforeseen and emergent behaviours

Spuybroek's approach to architecture underlies a critique of the mechanistic conception of the human behaviour within a system built purely as set of tasks, routines, and habits. His programs come "in-between", as the materialization of the "undecided", as a "space of accidents". Using his diagrammatic techniques, flexibility is translated into movement and movement into flexibility. In this way movement becomes an architectural response to the "undetermined" movements of a body, a morphing of a table into a corridor and vice versa[78]. This process creates a qualitative change. In the actuality it may respond to a person walking alongside a table, or drinking a cup of tea there:

---

[78]See his design for the V2 Lab in Rotterdam.

> It is an architecture that not only articulates planned and foreseen behaviour [...] it also stimulates unforeseen behaviour (Spuybroek & Sik, 2002, p. 245).

At the end, diagramming is finding a vector:

> ...constructing this vector-toward-something-else, can only be done by diagramming, by seeing structure and architecture beyond image and before one 'sees' actual buildings. It is a professional way of dealing with this moment of 'blindness': being in between ones contraction of the world, and ones expression of something new (Spuybroek & Sik, 2002, p. 246).

The essence of Metadesign, according to Spuybroek, is the diagram. The design is something that does not foresee the real, as with diagrammatic architects as Rem Koolhas and Peter Eisenman, but that should be placed exactly "in between the world-as-imagined and the world-as-experienced" (Spuybroek & Sik, 2002, p. 246). As "life runs parallel with the diagram, they move in the same direction, they intertwine, they couple, but never oppose" (Spuybroek & Sik, 2002).

The computer and the experience of space

According to Spuybroek, this is something that can be done only by working with a computer, because it is impossible to reach the same level of integration between form and information by drawing. Moreover, working with a computer enables the designer to overcome transparent intentionality, and to equally process perception, action, and construction within the system, materializing in this way all sorts of things that are in between (Mulder & Post, 2000). Usually, in architecture, only transparent and expected behaviours are materialized and expressed in forms that have a name, like floor, wall, column (Mulder & Post, 2000). Spuybroek's architecture instead is a spatial experience, something that takes place neither in the body nor in the world, but only in the coupling of the two.

The continuous flowing of events

Spuybroek argues that in a time and world where we can truly think complexly, we should not deny ourselves an architecture of the complex. Like mathematics, physics, and biology, also architecture must deal with processes, time, and complexity.

He is interested in how architecture can help in increasing the dimension of potentiality, or virtuality, between space, as an abstraction, and time, as a continuous flow of events. According to him, architecture and, implicitly, Metadesign, must be an architecture of connectivity and topology, and it does not necessarily have to deal only with buildings.

2.3.4.2. Constructing the Electronic Space

Laboraitorie d'Architecture et d'Urbanisme (Lab[au]), based in Brussells and established in 1995, adopts the term Metadesign with the objective to set a new discipline. Lab[au] gathers independent artists, architects and computer scientists[79], and aims to be an independent collective for critical study and production concerned with the developments and consequences of new information technologies. The goal of Lab[au] is to develop a broad concept of space and to define a new architectural

[79] Lab[au] is Manuel Abendroth, Jérôme Decock, Carl DeSmet, Pieter Heremans, and Alexandre Plennevaux.

and urban practice, by merging the growing fields of information design in a new discipline that they call MetaDesign[80].

Codes and processes

According to Lab[au], an investigation in information design needs to question recent technological progress and how this influences the definition of design, its methods and its purposes (Lab[au], 2003a).

Current computation and communication technologies influence our modes of production, work, and knowledge, and affect our sensorial and cognitive systems, our social relations, and their environment. They introduce a notion of flow, according to which information can be described as a spatial-temporal system whose dynamic state is the result of processes. They also introduce the idea of a meta-level of this information because each piece of information requires other information to be processed. According to Lab[au], these considerations and specificities of information technologies show that it is necessary to think in terms of process rather than in terms of a finished product. Likewise, the process must take precedence over design at a meta-level, that is to say to design the codes by which information will be processed both in technical and representational aspects (Lab[au], 2003a).

This specificity of digital technologies provokes new design methodologies. It reveals the integration of time as an active parameter, and inspires the conception of a programmable spatial-temporal structure, for instance hypertext, which is an indexing system, which enables the user to interconnect, in multi-linear ways, any

[80] I will adopt in this paragraph the spelling adopted by Lab[au].

digital information. The interaction between information and a user further reveals that the design of processes or systems that integrate the users interaction over time is an active part in the structure of information itself.

As architecture and urbanism, MetaDesign has to be a discipline that considers spatial and temporal organization. In fact, information flows, in the processes of computation, communication and storage, can be seen as spatial-temporal forms of data organization, whose relations can be drawn in the structuring and visualization of information.

In summary, "Metadesign is about the setting of codes" (Lab[au], 2003a), and it draws concepts from cognitive science and from architecture and urbanism, from information and communication sciences, and from organizational and design methods for the construction of spatial-temporal structures. In Lab[au] practice, MetaDesign is a methodology that enables the construction of a hypermedia electronic space, by enabling the structure of information:

> Metadesign is a discipline and a methodology based on the structuring and the transcription under textual, graphic or spatial form of the processes of inFORMation, computation, communication and stockage. Based on the structural, semantic and conceptual analysis of the media, Metadesign is not only a theoretical approach but it involves the elaboration and the production of works, considering and conceptualizing the specificity of a medium and its perceptive and cognitive modalities. [...] This structuring (MetaDesign) implies the construction of spaces, of interfaces, the managing of information and the conception of the tools necessary to their conception (Rollins, 2002)[81].

---

[81]Originally: "Le Metadesign est une discipline et une méthodologie axée sur la structuration et la transcription sous forme textuelle, graphique ou spatial des processus d'inFORMation, computation, communication et édition (stockage). [...] Basé sur l'analyse structurelle, sémantique et conceptuelle du média, le MetaDesign ne constitue pas seulement une approche théorique, vise aussi à l'elaboration et à la production de travaux considérant et conceptualisant les spécificités d'un médium, modalités

The electronic space

Information and communication technologies determine an information space, the Net, which is a fabric of temporary interconnections, a space composed and decomposed by data and by the flows that transport them and that generate systems of relations. In order to represent this kind of space and translate it into something sensorial, MetaDesign manages and structures matter and information by means of interfaces, indexication of contents, computational processes programming, and statistical analysis (Frank & Abendroth, 2003).

Even though Lab[au]'s approach to Metadesign is information-centered, concerned with providing connectivity and access, information is seen not as content, but as flow, network and environment: "meta information vs. metaphors and given as objective reality vs. notions of simulation"[82] (Frank & Abendroth, 2003).

Lab[au]'s concept of space is perceptual and cognitive. It calls for a change in the notion of territory and space itself, both in structural and semantic terms. It works in contrast to the notion of electronic space as pure simulation, and compliments an idea of electronic space as extension or multiplication of the form of language and reality. Being digital information both in process and in system, and having a highly malleable structure, "everything becomes transformable, liquid, dynamic not only in space but also in time"[83] (Frank & Abendroth, 2003).

---

perceptives et cognitives. [...] Cette structuration (MetaDesign) implique la construction d'espaces, d'interfaces, la gestion de l'information et la conception des outils necessaries à leur conception".

[82]Originally: "meta information contre metaphores et donnée comme réalité objective contre des notions de simulation".

[83]Originally: "tout deviant transformable, liquide, dynamique pas uniquement dans l'espace mais aussi dans le temps".

Communication and computation technologies project us into "hyperspaces", which determine a new relation between information and the individual by combining the perceptual with the conceptual, the concrete with the abstract. The direct correlation between information structures and space constructs determines a "performative language", which augments cognitive processes by inscribing new modalities of interaction and immersion, and by "being there" in the rhizomatic and digital networks.

Lab[au] refutes the "mechanical" approach inherited by the first reflections on computer science (McLuhan, Flusser, etc.), and, in relation to the changes induced by new technologies, argues:

> As a medium, every technology has a direct impact on the way we communicate, but also on the perception and the understanding that we have of the environment, and as a consequence on the way we think, we speak, and most of all we cognitively build the universe. With the creation of the networks, the passage from a way of communication to another - from text to hypertext and now to hypermedia - is not only the passage from a technology to another, but more radically the passage from a Cartesian and structuralist thought to a thought that is autoreferential and, most of all, autopoietic (Rollin, 2002)[84].

As information architecture, MetaDesign represents the extension of architecture in the digital age, supporting new concepts of space that are simultaneously functional, social, and cultural. In Lab[au]'s projects, these notions of space have been

---

[84]Originally: "En tant que medium, toute technologie exerce un impact direct sur nos modes de communication, mais aussi sur la perception et la comprehension que nous avons de l'environment et par consequent sur notre manière de penser, de dire et surtout de construire cognitivement l'univers. Annoncé l'avènement des réseaux, le passage d'un mode de communication à aun autre - du texte à l'hypertexte et aujourd'hui à l'hypermédia - ne marque pas simplement le passage d'une technologie à une autre, mais plus radicalement le passage d'une pensée cartésienne et structuraliste à une pensée en système autoréférentiel et, surtout, autopoï étique".

examined, using applied concepts such as "hypertextual enviroment" (structural spaces), "datascapes" (cartographies), "avatarachitecture" (perceptual and cognitive spaces), "DNarchitecture" (information structures for identity), "eSPACE.CONSTRUCTionS" (networked spaces).

E.motional spaces

Lab[au] assumes that the experience of space, thus also electronic space, influences our behaviour and our emotions:

> Conceiving the electronic space is then working on these spatio-temporal structures in relation to the cognitive and mental processes and to how they influence through movement (motion) our actions (emotion) - e.motional space (Frank & Abendroth, 2003)[85].

Lab[au] considers emotion to be cognitively joined to action. From this perspective MetaDesign is also seen as a cinematic architecture that puts action and emotion on the same plane, using techniques like direct eye movement and movement patterns. An example is the project "sPACE - navigable music", where according to space and time parameters each interaction and navigation directly affects and transforms the environment, and its visual and musical space:

> The relation established between the processes of formalization of the space and the navigation brings to a new spatial experience, that of the generative and behavioural space (Frank & Abendroth, 2003)[86].

---

[85]Originally: "Concevoir l'espace électronique, c'est donc travailler sur ces structures spatio-temporalle en rapport au processus cognitifs et mentaux et comment ils influencent à travers le déplacement (motion) nos actions (emotion) - e.motional space".
[86]Originally: "La relation qui s'établit entre le processus de formalisation de l'espace et la navigation amène à une nouvelle experience spatiale, celle d'un espace génératif et comportamental".

In "sPACE - navigable music" the relation between the spatial, visual, and sonic formalizations processes and the editable interactivity of users leads to an experience that combines architecture, music and cinematic techniques through movement patterns. According to Lab[au], this method could be easily extended through networks, and augment the experience of shared and collaborative processes.

Intersubjective spaces

Technology does not only deliver content but also, through its code and its structure, conveys a specific meaning. According to Lab[au]:

> ...this specific meaning is contained by the meta-construction and defines the programming languages [...] as a metalanguage, a construction between technology, structure and content (Frank & Abendroth, 2003)[87].

According to Otto Rössler the world "is not the world in which we live", but the interface through which we perceive and act, and the electronic realm induced by computation and communication technologies is not "the world of data and information" in which we live because the real world "doesn't function anymore". Rather it exists as the interface to a set of symbolic and expressive "processes". According to Lab[au] the fact that we can modify the interface and, thus our perception and cognition, does not mean that we can modify the world as a whole (Lab[au], 2002b).

[87]Originally: "ce sens spécifique est contenu da la méta-construction et définit les langages de programmation [...] commme méta-langage, une construction entre technologie, structure et contenu".

It is clear, as Marshall McLuhan has underlined in his work, that there is a close relationship between our sensory apparatus and the technological extensions of our body, which directly conditions our perception and behaviour. The assignment condition (or "cut") can thus be modified by technology and negotiated by human beings in relation to technology, balancing possible and feasible. However, the assignment condition must be also extended to the consensual, because reality is a problem of intersubjectivity:

> Digital technologies develop relational systems, determined by a high degree of interactivity and immersion, thus gathering the parameters of an active space. Creating an interface is thus programming human characteristics and behaviours inside the electronic space [...] The interface, related to the assignment condition sets up a relational system in which the cyberspace takes the form of an experimental space, as much through mental processes as through the direct and sensual interaction with information (Lab[au], 2002b).

According to Lab[au], technologies influence our mental processes by influencing our symbolic and social constructs. Digital media make relationships structural and "programmatic".

Determinism and constructivism

MetaDesign is seen as a technology determinism/costructivism that constitutes the main vector of networked and information-based societies:

> A technology is not an independent or alien object, it complements integrally our sensorial and cognitive system; as a medium, it conditions not only communication modes but also the way we perceive and conceive our environment [...]. MetaDesign is information architecture, related to the structuring of information, its textual, graphical, spatial and biomorphic [auto-generative and n-dimensional] transcription and interfacing grounded on the inherent logics of computation and communication technology in networked societies [...]. Metadesign deals with the setting of new 'senses' as components of language, while

> improving, increasing our cognitive capacities and influencing in a major way our psychic state (consciousness), our emotional and social behaviour and thus participate as much in the individual project as to the collective (Lab[au], 2003b).

Lab[au] argue that information architecture deals with intelligible electronic constructs not only as modalities of perception and cognition, but also as ontological active settings.

The "i-Tube" project

"i-Tube" is a web browser which allows each user to index and share information through the network. The project "i-Tube" proposes a graphical user interface and a navigation system for online databanks. Based on information cartographies displaying "inFORMation" processes as a processual and generative space, it is an investigation in three-dimensional hypertext mappings and in their social and cultural implications.

The information is transformed into membranes which are then folded into space, according to user-defined parameters. Each membrane thus acts as a support for information display. The successive consultation of the databank forms an electronic-tube, a digital topography that induces explorative browsing. With the proposed interface, each user navigates in a three-dimensional universe what is generated in real time by the user. By the specific information it contains and the visual codes it sets up, this user-defined environment leads to the concept of a user profile, a trace of the personalized consultation. So the interface becomes a formalized canvas of cognitive behaviours, a mental map of each user ("Dnarchictecture"). Also, each linking of information (assembled membranes) can provide a sample of user identity, a personal space which can be shared with others for social exchange ("AvatarArchitecture").

The "DNarchitecture" is a trace of users reading. In "i-Tube" the hypermedia structure incorporates the reader's trajectories, becoming polysemic and open. This "hypertrace" is a hybrid construct: an architecture, an interface (colour, intensity/saturation, spatial shape), and a mental map of the user.

The "AvatarArchitecture" is an exchange and identification device that enhances the social participative exchange of data throughout the virtual augmented environment. The "i-Tube" project links the question of interconnection between user and information (or among different users) as a concern of interface, formalizing a place to be collectively experienced and permanently evolving. The interface must be not only a communication device with the cyberspace, but also a tool for inter-personal communication that transforms itself into a true social environment, and transposes the electronic space experience to a reconceptualisation of tangible and concrete body space. The project transforms the concept of consultation space and information access into a medium of social exchange, extending consultation logics to comparative reading and understanding, and producing a fluid and dynamic index system:

> Dynamic indexing systems investigate the qualification and quantification of information from structured and fixed models, universal thought, to the mnemonic culture according to networked societies (Lab[au], 2001).

With this project Lab[au] experiments with procedural and generative settings in a space that becomes an intelligent matrix in relation to the programmed settings (algorithms) and the influence of the user-defined parameters. Lab[au] theorize and practice a programmatic design that mainly relies on the computational and connective nature of digital media.

2.4. Integration of Approaches and Viewpoints

To compare and integrate all the approaches and viewpoints regarding Metadesign described in this chapter, the identification of some theoretical and practical tendencies is useful. Also, clusters of concepts that formulate a set of coherent elements are able to produce an integrated conceptual framework. At the end of the chapter the anticipatory, participatory and sociotechnical issues raised by Metadesign are articulated, interrelated, and summarized in relation to Metadesign and to other current philosophies and design methodologies.

2.4.1. Metadesign: An Overview

As described in the previous sections, the term Metadesign came into use during the intellectual debate on art, culture, and media which has been ongoing since the 1980s, in many different practical fields, already mentioned. Within both intellectual debate, and practical application, different understandings of the term Metadesign have produced different frameworks, whose foci range from theoretical issues to operational methodologies.

A single definition of Metadesign does not exist. Since the 1980s the notion of Metadesign has developed an oscillatory trajectory, the origins of which seems to lie in the etymology and use of the prefix "meta-". The approaches and definitions presented in the previous sections and here summarized and contextualized refer to this field of oscillatory significance. This overview indicates that Metadesign is neither an established discipline nor a coherent theory, but rather the expression of assumptions and concerns that can be led back to the same field of meanings and concepts, composing the fabric of a consistent design culture.

2.4.1.1. Summary of Definitions

The approaches and definitions presented in the previous sections are briefly summarized in the following table:

Figure 2. Definitions of Metadesign.

Author (paragraph)	Definition (summary)
Gene Youngblood, Kit Galloway, and Sherry Rabinowitz (2.2.1.)	Metadesign is an *extra-aesthetic strategy* aimed to instigate a revolution in the communication world, and overcome the broadcasting style of mass culture, whilst redefining art and enabling it to become politically effective. As a strategy, it deals with the creation of *context* rather than content. It is a mode of *integrating systems* (both technological and social) and setting actions in order to create environments in which people may cultivate *creative conversations*, and control the context of their cultural and aesthetic production. In doing so Metadesign supports the constitution of electronic communities and provides them with alternative models for the development and exploitation of networked technologies as a central instrument for the social construction of their own reality (*autonomous reality-communities*).
Derrick De Kerckhove (2.2.2.)	Generally speaking, Metadesign is the kind of design that puts the *tools* rather than the object of design in your

hands. Specifically, this is framed in two different ways:

As a property of network art, it defines the conditions for the process of interaction rather than the process itself, taking advantage of the Net for its interactive properties rather than simply as a vehicle for promoting content (*webness*);

As an instrument of *mass customisation*, Metadesign is a *networked model of design* produced by the transition from an age of broadcast technologies to one of a networked global environment. It is the design of tools, parameters and operating conditions that allow an infinite flexibility in *tailoring* the industrial product, and enable the end-user (*prosumer*) to take charge of the final design. Cyberdesign is its synonym.

Paul Virilio
(2.2.3.)

Metadesign is a deep effect of the *technomorphisation* of society. It is a process of adaptation to electronic media, a *neurological form of design* that is directed to shape our *perceptual and cognitive systems* by information processing, and to colonize and reorganize the *organic* according to the model of intelligent machines.

Humberto Maturana
(2.2.4.)

Metadesign enlarges the issue of design to include the nature of our very existence, and implies an *epistemological and ethical rethinking of human-technology relations.* Everything can be designed, but only *co-creatively.* No deterministic approach to biological evolution and human design is arguable, because human beings exist as systemic entities in a *relational space* under continuous structural changes, and because their doing and their cultural history is fundamentally driven by emotions (*emotioning*) rather than by technology.

Metadesign opens up new relational dimensions. It can be seen as a *dynamic work of art*, which produces an aesthetic experience intertwined with our social and technological present, and which has the potential to become a *grounding reality* in the course of human history.

Eugene Thacker (2.2.4.)

Metadesign represents a *critical and creative investigation* into the possibilities of transformation of human beings and culture, rather than a mode of praxis.

It is a kind of design that is not instrumental, but ethical. However it is not based on a moral law, but is a flexible and communitarian *mode of existence* based on embodied interactionism (*juridical model vs. affective model*).

Metadesign takes a *bottom-up approach* that is *eventmental* and *non human-oriented*, looking at modes of individuation which includes bodies of all kinds (molecular, organismic, subjective, intersubjective, conceptual, institutional, social, emotional, and ethological).

Lev Manovich (2.3.1.)

Metadesign means working on a *meta-level*. It consists in *designing general structures and tools* which can be used with *arbitrary information*, and which are employed by a user to organize information that always change and grow.

Lars Spuybroek I (2.3.1.)

Metadesign is both an informational visualization technique that place itself at the interior of a process instead of the exterior of a sensed form (*diagramming*), and an industrial design model.

At an industrial level Metadesign means *designing with templates*. It represents an informational system, a *networked system of decisions* that allows the programme to design the way of designing itself rather than the final product.

A user can make his or her own variations within the digitised continuum, and the information of his or her own design are immediately transmittable to a production machine that assembles all the parts, and sends it over to his or her user space.

SRL (2.3.1.)	Metadesign is the *design of a design process*, meant as an *ordered set of decisions.* It is a meta-level process of designing systems that includes partitioning the system for functions, i.e. partitioning the design process into a set of decisions and planning the sequence in which these decisions will be made, by using a domain independent method to process domain dependent information.
Celestino Soddu (2.3.2.)	Metadesign is the design of a *generative principle*, which embeds the idea of the designer as producer of an *idea-product* and defining paradigm and algorithms of transformation. Conceived as the act of designing a system or species of design instead of a design instance, it is an operational tool to realize the idea-products as executable idea (*metaproject*). The designer is the producer of the idea, or the generative code, the user the one who chooses the form.
Michael Pontecorvo (2.3.2.)	Metadesign is interactive generative *design technique* for *consumer-centered product design.*
Yevgeny N. Lazarev et al. (2.3.3.1.)	Metadesign is a specific trend of *art-image modelling* applied to industrial design. It consists of the production of forms (*art-image forms*), focused on the organization of the individual's own attributes, manifestations and human relations rather than the production of objects and values ready to be consumed. Concerned with human creativity, Metadesign allows the user to become co-author (*metaconsumer*) by interacting at an aesthetical and emotional level with an art-image form capable of modelling his or her own essence, intrapersonal manifestations, and interpersonal relations.

Gerhard Fischer at L3D (2.3.3.2.)

Meta-design represents an issue of how to create new media and environments that allow users to act as designers and be creative by providing them with social and technical support.

Operationally, it is a design methodology characterized by activities, processes, and objectives focused on: (1) the design of a *technical infrastructure* based on seeds and mechanisms (customisability, end-user modifiability, and end-user programming) that allow users to evolve the seed at use time; (2) the design of a *learning environment and work organization* that allows users to migrate from passive consumers to end-users, users, and power users; (3) the design of a *sociotechnical environment* in which users are recognized and rewarded by their contribution and can accumulate social capital.

Lars Spuybroek II (2.3.4.1.)

Metadesign is *diagramming*. It means finding a structure (*vector*) in a system of non-fixed relations, as something in between the world-as-imagined and the world-as-experienced, and before its actualisation.

As an architectural technique based on information-processing, Metadesign can help in increasing the dimension of potentiality, or virtuality, between space, as an abstraction, and time, as a continuous flow of events. It can support an architecture of connectivity and *topology*.

Lab[au] (2.3.4.2.)	MetaDesign is a discipline that merges the growing fields of information design (*information architecture*), and that is involved in spatial and temporal organization (like architecture and urbanism). Grounded in the inherent logics of computation and communication technologies of a networked society, MetaDesign is related to the structuring of information, its textual, graphical, spatial, and biomorphic interfacing by means of indexication of contents, computational processes programming, and statistical analysis. It enables the construction of a hypermedia electronic space where information is seen not as content, but as flow and environment. Dealing with intelligible electronic constructs, not only as modalities of perception and cognition but, also as *ontological active settings*, and the embedding of new senses as components of a language capable to put action and emotion on the same plane (*performative language*). MetaDesign increases our perceptual and cognitive capabilities and influences our psychic state (*consciousness*), our *intersubjective*, and *social behaviour*.

General observations

Referring back to the meanings of the prefix "meta-", we can say that all the definitions summarized in the table above, together express an idea of Metadesign as a design approach and methodology that can work at an informational meta-level ("meta-" as *behind*), at a participatory and collaborative level ("meta-" as *with*), and at the deep intersubjective level of our "being in-between" ("meta-" as *between/among*). Looking at these summaries some general observations can be drawn and some differences outlined, before producing an integrated conceptual framework (see 2.4.3.).

The following differences aim to be neither exhaustive nor antithetical or incompatible, but simply an indication of some perspectives, which highlight how Metadesign expresses a design culture that is consistent, but that is not definitive.

2.4.1.2. Model of Design vs. Mode of Existence

Metadesign generally represents a powerful alternative to hierarchical approaches and broadcasting models in art, communication, and design. However, some approaches see Metadesign only as a design trend, as part of a coherent evolution of design methods and techniques responding to new informational and networked technologies (Manovich, Spuybroek). These approaches, especially in industrial design, neither question nor overturn the idea and the role of the user as consumer or client in the process of production (De Kerckhove, Soddu, Pontecorvo). They are focused on the concrete industrial design possibilities provided to designers and users by current informational and networked technologies, and frame Metadesign as a networked model of design (De Kerckhove, Spuybroek I). In doing so these approaches support market trends of personalization and mass customisation, and discard the user as designer.

Other approaches instead highlight and explore the large potential and implications of Metadesign when seen as a form of design capable of working, not only at an informational meta-level, but capable also of opening up new relational dimensions and modes of existence. Art and cultural debate (Youngblood, Virilio, Maturana) have been extremely proactive in developing Metadesign as a reflexive method of thinking about and beyond design. This has led to a consideration of Metadesign in epistemological, ontological, and ethical terms (Maturana, Thacker, Lab[au]), rather than simply in operational terms.

2.4.1.3. Technology Determinism vs. Constructivism

Another difference that can be highlighted is between "close" and "open" approaches. Some approaches to Metadesign show a sort of "close" attitude, which can be expressed both in operational and theoretical terms. In operational terms Metadesign can be seen as processes of design conceived as an ordered set of decisions and plans (SRL), and partially also as algorithms of transformation (Soddu, Pontecorvo), or processes of topological organization (Spuybroek, Lab[au]). In theoretical terms Metadesign is seen to have a deterministic and programmable influence on our perceptual and cognitive systems (Virilio, Lab[au]).

Other approaches see Metadesign in relation to systems that need to be sociotechnically (Fischer) or ontologically (Maturana, Thacker) open and co-creative.

2.4.1.4. Dimensions of Intentionality

If Metadesign is conceived as an industrial networked model of design, no matter whether it is based on participated design processes or morphogenetic codes or not, this approach offers to the user an amplification and refinement of his or her options of choice (De Kerckhove, Soddu, Pontecorvo).

If Metadesign is approached in a sociotechnical way, the user has the opportunity of participating and collaborating in the process of design with an active, structural, and intentional role (Youngblood, Galloway, Rabinowitz, Maturana, Fischer).

If, then, Metadesign is approached from a topological perspective, the user has the possibility of participating and collaborating in the organization of the designed space with an active, interpretative, and unintentional[88] function (Spuybroek, Lab[au]).

2.4.2. Elements for an Integrated Conceptual Framework

This section will point out the key concepts significantly recurring in the theoretical and operational approaches to Metadesign that have been identified, collected and examined in this chapter. At the end of the section these concepts will be organized in a matrix (Fig. 3), to reveal their interconnections.

According to the theories and practices mentioned in this chapter, Metadesign is characterised by concepts, principles, and operational models that can be summarised and aggregated in the following clusters of concepts:

- (a) Structures;
- (b) Modes;
- (c) Bodies;
- (d) Environment.

All these clusters are interconnected and they presuppose each other. The aim of this analysis is to outline the most recurring and general concepts that provide evidence of Metadesign as an emerging design culture, and also to highlight limits and possible developments.

2.4.2.1. Structures

The focus of the meta-level is on the design of general structures and processes, rather than on fixed objects and contents. This cluster of notions of *higher order design* can be summarized as following: *(a)* designing structures and tools which can be used with arbitrary information, as in interface and interaction design (Manovich); *(b)* designing with templates, or designing the way of designing itself, as in industrial design (Spuybroek); *(c)* designing a structure in a system of non fixed relations, or diagramming a process for unforeseen and emergent behaviours, as in an architectural practice based on information-processing and non-visual techniques (Spuybroek); *(d)* designing a design process as an ordered set of decisions and plans, as in distributed engineering for industrial design (SRL); *(e)* designing a generative principle in terms of a morphogenetic code, for different applications of consumer-centered design (industrial design, architecture, urban planning, etc.) (Soddu, Pontecorvo); *(f)* designing seeds and mechanisms for co-evolutionary processes, as in sociotechnical systems design (L3D); *(g)* setting the conditions for the process of interaction, by putting the tools rather than the object of design in the hands of the user (De Kerckhove).

---

[88]Simply acting in that space, without being necessarily conscious or concerned with the results of his

This meta-level presupposes the granularity and malleability provided by the computational nature of the structures and processes on which Metadesign focuses. Computational granularity and malleability, when applied to a higher order design, are translated into a general idea of *modifiability*, and ordinarily produce an "end-user orientation". This orientation follows different goals and applications, "end-user tailoring", "end-user modifiability", and "end-user programming", shifting the modifiability of components from molarity to molecularity[89].

2.4.2.2. Modes

Working at a meta-level implies methods and techniques that are fluid, rather than prescriptive and for this reason I will call them "modes". The methods and techniques that have been previously elaborated can be summarised as the following: (a) diagramming; (b) seeding; (c) critiquing; (d) underdesigning; and (e) underprescribing[90].

(a) Diagramming, as we have seen, means to design a structure in a system of non-fixed relations (Spuybroek, Lab[au]). This can be applied as a networked model of design in terms of a system of possible decisions the user can make on the basis of a template, or as construction of a spatial experience where unforeseen and emergent behaviours can take place. In both cases diagramming is an organizational and topological concept.

---

actions.

[89] Borrowing the term from Deleuze & Guattari, we can define molarity and molecularity as two different scales in the analysis of a structure.

(b) Seeding means to provide users with constructs and mechanisms that user themselves have originally designed, together with the designers. It allows users to be involved in the evolution of seeds and system, adapting them to their own specific needs. A seeding method has been applied in the setting of the Electronic Café Network by Galloway and Rabinowitz, and it has been developed in a formal model, called Seeding, Evolutionary Growth, and Reseeding (SER) Process Model at the L3D Centre of the University of Boulder, Colorado. Seeding can also mean to trace and incorporate in digital structures the activity of users, to enable the electronic space to evolve, the mnemonic capabilities of users themselves be experientially enhanced, and the social exchange of data empowered (Lab[au]). Generally speaking, seeding is a participatory and evolutionary concept that combines "design time and "use time".

(c) Critiquing means a process of negotiation among users that exploits the distinct domains of their knowledge, and allow them to sustain a distributed and shared cognition and practice (L3D) or the practice of creative conversations (Youngblood, Galloway, Rabinowitz). It is a behavioural and social concept.

(d) Underdesigning essentially means to let the system be subject to the continuous flowing of events, rather than predeterming any possible need, task, goal, behaviour, etc. (L3D). It can be seen as a general method, including the techniques of diagramming and seeding.

---

[90]Most of these terms have been borrowed from the conceptual framework and ideas developed at the

(e) Underprescribing means to let the domain or context evolve, rather than rigidly predetermining it (L3D). It is analogous to underdesigning, but conceptually it is a social concept rather than a technical one. In fact, it is usually based on critiquing processes (L3D).

2.4.2.3. Bodies

Most Metadesign practices neither explicitly address nor question the idea of the body, but some elements can be gathered. These refer to the idea of "embodied interactionism" in terms of sensing and emotioning (Youngblood, Maturana, Lazarev, Lab[au]), and also in terms of an affective model of being (Thacker). They entail an event-oriented and non human-centered ontology, and an ethical "know-how" (Thacker). It is clearly a weak aspect in the development of Metadesign methodologies and practices.

2.4.2.4. Environment

The idea of "environment" is a conceptual element shared by most Metadesign approaches. In these approaches, the environment is generally characterised by the following features: (a) inhabitability; (b) relational setting; (c) co-evolution; and (d) conviviality.

(a) The feature of *inhabitability* is provided by assuming that data can compose ontological active settings and therefore an objective reality (Virilio, Lab[au]). This

---

L3D Centre of the University of Boulder Colorado.

means that electronic space is inhabitable, and opened up by the interface (Lab[au]). The electronic space becomes the environment in wich the user actually lives in, and interacts with.

(b) The feature of being a *relational setting* is characterised by the assumption that the environment is not only an inhabitable electronic space, but a relational system and dimension negotiated by human beings in relation to technology (Youngblood, Galloway, Rabinowitz, Maturana, Thacker, Lazarev, Spuybroek, L3D, Lab[au]).

(c) The feature of *co-evolution* is provided through understanding the generative power of reciprocal and recursive interactions (Maturana, Thacker), and recognizing the need for open systems (L3D).

(d) The feature of *conviviality* is denoted by enabling an autonomous, usually communitarian governance of meaning and context (Youngblood, Galloway, Rabinowitz, Lazarev, Maturana, Thacker, L3D).

In conclusion, we can note that Metadesign has reached a relatively large development in methods and techniques of meta-level design ("meta-" as *behind*). A high standard of development in methods and techniques for designing together ("meta-" as *with*), but a weak development level (primarily theoretical) of methods and techniques for the design of the "in-between", i.e. the design of relational settings and affective bodies ("meta-" as *between/among*).

Figure 3. Facets of Metadesign.

	YGR	DK	PV	HM	ET	LM	SRL	SP	YNL	L3D	LS	LAB
Structures												
- higher order design	x	x	x	x	x	X	x	x	x	x	x	x
- modifiability	x	x	x			X		x		x	x	x
Modes												
- diagramming		x									x	x
- seeding	x									x		x
- critiquing	x									x		
- underdesigning	x									x	x	
- underprescribing	x									x	x	
Bodies												
- embodied interactionism	x			x	x				x		x	x
- event-oriented ontology	x				x	X		x			x	
- ethical know-how					x							
Environment												
- inhabitability			x									x
- relational setting	x			x	x				x	x	x	x
- co-evolution				x	x					x		
- conviviality	x			x	x				x	x		

2.4.3. Raised Issues

Metadesign raises a set of issues that appear interrelated, and that I have identified as anticipatory, participatory, and sociotechnical issues. In the following sections I will draw them together in relation to the previously mentioned approaches to Metadesign and to current design theories and methodologies, in an attempt to establish some comparisons.

2.4.3.1. Anticipatory Issues

The first issue raised by Metadesign concerns the possibility for designers to anticipate users' needs and tasks, as well as situations and behaviours. This issue entails questions of situatedness and embodiment, and can be seen, as with the other issues, from different perspectives: methodological, epistemological, and even ethical.

Focusing on the dynamic dimension of processes, Metadesign exploits the malleability of software and deals with arbitrary information and computational artefacts that can be organized and structured time and time again. The given possibility of transforming and modifying contents and contexts by interacting with the system and adjusting it, allows the user to respond to the mismatch between what can be foreseen at design time and what emerges at use time. As we have seen, this non-anticipatory feature of Metadesign can be developed as much as a product refinement more rapid and subtle than traditional consumer research techniques, as within theoretical argumentations and conceptual frameworks more concerned with the exploitation and enhancement of human and social creativity in (and beyond) art and design.

At a methodological level, it is clear that designing a system that can sufficiently anticipate all possible uses in advance is an impossible task (Winograd & Flores, 1986; Greenbaum & Kyng, 1991). As it has been demonstrated, by recognised design methodologists, the very problems are ill-defined and they cannot be delegated only to professional designers, because they cannot be understood well enough to be described in sufficient details (Schön, 1983; Rittel & Webber, 1984). Demonstrating the strong interrelationship between problem framing and problem solving, the same design methodologists have highlighted how new requirements emerge during the development of a system, because they cannot be identified until portions of that system have been designed (Schön, 1983; Rittel, 1984). The process of framing and solving problems is an ongoing process that cannot be isolated to solve each problem at design time. Furthermore, such isolation would excluding from this process the user who will encounter these problems and who has the necessary knowledge to incrementally refine the system and benefit from the "talk-back" of partial solutions (Schön, 1983).

Lucy Suchman clearly pointed out how the idea of anticipation could be categorised into short-term and long-term modes, that she called "situated actions" and "planned actions" (Suchman, 1987). Addressing and strengthening this categorisation, Bonnie Nardi outlined that users at use time will always discover mismatches between their problems and the support that a system can provide them, even if they have been involved in the design of that system. In fact, problems are situated, and they cannot be completely anticipated at design time when the system is developed:

> As it has been shown time and again, no matter how much designers and programmers try to anticipate and provide for what users will need, the effort always falls because it is impossible to know in advance what may be needed (Nardi, 1993, p. 3).

According to Nardi, to deal with this fact is a "matter of programming" and shifting from a user perspective to a designer perspective. A designer perspective focused on the potential of software was sustained also by Mackay, when claiming for the creation of co-evolutionary environments where users could be co-developers, engaged in end-user modification and programming (Mackay, 1990). It would be an "unself-conscious culture of design" (Alexander, 1964), where the construction of a solution is driven by users experience at use time, rather than being governed explicitly by represented rules and principles requiring the anticipation of the solution at design time.

The necessity of paying attention to processes and to unforeseen and emergent behaviours has recently been noted by John Wood, who approaches the task from a more epistemological and ethical perspective (Wood, 2000). According to him situated actions are always a functioning part of our spatio-temporal surroundings, but nonetheless:

> Many systems concentrate on the anticipatory aspects of decision making, rather than on a more situated process of alterness to emergent conditions, and a creative and unplanned opportunism (Wood, 2000).

The anticipatory features of design have origins in the teleological conviction that outcome is more important than process. This conviction is embedded in our model of consumption (Wood, 2000), and also in our teaching culture (Illich, 1971; Bruner, 1996).

If on the methodological level, to deal with the impossibility for designers of anticipating users' needs and tasks, as well as situations and behaviours, means to adopt a perspective that goes from users involvement to end-user programming, on an epistemological and ethical level, this corresponds to the idea of a shared creativity:

> Perhaps we can all become designers [...] we may hope to encourage a more convivial society, based on the flow of shared creativity (Wood, 2000).

Talking about flow in this context pushes the understanding of situatedness beyond the causal frame of goal-directed approaches, according to which every action is accompanied by a particular kind of mental event which plays a causal role in directing intentional behaviour. I am supposed to know in advance (or at least to foresee) the result of my action, and the representation of the goal I can achieve is for me instrumental (McFarland, 1993). Within a causal frame, process is conceived as explicit and intentional, goal-directed or, we can also say, object-oriented, proceeding through predictable stages and closed states. It is a "subject-tool-object-outcome" scheme (Kuutti, 1996).

On the contrary, according to the idea of relational embodiment, individuals and relationships are never fully defined, but always dynamically constituted as part of a process (Fogel, 1993). Action is embodied and fundamentally relational, so that our behaviour is directed not by any goal representation, but in an holistic manner and through continuous changes in the possible states of the world. On this basis collaborative processes are conceived as looser and unpredictable, proceeding through transitional states, or, we can also say, process-oriented.

The idea of relational embodiment challenges any mechanistic and rational "structured paradigm" of human-computer interaction, still reflecting industrial processing and a vision of a world where goal-directed, rational routines and their interactions are considered to be fundamental building blocks (Lea & Giordano, 1997; Finholt & Sproull, 1990).

Therefore, another way of addressing the anticipatory problem in design is also to talk about embodiment as "situated observation-in-action", or a "proprioceptive observations of 'being-with'" (Wood, 2000).

If we consider the field of the sciences of cognition, there is a corpus of studies that can be traced back to several disciplines and that stem from a dissatisfaction with previous paradigms[91]. One of the approaches to which this area of research has led, is named "enactive approach"[92]. It places itself within the contemporary epistemological inquiry on the scientific validity of the objective method and the sustainability of non-scientific methods.

Following the enactive approach we produce our world and our consciousness, that is to say the way in which we perceive the outer environment and ourselves, through our experience. According to Evan Thompson (Thompson 1999; 2000), we do this by interacting with the world through our "relational embodiment":

> ...the mind does not internally represent an independent external world, but rather it enacts a meaningful world through embodied action. To say that cognition is embodied means that it depends upon the perceptual and motor capacities of our bodies, and is intertwined with the environment (Thompson, 1999, p. 2).

---

[91] I refer to the main established paradigms of cognition called "cognitivism" and "connectionism". Simply, "cognitivism" is based on the hypothesis that cognition is the manipulation of symbols, which represent features of the world or represent the world as being a certain way. This approach establishes that the study of cognition as mental representation is independent from the domains of neurobiology on one side and sociology and anthropology on the other. The cognitivist orthodoxy was challenged by the connectionist approach in the late seventies. Revitalizing ideas from the pre-cognitivist era of cybernetics, "connectionism" is based on the hypothesis that mental processes occur through the emergence of global patterns of activity in a network of neural or neural-like components. The idea of emergent phenomena, higher-level phenomena that arise through the interaction of lower-level elements according to so-called learning rules, is fundamental.

[92] The enactive approach was first defined by Francisco Varela, Evan Thompson, and Eleanor Rosch in their book "The Embodied Mind: Cognitive Science and Human Experience", published in 1991. It represents an alternative hypothesis both to cognitivism and connectionism, questioning cognition as a representation of a symbolic processing. The name "enactive" has been proposed to emphasize the growing conviction that cognition is not the representation of a pre-given world by a pre-given mind but it is rather the enactment of a world and a mind on the basis of a history of the variety of actions that a being in the world performs. On a philosophical level, the enactive approach questions the objectivism/subjectivism assumption about the way the world is, what we are, and how we come to know the world.

This belonging, this life made up of embodied actions, is the ground of our cognition. An outer world that our mind internally replicates, like a mirror, does not exist. What does exist is our body, with its perceptual and motor capacities and the worlds of meaning that our actions produce. The scientific studies and research that refer to the enactive approach are working to demonstrate that cognition is an embodied action that has no ultimate foundation beyond its physical, biological, and cultural history.

In the field of computing, a non-representationalist stance toward interaction and cognition grounded on radically embodied cognition (Agre, 1997; Chalmers, 1999; Clark, 1997; Smith, 1996; Stein, 1999) is provided by Paul Dourish (Dourish, 2001). Dourish puts forward a view of embodiment that focuses on it as a participative status, a way of being, and on technological artefacts as part of the same pattern of action[93]. The embodied interaction perspective described by Dourish begins to illuminate not just "how we act *on* technology, but how we act *through* it" (Dourish, 2001, p. 154).

According to Wood, embodiment enables, through empathy, a cycle of mutual presence:

---

[93]He focuses primarily on "meaning" and "coupling". Meaning involves a set of related but distinct phenomena, including intentionality, ontology, and intersubjectivity. Each of these plays a role in understanding embodied interaction. Intentionality concerns the directedness of our actions, and the effects that our actions are designed to cause. Ontology concerns the ways in which, through our interaction with technological systems, we come to understand the computational world in which and through which we operate. Intersubjectivity reflects the fact that this world is one we share with other individuals; the understanding we develop of technological artefacts and social action are ones that emerge in concert with other people. Coupling shows just how we can understand and interpret interactive systems, but how we can operate through them. Effective action involves being able to reorient oneself towards technology, turning it from an object of enquiry and examination, into a tool that can be used.

> Finally we may speculate that a more flow-oriented ethics of conviviality may be created from a similarly paced cycle of empathy for others, and respect for oneself (Wood, 2000).

This leads to a discussion of empathy and creativity in relation to senses and emotions. These are topics, like embodiment, that most design approaches, concerned with anticipatory, participatory, and sociotechnical issues, have not yet explored and exploited on the theoretical and methodological level.

2.4.3.2. Participatory Issues

Another issue raised by Metadesign concerns the participation of the users in the design process, and how this affects their role and the role of the designers themselves. The issue can be seen from different perspectives: methodological, epistemological, ethical, and political. It entails questions of co-creation and professionalism.

On a methodological level, it is easy to see how the issue of anticipation turns into an issue of participation, both in terms of an engagement of users in the problem framing/problem solving process, and in terms of their coupling with the electronic world they inhabit. Therefore, the issue of participation deals on one side with participatory design and evolutionary design, on the other side with embodied interactionism (Dourish, 2001).

In the history of design the claim for a participatory approach is grounded in the analysis of everyday design practices, which have shown the necessity for knowledge workers and designers to engage in creative activities in order to cope with the unforeseen complexities of everyday, real-world tasks (Rogoff & Lave, 1984). As we have seen in the previous paragraph, this approach centres on the recognition of the impossibility for designers to anticipate users' needs and tasks, as well as situations and behaviours.

Traditional participatory design is an established methodology that occurs at design time, and involves users and developers in order to produce an optimal system. Only recently, participatory design has begun to take into account situatedness, and adaptable systems have become a topic in participatory design: "*use* is *design*" (Allen, 1993, p. 240). This is why participatory design is sometimes connected to evolutionary design[94], even though evolutionary design, putting emphasis on the human guidance of the process or on the absolute autonomy of the software, is less collective, and it deals more with exploration instead of participation.

> As a mature research area and evolving practice among design professionals, participatory design has its origins in the early work on sociotechnical design (Mumford, 1987) and work-oriented design (Ehn, 1993). Its major focus is to explore conditions for user participation in the design and introduction of computer technologies in the workplace (Kensing et al., 1998). It is mainly concerned with the politics of design, the nature of participation, and methods and techniques for participation. Participatory design can be thought of as a framework for supporting the interaction between designers and users of a system at design and deployment time (DePaula, 2002, p. 31).

[94] For instance, concepts like "reciprocal evolution" (Allen, 1993) or "explorative evolution" (Bentley, 2000). "Reciprocal evolution" is concerned with building systems that evolve not only in response to new technological capabilities, but to design opportunities emerging from continual study of how current products are changing people's organization of work and interaction, and their expectations and desires for technology functionality. "Explorative evolution" is a method that employs computers as creative problem solvers by using evolution to explore for new solutions. It relies upon a representation based on components rather than a parameterisation of a known solution like in conventional search algorithms. Here "evolution is used as an explorer, not as an optimiser" (Bentley, 2000, p. 163).

Although this "time" can extend from a week-workshop to a year long collaboration, extending the product life-cycle through a linear process, participatory design is not concerned with creating technologies that support structural changes and co-evolutionary processes at the use time.

For participatory design, like most design approaches focusing on the user, participation is a way of increasing the chances that a design corresponds to real needs and will be used as intended. Participatory design supports diverse ways of thinking, planning, and acting through which people make their work, technologies, and social institutions more responsive to human needs, and this requires the social inclusion and active participation of the users. Users should be empowered to propose and generate design alternatives, and become more deeply involved in the process as co-designers (Greenbaum & Kyng, 1991; Schuler & Namioka, 1993). Participatory design has focused on system development at design time by bringing developers and users together to envision contexts of use.

User-centered design approaches (Norman & Draper, 1986), whether done *for* users, *by* users, or *with* users, have also focused primarily on activities and processes taking place at design time in the original development of a system. In user-centered design, designers generate possible solutions and users are predominantly in a reactive role (Fischer, 2003).

Participation was already an issue in design in the 1970s. In 1971, an important conference, entitled "Design Participation" was held in Manchester. It covered a wide range of topics relating to design participation, also focusing on adaptable environments, and on the relevance of the new computer-aided design and design methods which could break the existing professional monopolies in design expertise[95]. Design participation was conceived as "giving all the people access to the tools, resources and power which have been the jealously-guarded prerogatives of the professional" (Cross, 1971, p.11). According to Stringer, one of the speakers at the conference, participation meant variously: from participation in planning to participation in continuously-changing, from do-it-yourself to adaptable environments, from active taking part to design participation in constructive terms (Stringer, 1971).

Moreover, according to Nuttal, the need for participation had its origin in the failure of the idea of functionalism, the idea that a person's need could be defined, modelled, and translated into objective artefacts, which satisfy those needs. On an ethical level, to define a person's needs without his or her participation is to deny that person's humanity, for the essence of being human is to be undefinable, to retain one's mystery (Nuttall, 1971). It means to impose a juridical model against a participative and flexible one.

Participation becomes synonymous with coupling the electronic or sociotechnical world that users inhabit, and also promotes embodied interactionism. Participation becomes a participative state, a way of being (Dourish, 2001), accomplished by means of a performative language of interaction and immersion through which the user acts in that world with a different level of awareness and intentionality.

[95]On that occasion Mitchell had already highlighted the role of computers in facilitating participatory design: "sometimes we can search for solutions to problems by the direct manipulation and observation of the object, system, or situation which concerns us" (Mitchell, 1971, p. 73).

On an epistemological level, the capability of the user to take part into the design process or in the enaction of the world he or she inhabit puts him in a co-creative position. Co-creation can be conceived, not only as fundamental in order to deal with the complexity of unforeseen problems and their solution, but also as foundational to human condition, which is substantially relational and as such it must be addressed (Fogel, 1993; Maturana, 1997; Thompson, 1999; Varela et al., 1991). Co-creation can be also thought in terms of co-evolution. Co-creation, when conceived beyond the methodological terms of co-development (Henderson & Kying, 1991) or an evolution-based design approach (Fischer, 2003), has been mainly addressed in term of conviviality and social creativity (Fischer, 1999). Yet this process has rarely been discussed in relation to embodiment. This has consequences in the way in which participation is thought to be triggered, focusing on rational motivations rather than emotional; social motivations rather than deeply intersubjective; convivial rather than enactive.

An epistemological perspective seems necessary to deal with the blurring of the idea of user participation on the methodological level. According to Ehn, the merging of industrial (material) design and software (virtual) design, and the embeddedness of computer artefacts in our daily life challenge the idea of user participation, because we have to look not only to professional work practices, but to a private life blurred with professional life:

> All this makes the idea of user participation complex to handle, since the subject we are dealing with tend to dissolve (Ehn, 1999).

According to Ehn, we need to understand and design computer artefacts in a wider context.

The idea of a possible "design by all" (Kari-Hans, PhD Design list[96]) always produces strong reactions in the field of professional designers. Simon suggested that all practitioners are designers (Simon, 1969), and Schön, that design is a general human activity (Schön, 1987). Winograd then stated that the design of computer artefacts is an activity that is conscious, a creative conversation with material, a social activity that keeps human concerns in the centre and has social consequences (Winograd, 1996). Nevertheless, design participation is often perceived as a challenge to design expertise and existing professional monopolies, more than an issue concerning conventional approaches to participation in planning, and sociotechnical issues of who is to control the future (Cross, 1971). As Cross had foreseen:

> Professionalism is a particular kind of specialisation, and specialisation - the division of labour - is the technique of production-line technology. As we develop new technologies we will develop new roles and new images of ourselves (Cross, 1971, p. 11).

The user changes, the professional too. The consequences of this are that:

> 1) All humans design, but in our current western society which is founded on expertism, design is generally understood as something reserved only for experts;
> 2) The society is all the time becoming more design intensive, and the freedom to live, act and realize one's own aspirations is increasingly dependent on designs people have not had a chance to influence, as well as the competence to compete in the market through designing. The social and political importance of enabling people to design for themselves, and to participate effectively in the design of things/systems/policies that affect their life, and to make a living designing (to some extent), is growing (Kari-Hans, PhD Design list).

[96] Look at http://www.jiscmail.ac.uk/lists/PHD-DESIGN.html.

2.4.3.3. Sociotechnical Issues

The last issue raised by Metadesign and pointed out in this work concerns whether and how Metadesign can be framed as a sociotechnical approach, and what a sociotechnical approach can mean today.

The issues of anticipation and participation imply design methodologies and social and political agendas, that should lead to a view of Metadesign in terms of a sociotechnical design, per se. Clear instances of Metadesign as sociotechnical design can be found in the thinking and practice of Kit Galloway and Sherry Rabinowitz in the 1980s, and are today the conceptual framework and computer systems developed at the L3D Centre of the University of Boulder, Colorado. However, there are elements in the way Metadesign addresses the issues of anticipation and participation that add new standpoints to sociotechnical approaches. Combine these with other approaches and design methodologies, like interaction design, and we must question the importance of a shared values system as main motivational support to collaborative or co-creative practices of design. These elements are expressed by those Metadesign approaches that stress the reciprocal interrelationship and the interdependencies between humans and machines, their mutual shaping, and the emergence of new bodies and new inhabitable environments. Instances of these approaches can be identified in the theoretical arguments of Maturana and Thacker (also Virilio from a critical perspective), in the unique design practice of the art-image forms by Lazarev and his colleagues at the Mukhina College of Art and Design, and, today, in the electronic constructivism of Lab[au].

To approach the definition of "sociotechnical" from this wide angle and in all the interconnected facets and issues Metadesign induces, requires an account and exploration of the concept and its developments.

Sociotechnical systems theory originally developed in the context of manufacturing technologies in industrial organizations (Mumford, 1987) and currently, it has afforded a robust foundation for understanding relationships between new information technologies and service sector organizations (Taylor, 1994; Tornatzky & Fleischer, 1992). According to Bikson and Eveland:

> Briefly, sociotechnical systems theory treats an organization as a complex whole comprising two interdependent subsystems: a social system involving work groups, jobs, task interdependencies, work flow, and the like; and a technical system including, for example, electronic hardware, software, networks, applications, tools, and so on (Bikson & Eveland, 1996, p.428).

Bikson and Eveland, and Mumford (Mumford, 1987) agree that each system is open, and susceptible to the effect of events which take place in its local environment. Both system and environment are reciprocally influential, so that changes in one inherently lead to changes in the other. An attention to process and continuous implementation are key enabling factors for the development of sociotechnical systems:

> ...the key ideas of sociotechnical systems theory as it applies to technology implementation are continuous mutual adaptation of tool and context, task emphasis, the priority of process, and changes in evaluative criteria over time (Bikson & Eveland, 1996, p.436).

Both Bikson and Eveland (Bikson & Eveland, 1996), and Mumford (Mumford, 1987) stress the "'principle of incompletion", according to which the design of sociotechnical systems is an interactive and continuous process.

Mumford states that sociotechnical design expresses a clear ethical principle of democracy (Mumford, 1987). This increases the ability of the individual to participate in decision making, and in this way enables him or her to exercise a degree of control over the immediate work environment. The aim is to optimise the behaviour of both technology and social organization in order to increase productivity, and provide opportunities for individual learning and the development of multi-skills.

We can also find sociotechnical frames in social informatics. Social informatics has been a subject of systematic analytical and critical research for the last 25 years. This body of research has developed theories and findings that are pertinent to understanding the design, development, and operation of usable information systems, including intranets, electronic forums, digital libraries and electronic journal (Kling, 1999).

The analytical failure of technological determinism is one of the interesting and durable findings from social informatics research, whose aim is to develop an understanding of information technologies in social life. Social informatics criticizes the common approach to conceptualising new forms such as electronic journals, on-line newspaper, electronic forums, Web sites and digital libraries by emphasizing their technologically based information-processing features, such as enabling authors and readers to communicate more directly without the mediation of libraries or expensive publishers. Subsequently, a sociotechnical approach has developed that considers these new forms by mixing together both technological elements and social relationships into an effectively inseparable ensemble:

> Here computerized information systems are conceived as social technical systems, a complex and interdependent system comprised of people in various roles and relationships with each other and with other system element; hardware; software; techniques; support resources; and information structures (Kling, 1999, p.).

The aim is to connect technological artefacts to a social world in a lively way, helping designers to effectively understand the relevant life worlds and work worlds of the people who will use their system.

We can also find instances for the adoption of a sociotechnical frame in a discussion about social design (an emergent topic within the designers community), that Margolin raised inside the PhD-Design mailing list. In a message about design for social responsibility, Margolin wrote:

> ...we argue that social design can become a new paradigm for designers as a complement to market design [...] We see a continuum between market design and social design. But we argue that by considering social design as a paradigm rather than an instance of the broader concept of design, we give it more power as a project and can begin to delineate how a designer would work according to this paradigm in a way that is different from the way other designers work (Margolin, 20 Sep 2002).

On that occasion Morelli replied:

> ...in the new paradigm the idea that the output of the designer's activity should be a (material) product needs to be reviewed. I read Victor Margolin's paper for common ground with extreme interest, but after reading it I tried to think how the perspective suggested by the paper would change if we think that the designer would aim at providing something different than products, such as services, information or simply know-how (Morelli, 11 Oct 2002).

According to Morelli, it may be more useful to use the concept of sociotechnical frames, proposed in studies on social construction of technology (Bijker, 1995), because it contains more operative parameters for the analysis of the sociotechnical context in which the design action is taking place. Interestingly, reactions to this debate highlighted social design as a mediation process (Russell, 14 Oct 2002), as an ability to open the door to others to participate (Cooker, 25 Sep 2002), but first and foremost as the design of non-material social interaction situations (Popov, 25 Oct 2002).

These emerging approaches in the field of communication and outside the market-driven concerns of work organizations enlarge the original sociotechnical systems theory, but still express a general approach that is problem-centered, and aimed to the joint optimisation of social and technical systems:

> The concept of the socio-technical system was established to stress the reciprocal interrelationship between humans and machines and to foster the program of shaping both the technical and the social conditions of work, in such a way that efficiency and humanity would not contradict each other any longer. [...] the idea of socio-technical systems was designed to cope with the theoretical and practical problems of working conditions in industry (Ropohl, 1999, p. 59).

However, as Mumford outlined there are two main challenges for the sociotechnical approach. A first challenge is that today a great deal of technology is flexible and present new options both in design and use; secondly there is a challenge to develop sociotechnical systems at a macrosocial level (Mumford, 1987).

To deal with these challenges, and gain new insights in the framing of sociotechnical systems, other approaches consider the effects of systems theory or autopoietic systems. Looking at general systems theory, Ropohl focuses on how acting can be understood, and describes the concept of active entity as an "action system":

> An action system is, unlike the concepts of sociological systems theory, no fictitious system of actions, but an empirical subject of acting, a system that acts. Acting is understood as transforming a starting situation into a final situation to pre-set goals, or, in the functional terms of systems theory, as a transformation of inputs and outputs dependent on specific internal states (including goals); inputs, states, and outputs can be characterized as matter, energy, or information and occur in space and time (Ropohl, 1999, p. 60).

Similarly, with the aim of describing how heterogeneous human and non-human, social and material entities are related to one another in the sociotechnical environment, the actor-network perspective developed by Latour and Calon within the study of science and technology stresses both the contingency of networks (i.e. they are not determined, permanent, or universal), and their emergent qualities. Not only are humans and non-humans to be seen within the same (conceptual and terminological) framework, but micro-actors (individual, door-closers, etc.) and macro-actors (institutions, corporations, etc.) are also to be examined in this manner. The episteme's focus has to be based on notions of agency, rather than on notions of identity (Macgregor Wise, 1997).[97]

[97]The actor-network perspective of technology describes society and technology as mutually determining at various, interconnected levels. This perspective is alternative to both social and technological determinism. Approaches which lean toward society begin with the assumption that technology and its resulting consequences are planned and inaugurated by social actors, most often large institutional entities. Approaches leaning towards technology assume instead that technology develops according to its own internal necessity and out of dynamics beyond human control.

A further development of the actor-network theory is pursued by Felix Stalder in order to understand socio-technological dynamics in computer-based communication networks. Trying to advance this theory into directions that better capture the particular dynamics of the setting, he considers autopoietic systems:

> During the development of the product the actors and the plan changed, but not the plan's centrality. The science of complexity, as nascent as it is, can help us to develop tools to think about settings that have no overall plan but nevertheless show regularities. [...] The concept of the border in the theory of autopoietic systems is one example of how to think about organizational closure and continuity at once with interactive openness and structural plasticity (Stalder, 1997, p. 20).

The call for an exploitation of technological flexibility both at design and use times, the attention to the relationships and interconnections between the micro and macrolevel of the sociotechnical environment, the focus on the nature of acting and agency, the criticism to a persistent teleologism in the sociotechnical approach. All these advocated and recent inputs to the sociotechnical issue call to our mind facets of Metadesign, such as those clustered around the topics of "bodies" and "environment" (like embodied interactionism, event-oriented ontology, relational settings, etc.), and highlight the contribution that Metadesign as emerging design culture can give to the sociotechnical issue.

These issues also point out how the design of sociotechnical systems must deal, not only with specific work organizations or information systems, but with a general dimension of today's computer-mediated everyday experience. This highlights in turn that the design of sociotechnical systems is not solely a matter of designing and adjusting technological artefacts in harmony with the people that will use that system, but specifically a matter of how to revolutionise the design of their interaction with, and amongst, the system. From this perspective, Metadesign also spreads a new light on approaches and design methodologies like interaction design (Preece et al., 2002), originally defined as "the design of spaces for human communication and interaction" (Winograd, 1997).

Metadesign allows us to address interaction design as a sociotechnical issue against the trend towards assimilating it to experience design. Experience design can be conceived as the way business creates products and services paying careful attention not simply to expressed needs, but to an individual's entire experience (Agoston et al., 2000).Furthermore, an approach to the sociotechnical issue in experiential and co-determining terms questions the importance of a shared values system as main motivational support to collaborative (or co-creative) practices of design.

3. Building a Bridge Between Net Art and Metadesign

This third chapter describes how contemporary and interactive art practices share with Metadesign similar concerns about interaction, participation and autonomous creation as means for an expansion of human creative capabilities. On the basis of this correlation, the chapter establishes a transdisciplinary dialogue between the emerging culture of Metadesign and an intersubjective attitude in aesthetics that finds its fulfilment in Net Art, and in its collaborative practices particularly.

The purpose of this chapter is to stress how the analysis of the patterns of interaction and creation that the practice of Net Art has been able to investigate from the very first can contribute to advance Metadesign conceptual framework and principles in relation to the aspect of co-creation, and provide further elements for the understanding and definition of a new design space.

* * *

Compared to Metadesign, particularly to those applications of it more business oriented or technologically driven, Net Art has been able to answer to our new material and existential conditions with an experimentalism, that has allowed it to explore and exploit in greater depth the embodied and intersubjective dimension of human creativity.

In terms of human-computer interaction such insights and advances are still to be properly studied and treasured. In order to focus on the artistic strategies of Net Art from an interactional perspective, and to understand their aesthetic outcome (and therefore the results that the case studies will provide) within such a perspective, it is necessary to frame the theoretical assumptions that underlie them. This frame does not work in relation to a single and established genre, but to the evolution of a specific aesthetical path. The focus here is not on the issue of authorship (although, of course, this is at stake), but on the issue of creative activity, and on the aesthetical significance and implications of the creative experience triggered by the artwork.

3.1. Instances and Paths of Co-Creation in Art

This section describes instances and paths of co-creation in art, developing an analysis that connects contemporary art and net art. The hypothesis is that there is a relational attitude in art, focusing on collaborative and intersubjective processes of creative experience. This attitude represents both a status of contemporary art and aesthetics, and a kind of anthropological culture[98] in art that interactive arts - and net art specifically - enhance and explore as a sensitive response to current material and existential changes in human condition.

3.1.1. Relational Development of Form and Meaning in Contemporary Art

In this section I argue for the recognition of a relational function in contemporary art, which grounds on a crisis of form and meaning as traditionally conceived. This

---

[98]By anthropological culture, I mean that such a relational attitude is not an univocal development, but rather a cultural path that belongs to the history of art and co-exists with other instances. Today's status of contemporary art and aesthetics, particularly today's interactive and networked art practices bring this attitude to the surface.

crisis originated from the same process of dematerialization that challenged modernist design[99], and led to a focus on the idea of "process" and "experience" analogous to the one shared today by a human-centred approach in the design field[100]. The argument is supported by aesthetical studies that focus on the nature of the relationship between artwork, artist, and audience both in relation to the art form, and to the emergence of meaning.

3.1.1.1. Dematerialization and Performative Order

The paradigms of representation and aesthetics as visual pleasure started to be shattered with the process of dematerialization. Avant-garde movements in the 1960s and 1970s moved in opposition to the still-dominant modernist aesthetic. Movements like Earth Art, Fluxus, Performance, and Conceptual Art shifted towards an expanded dematerialised view of art, and towards works that incorporated the new electronic media tools, especially video and the computer. The incorporation of mass culture and photography into the fine arts by the Pop Movement, in tandem with the use in the arts of new forms of electronic representation marks the moment of a major crisis for representation (Lovejoy, 1997).

According to Davis, the "de-materialization of the object", which Lucy Lippard stresses as a feature of Conceptual Art, is carried to its technological end in artistic work with computers and computer networks (Davis, 1973). However, the trend towards a de-materialised art object had already dismantled the association between the fine arts and the physical, before the arrival of the "network society":

---

[99]See 1.2.

...the more painters, sculptors, and all their allied colleagues discard their preoccupation with carefully crafted objects made for interior use and preservation, the more they use materials difficult to order in traditional ways (such as earth, loose pieces of felt, or feedback electronic imagery), the more they exchange static strategies and display spaces for conceptual and performance structures (such as billboards on the street, the earth, the sky, and television), the less inevitable becomes the association between the fine arts and the physical (Davis, 1973, p. 168).

Another term that has been used to express such a process of dematerialization (as we have already seen in 1.2.) is the word "immaterial", whose origins are connected to the homonymous exhibition of telecommunication art held at the Centre Pompidou in 1985 and curated by Jean-Francois Lyotard. The term "immaterial", according to Lyotard merely expresses that today, throughout the world, material can no longer be seen as something that, like an object, is set against a subject. Rather, Lyotard states, it is an "increasing mutual penetration of matter and spirit", already clear in the use of word processing systems (Davis, 1973, p. 154).

Generally speaking, what is true about contemporary art is that it is hard to trace the artworks back to their linguistic status, whether they are focused on social or subjective issues. The objective, universal and all-absorbing languages of the historical avant-gardes of the first decades of the 20th century, and their revival operated by the neo avant-gardes on the second half of the century, have been replaced by the study of language itself, which has characterized the modern and the postmodern. Today, on the contemporary scene, there are any movements aiming neither to change the world, as historical avant-gardes tried to do, nor to work on the artistic form, as neo avant-gardes did. They are not even aiming to establish

---

[100]For some references, see 1.5. and 2.4.3.

themselves as an individualized language, as modern and postmodern did. Nowadays the parameters of judgement of the art system are neither representative nor linguistic, but performative (Parmesani, 1997).

3.1.1.2. Form as Collaborative Relationship

Such a performative dimension of contemporary art can be translated as a convivial, interactive, and relational function of contemporary art. This position is sustained by many contemporary authors and scholars, particularly from Nicholas Bourriaud in relation to the art form (Bourriaud, 1998), and Fulvio Carmagnola (Carmagnola, 1998) in relation to the art meaning. According to their analysis, form becomes a collaborative relationship and meaning an intersubjective event.

On the basis of the belief that any artwork produces a model of sociality, Nicholas Bourriaud has developed his relational aesthetics as an aesthetical theory that evaluates artworks in relation to the interhuman relationships they are able to imagine, produce, or trigger. According to Bourriaud, the artworks do not aim at creating imaginary or utopic realities anymore, but they try to reconstruct "ways of existence" or "action models" inside the existing reality. It is a "relational art", an art that he defines, using as a theoretical horizon the sphere of human interactions and its social context, rather than the assertion of a symbolical space that is autonomous and private.

According to Bourriaud, the reasons behind this shift towards a relational aesthetics are the general urbanization after World War II and the city as experience of proximity:

> This intensive meeting regime, once elevated to absolute rule of civilisation, ended up by producing correspondent artistic practices, that is to say an art form whose substratum is intersubjectivity and whose central theme is the being-together, the «meeting» between viewer and painting, the collective elaboration of meaning (Bourriaud, 1998, p. 15)[101].

Differently from literature, cinema or theatre, these works of art that can be "exhibited" and discussed in "real-time". They open a relational space, a specific sociality. In this way the work of art becomes a "social interstice", that is:

> A human relationships space that, fitting in more or less harmoniously and openly with the global system, suggests new possibilities of exchange, other than those that are working in the current system (Bourriaud, 1998, p. 16)[102].

Bourriaud's relational aesthetics are not a theory on art, but a theory of form seen as, borrowing the expression from Deleuze and Guattari, "affections and perceptions block":

> The form of the contemporary work of art stretches beyond its material form: it is a linking element, a dynamic agglutination principle (Bourriaud, 1998, p. 22)[103].

---

[101]Originally: "Ce régime de rencontre intensif, une fois élevé à la puissance d'une règle absolue de civilisation, a fini par produire des pratiques artistiques en correspondance: c'est-à-dire une forme d'art dont l'intersubjectivité forme le substrat, et qui prend pour thème central l'etre-ensemble, la «rencontre» entre regardeur et tableau, l'élaboration collective du sens".
[102]Originally: "un espace de relations humaines qui, tout en s'insérant plus ou moins harmonieusement et ouvertement dans le système global, suggère d'autres possibilités d'échanges que celles qui sont en viguer dans ce systeme".
[103]Originally: "La forme de l'oeuvre contemporaine s'étend au-delà de sa forme matérielle: elle est un élément relant, un principe d'agglutination dynamique".

The form is no longer a contour opposed to a content, but it is a "negotiation with the intelligible" that we share. This sharing extends until intersubjectivity, and becomes essential for the "production" of the artwork:

> Intersubjectivity, within the frame of a «relationist» theory of art, represents not only the social frame of the reception of art [...] but it becomes the essence of the artistic practice (Bourriaud, 1998, p. 23)[104].

The form can only be created by a meeting between two plans of reality and inside an eventmental temporality autonomously generated by the works and caused by the meetings[105]. Within this perspective, collaboration is a kind of "intersubjectivity engineering", inside which the viewers are involved in the form production process itself through a dynamic interaction with the space of the exhibition[106].

The function of art, in regards to this phenomenon and to technology specifically, consists in taking the perceptive and behavioural habits induced by the techno-industrial complex and transforming them into what Nietszche calls "possibilities of life". Put simply, art can reverse the authority of technique in order to make it the creator of manners of thinking, living, and seeing (Bourriaud, 1998).

3.1.1.3. Meaning as Intersubjective Event

Fulvio Carmagnola founds his analysis of the crisis of meaning on an understanding of the crisis of the traditional art form in contemporary art. According to him,

---

[104]Originally: "L'intersubjectivité, dans le cadre d'une teorie «relationniste» de l'art, ne représent pas seulement le cadre social de la reception de l'art [...] mais elle devient l'essence de la pratique artistique".
[105]Bourriad gives the example of On Kawara's telegrams.

contemporary works of art have the effect to confound and irritate, rather than to fulfil the need for completeness and beauty. They do not aim to pacify, but to create crisis (Carmagnola, 1998). In this way, meaning becomes shifting, unstable, continuous differentiation: "the result of an act of contingent choice, on the basis of an extreme redundance of possibilities" (Carmagnola, 1998). Contemporary art keeps stretching the boundaries of meaning, facing the risk of losing it, and conceives it not as a final and pacificatory meeting between significates, but as a transitory operation, as "trajectivity".

This approach deeply challenges the aesthetic thinking that centres on the notion of formativeness (Pareyson, 1974), and that sees a work of art as a unique and complete universe. According to Carmagnola, in contemporary art meaning is not to be found in understanding but in paradox, and the equivocality of simultaneous and convergent directions. It is a "becoming" that produces instead of reducing.

Meaning moves horizontally, from discourse to discourse, from translation to translation, from code to code, and not vertically, from appearance to the things as they are outside. We can merely track its transformations. Just as Liebniz's city can be viewed from infinite angles, corresponding to the perspectives of different travellers in different positions, so the epistemic object is the product of a cultural mediation whose partiality does not imply loss of objectivity, because different descriptions enrich the perception of the object.

---

[106]According to Bourriaud, there are different levels of relationality. They can concern the form, but also the exhibition and the dynamics of exchange and technological intermediation.

Carmagnola links the relational attitude of contemporary art, highlighted by Bourriaud to a continuous process of transformation of meaning. Furthermore, he links the notion of intersubjectivity to an idea of irreducibility and creative becoming. Again, intersubjectivity, as a form of exchange, becomes essential for the artwork:

> This is my perception of art: it is never linked to the possession of the object, but to my becoming [...]. And in this becoming takes place that exchange of subjectivity (not of possession) that creates that something more that frees the object from itself (Pasini, 1994, pp. 12-13).

3.1.2. Participation and Interaction

When the cultural awareness of art as a form of experience begins to grow, the contemplation of the work of art as a finite and semantically perfect object becomes challenged. While in contemporary art this process of deliverance from the art object as such and the exploitation of intersubjectivity have mainly meant new forms of "negotiation of the intelligible", in interactive art this process has more radically questioned the issue of the author as a privileged creative subject. Intersubjectivity in interactive art has been translated not only in an active participation of the viewer (like in early practices of communication art), but also in new forms of structural interaction, which opened up new opportunities for mutual exchange and for setting up new creative situations.

In this section participation and interaction will be examined as the core aesthetical principles which interactive art, and later net art, have theoretically and practically translated. Here, we see the same process of deliverance from the art object and the exploitation of intersubjectivity that have been at work in contemporary art.

3.1.2.1. Cultural Conditions

Art as we know it begins during the Greek revolution in the 6^{th} century B.C., with the notion of a creative and representative art, an art envisioned by artists whose names are now renowned. If archaic art were a mere visual indicator to convey ritual or religious meanings (let us think for instance at the representation of the Pharaoh in Egyptian art as a very tall figure to indicate his divine majesty and his role) it was because the society was an oecumene, a community that shared the same beliefs and values (Ceserani, 1988).

With the Renaissance, and in particular from the 16^{th} century onwards, another change takes place. Art acquires value in itself, frees itself from communication. It is no longer used as a vehicle to convey an institutional message predetermined by the Fathers of the Church or by the court humanist. The legend of the so-called artist creator begins. He is autonomous and has all the abilities that the God of the Renaissance possesses as the architect of the universe. The artist also tries to emancipate his art from a representative function, and to explore new forms of expression and the potential of language. Meanwhile the viewer looks, observes and finally experiences - in a world that is fragmented and in the absence of any codified and ultimate system of meanings - the world of the artist.

3.1.2.2. Artwork as "Open Work"

When the cultural awareness of art as experience begins to grow, the contemplation of the work of art as a finite and semantically perfect object becomes challenged.

The assumption that there is a sharp division, and an automatic and univocal relationship between the act of transmitting an aesthetic message and its reception is abandoned. The aim becomes the involvement of the audience, and an interactive expansion of their sensitivity: the work of art is opened (Eco, 1962).

The significance of the artwork is initially opened in a sensorial and hermeneutic fashion. Without a viewer the piece is incomplete. The collaboration between artist and viewer becomes so essential that it transforms our perception, normally centred on subject and object, making the opposition "self"/"other than self" less rigid. Viewers and author become part of the same flow, of the same creative activity. This collaboration works beyond the object, and questions the subject, challenging our very idea of what art is or can be (Ascott, 1987; Costa, 1999).

The opening of the artwork as both object and subject moves along trajectories that begin with the multi-sensorial involvement of the viewer pursued by Futurism, Dadaism, Surrealism, and Bauhaus, and continue in the behavioural and intellectual involvement of the audience which was investigated by the artistic practices of the 1950s to the 1970s, e.g. from cinetic art to happenings. From the bicycle wheel by Duchamp, a ready-made piece with which the viewer must physically connect, to Calder's mobiles that require the lightest touch to move and then fully exist. From the cleaning of the blackboard pictures by Picabia, to the analogic and digital technological systems, to the Internet, and recent molecular technologies such as biotechnologies, nanotechnologies (Pignotti, 1993; Popper, 1993; Wilson, 2002).

3.1.2.3. Artwork as Interactive Work

It is nonetheless useful to draw a distinction between "participation" and "interaction", and to understand how the idea of "interaction" further broadens the context of creative activity (Popper, 1988; 1993):

> One first distinction between "participation" and "interaction" must be drawn. In the artistic context, "participation" means, from the 1960s on, active intervention (both intellectual and behavioural) of the viewer. This double invitation, that breaks with the traditional attitude towards the viewer, carries important socio-political implications. [...] The word "interaction", of more recent use in the artistic field, gives the viewer a role that is even more important. In this case, the artist tries to stimulate mutual exchanges between his/her works and the viewer, a process made possible by the recent technological systems that allow to create a situation in which the work of art reacts (or answers) to the actions (or to the questions) of the user/viewer. These artworks are usually to be found in the shape of a global net, they demand the complete participation of the viewer. Their meaning is undoubtedly sociological, more than directly political as the works of the Sixties, because they are more involved in environmental and daily issues, sometimes with a distinctive scientific quality. In the contemporary art context, "participation" indicates the relationship between the viewer and a "finite" work of art, whereas "interaction" designates the mutual exchange between the user and an "intelligent" system. Up to recent times, in particular in the United States, the word "interaction" was used exclusively to designate the exchanges between the artist and the system, but nowadays it is also applied to the relationship between viewer and artist, established trough the intermediation of different kinds of net, from a simple electric or electronic device to a set of local or worldwide terminals. Within this broadened context, the creative activity is no longer limited to "professionals" - artists, architects, composers - but involves a wider audience (Popper, 1993, p. 8).

Interactive art is based not only on "participation", on the active intervention of the viewer (or user) and on the socio-political implications of this act, but also on "interaction" and the possibility to create mutual exchanges. "Interaction" allows the artwork not simply to be "open", but to set creative situations in which the artwork reacts and builds itself:

> When Duchamp suggested that the work of art depended on the viewer to complete the concept, little did he know that by the end of the century some works of art (such as interactive films) would literally depend on the viewer, not only to complete them, but to initiate them and give them content (Rush, 1999, p. 171).

The artwork tends to require the capability, and often the necessity to newly metamorphosise. Exploiting the ability of computers to react in real time, and to work at the level of the material sources of the creative process[107], images and sounds are modified in close relation to the presence and the actions of the viewers, which are transformed in their turn in active intermediaries (or co-authors) between tool, work and artist (Bordini, 2000).

Electronics and digital technologies have made these creative situations and events possible, disintegrating representation in electrons and then bits. Most significantly, however, digital technologies have made accessible the source of the creative processes, where images and sounds can be manipulated[108]. Lastly, the global interconnectivity of the Internet has enabled these new technologies to become something more than new tools, since they have the property of generating new relationships between human beings within the creative process, and of creating new languages and forms of experience (Ascott, 1987).

---

[107] I can modify a computational structure, combining differently the units of information that compose it, but I cannot modify, for instance, the composition of pigments on a canvas that have already been painted.

[108] In the computer art field, artists like Michel Bret, defending a "procédural art", stressed the difference between traditional tools, that do not allow the visual artists to work on something more than the objects, and the computer, which now permits them to have access to the processes and the sources of creative activity.

3.1.2.4. The Net Condition

Consistent with an aesthetical principle of "interaction", an interactive work of art can also be seen as a work that uses branching systems and networks for creating connective links and nodes. The role assumed by the interactive artist in creating the work is similar to the role of a systems designer, and the artwork takes on a different relationship to the viewer, who participates in the ultimate unfolding and meaning of the artwork itself (Lovejoy, 1997).

In this sense telematic technologies are not just extensions of other existing media, but rather they support "a new open-ended field of creative endeavour, one which is without an aesthetic of closure and completeness" (Lovejoy, 1997, p. 230). This creative endeavour has been extensively explored by Mario Costa and Roy Ascott particularly, who have stressed that the dimension opened up by the interactivity and connectivity of telematic technologies deals with new forms of creativity and existence.

According to Costa, in order to recognize the interaction, beyond an understanding of it as an active intervention in the moment in which the work is being made or completed, it is important to a focus on what he calls the "hyper-subject":

> The point is not the substitution of the *metaphysical subject* with an analogously metaphysical *absence of subject*; the most important thing is to understand how the functioning of a device modifies the subject in which it is inserted and makes it work (Costa, 1998, pp.85-86)[109].

---

[109]Originally: "Non si tratta di sostituire a un *soggetto metafisico* un'altrettanto metafisica *assenza-di-soggetto*; si tratta invece di capire come il funzionamento di un *dispositivo* atteggia e fa funzionare il soggetto che in esso si inserisce".

Costa's focus on the relation between subject and object within the interactive system that produces the artwork allows us to make a theoretical distinction between interaction as a form of "participation" and interaction as a form of "collaboration". Such a distinction seems to connect the notion of collaboration, approached by Costa in relation to the idea of "hyper-subject", to the issue of subject, and then to the one of intersubjective relationships. The peculiarity of collaboration, in the interactive art context, is that the subject relates and works with other subjects within a new perceptual and performative condition.

In this situation, the intersubjective relationship necessarily becomes a creative relationship. Roy Ascott's works and theories provide a clear insight into the characteristics of interactive art, and telematic art in particular. His observations underline how deeply creative the relationship and interaction between subject and object is within an art that is no longer style and form but sensitivity. It presents a possibility and modality of reality construction:

> Art, which was previously so concerned with a finite product, a composed and ordered outcome, an aesthetic finality, a resolution or conclusion, reflecting a ready-made reality, is now moving towards a fundamental concern with processes of emergence and of coming-into-being. This raises critical, theoretical, and aesthetic questions which we can no longer avoid. In an important sense the issue is political, it concerns as much the democratisation of meaning as the democratisation of communications, that is to say a shared participation in the creation and ownership of reality. [...] Instead of creating, expressing, or transmitting content, [the artist] is now involved in designing context: contexts within which the observer or viewer can construct experience and meaning (Ascott, 1993).

Noticing the change in the status of the art object and the artist, Ascott stresses the new collaborative dimension of artistic creation as doorway to a dataspace of semantic and material potentiality:

> The status of both art and artists changes radically [...] Responsibility for meaning is shared, creativity comes out of cooperation and authorship is dispersed. [...] The interface to these systems is not the window to an ordered reality as presented by Renaissance art, but a doorway to an infinitely transformable reality, the threshold to variable worlds, in which we can creatively move and meet and have our being (Ascott, 1991, p. 116).

Now, the next stage of radicality will be the reversible nature of the effect between real and virtual, between local and non-local (Ascott, 2002; Weibel & Druckrey, 2001). The Net, as it is configured today, imposes new conditions on the historical media and historical social forms of communication and art. Net-based installations are the latest stage of media art since the video-based sculpture of the 1980s and the computer-based, interactive installations of the 1990s. In net-based installations, the changes and advances of Net Art are clearly demonstrated by two traits:

> Firstly, the net forges a link between the local, physical, real and material space of the *hic et nunc* and the dislocated, virtual, immaterial space of the information sphere. [...] Secondly, the interaction is not unidirectional, monosensory and irreversible... In a computer-based net installation, for the first time the relation between the image and the viewer is reversible, i.e. it takes place in two directions (Weibel & Druckrey, 2001, p. 14).

According to Ascott, the radical nature of this "telematicity" can even be found at the heart of molecular structures and epigenetic systems (Ascott, 2002). Thus, while interactive art is being networked and is evolving towards forms of intersubjective creation it is also experiencing, by the means of nano and biological technologies, new ecologies and new materializations[110].

3.2. The Lesson of Net Art

Compared with previous experiences of telecommunication art and with other interactive art practices, Net Art has its own specificities. Rather than as an established genre or ideology, Net Art is conceived and analysed in this work as an example of "trans-genre" media, that is to say as a form of thought and practice. This approach to Net Art distinguishes between the understanding of aesthetic outcome from an interactional perspective, which is in turn framed within and legitimised by the aesthetical and cultural path described in the previous sections.

This section highlights the creative strategies and patterns of interaction that Net Art has been able to investigate from the very start. It stresses how their analysis focuses on the intersubjective processes of creation triggered by Net Art, and how such processes can be relevant for Metadesign in a transdisciplinary context. These processes might also contribute to identify a new design space that can match and enhance the potential of our contemporary material and existential conditions.

3.2.1. A Definition of Net Art

When artists discovered the Internet as a media for their work in the mid-90s, for many of them it appeared not only as a way out of the art industry and as a newly

---

[110]This aspect will not be taken into account within this work, which is focused primarily on the

discovered free space for their own work, but also as a chance for global and free communication: consumers who become producers; social networking over and through geographical and political borders; direct information exchange beyond economic constraints and without filtration through the mass media (Baumgärtel, 2001). Today there is a critical attitude toward such practice and this has now become one of Net Art's distinctive qualities. In fact, according to David Ross, one of the first to take Net Art seriously, discursive quality is always embedded in the actual work of Net Art, which suggests the collapse of the distinction between critical dialogue and generative dialogue. In turn, we could suggest the collapse of the artwork itself and its critical apparatus, into a single "back-and-forth continuum" (Ross, 1999).

Given this information, a distinction can be drawn between artworks realized in the World Wide Web and conceived of as their own self-contained Internet site, and artworks meant as social connections and collaborations which, according to Baumgartel, can take place in mailing lists or in other "virtual communities" (Baumgartel. 2001)[111].

The first "net-works", like Jodi or Superbad, are net-specific, which means that they could not exist in any other medium because. For example, they work with the technical dispositive of the browser software and the transmission speed of the Internet, but they do not invite an exchange, and their interactivity is limited to allowing the user to navigate in various ways through these sites by mouseclick. The second, in contrast to these, are projects or "networks", more strongly oriented

---

intersubjective processes of creation triggered by Net Art.

towards a wider participation. According to Baumgartel, instances of these are "net communities", which were born as a product of the collaboration between a collective of artists, programmers and political activists. Since the beginning these groups were concerned with producing situations that invite social interaction:

> From the beginning were thought of as 'context-systems' in which the artists offered an infrastructure in which a great number of users are able to communicate with each other and interact and therefore function as a 'network'. These projects are therefore also comparable with Joseph Beuy's concept of the 'social sculpture' (Baumgärtel, 2001, p. 160).

Like previous examples of telecommunication art, Net Art shows a tendency toward experimentation, a dichotomy between a formal aesthetic approach and a more socio-political approach, and generally "ludic, ironic, provocative and jubilatory features" (Bureaud, 2001). As Bureaud points out, Net Art has also inherited concepts and forms that were elaborated twenty years earlier (see 3.1.2.4.), such as the notion of connectivity, distributed self, ubiquity or telepresence, hypermedia, and the invention of "plastic" spatio-temporal forms that fluctuate to the rhythm of network flux.

In his survey on information arts, Wilson reviews all these elements of Net Art, and describes how, for many kinds of artistic activity in the current era, the World Wide Web is a critical context and source of many opportunities. According to him, many artists are using the Web primarily as a distribution system. Many are using the Web to create exquisite, nonlinear multimedia events that can be navigated differently by each visitor. Many consider it one of the most radical developments in the arts world

---

[111]To express this distinction Baumgärtel use the words "net-works" and "networks".

because of its promotion of interactivity, distributed authorship, decentred presentation, and the interleaving of image, sound, and text. All these uses exploit connectivity between persons, to collaboration and group work, creation of distributed archives, internationalism, and comment on the Web context (Wilson, 2002).

In this work, the expression "Net Art", now widespread, is adopted to identify an area of artistic practice that works on the interconnective properties of the Internet as a "raw material", and marks a difference from other practices, more concerned with an expressive exploration of the multimedia language of the Web (more often named "Web Art"). In adopting this expression, I do not mean to refer to "Net Art" as a kind of established genre or ideology, whose origins seem to go back to a malfunctioning piece of software (Shulgin et al., 2001). I refer to an idea of Net Art as networked practice of interactive art, better as "primarily a form of thought and practice based on the concept of weaving and not simply an interactive mode of art based on networked technology" (Ueno, 1996) As a kind of "trans-genre" (ibid).

Technologies of networked computing allow art to use permanent and global computer networks and a hypertextual and multimedia communication system: an electronic space that people can experience and navigate. The Web, as this space is usually called (even when accessible through mobile and ubiquitous devices like PDAs or cellphones), is properly a specific region of cyberspace (December and Ginsburg, 1997). Specifically, it can be described as the electronic space generated and generating itself by connections and activities of computer networking. In colloquial terms, this electronic space can also be described as "having to do fundamentally with connections between people or connections between things" (Ueno, 1996).

Net Art arises from these connections, from flows of data and network interactions. In general terms, we can say that it uses the Web as a raw material, for its connective and interactive properties, instead of exploiting it to promote particular contents or to produce objects. Net Art originates and generates interaction processes, so that the interactive properties of the work and the conditions for the process of interaction can be generally considered its main qualities (De Kerckhove, 1997).

Three interrelated levels of activity have been identified as constitutive of a work of Net Art. They have been called "movements"[112], and are: interactive exchange, morphogenesis, and emergence of meaning (Giaccardi, 2002). Rather than to produce a list of genre features or a tassonomy of possible genres, the analysis of these "movements" will enable the framing of Net Art within the aesthetical path explored in the previous sections of this chapter. Such a process, will also help us to recognize how peculiarly intersubjective and creative processes are at the heart of a work of Net Art.

3.2.2. Mov.1: Interactive Exchange

Interactive exchange relates to the 'making'. It is the result of interactions between users and computers, and within each group. It is the movement that defines the dynamics that lead to a 'material outcome'[113].

[112] I call them "movements" because they are correlated, and they cannot be imagined individually.
[113] Such a material outcome can also be, the simple "visualization" of a creative activity. Even though the third movement of emergence of meaning (see 3.2.4.) is actually part of the same creative process, it does not affect directly (that is to say structurally) the material "production" of the outcome.

According to its standard meaning, the idea of interaction identifies a particular way of action that involves several subjects. Specifically, interactivity can be defined as the peculiar property of computational tools and systems that qualify the user as an agent, able to start and perform actions alternately with the actions performed by the system or by other users with which he is having a dialogue, by means of the system (Vittadini, 1993). Through interactivity the user develops, from one who simply sends and receives, into the performer of the exchange between himself and the computer, or between himself and other users.

The place of this exchange, where users meet and relations come about, makes the interaction itself the real object of creative production. Therefore, the kind of interactivity that can be performed, and the quality of actions that the interactive properties and the conditions for the interaction process allow within the system are a matter of the greatest importance. In fact, different kinds and qualities of interconnectivity[114] affect the capability of the system to increase the scope and complexity of the space of creation. This capability can be seen as a form of "virtualization" (Lévy, 1998):

> By nature problematic, the virtual is similar to a subjective situation, a dynamic configuration of trends, forces, finalities, and constraints resolved through actualization. Actualization is an event, in the strongest sense of the term. An act is accomplished, but not predetermined, and it in turn modifies the dynamic configuration in which it assumes meaning. The articulation of the virtual and the actual animates the very dialectic of the event, the process, of being as creation (Lévy, 1998, p. 171).

Following the interactional perspective adopted in this work to investigate Net Art, the two planes of *poiesis* and *semiosis* (production and interpretation) are here kept separate in the analysis of the

According to this interpretation, the more collaborative capabilities are wide, the more the event is indeterminate. The more interactivity raises the virtualization of the system, the more deeply users are in the heart of creation.

A first, basic distinction can be made between an "interactivity of selection" and an "interactivity of content" (Vittadini, 1993). This distinction sounds a little schematic, but is very useful when connected to dynamics of virtualization/actualization.

Interactivity of selection is peculiar to hypertextual language. The active intervention of the user is exercised through a set of paths, searches or selections that he can make. The user interacts within a field of possible choices he has the power to realize[115]. When the outcome of his action is a new web page, an audio or video file, in short when it is retrieved information, the user can realize only what is already possible, and this condition is independent from the range of his selection.

Interactivity of content, or creative interactivity, incorporates the user directly into the "making". In this case, the user does not simply realize an option, but creates something new. The outcome of his action is not a web page or multimedia file selected and served through a hyperlink, but it can be any sort of content and action that the user can create or perform through an interface, and according to the structure or the performativity of the system that has been designed.

---

creative process.

[114]See note 24.

[115]In this case it is a dynamic "possible/real". According to Deleuze and Guattari, and Lévy later, the possible is already fully constituted, but it is missing existence. In this sense the realization of a possible is not an act of creation in the fullest sense of the word, for creation implies the innovative production of an idea or form.

In relation to the interactivity of content, a further important distinction can be made between different qualities of creative interaction. According to the distinction established in this chapter between participation and interaction, a difference can be made between an interactivity of content based on participation ("participatory interactivity"), and an interactivity of content based on collaboration ("collaborative interactivity"). This difference is of course again schematic[116], but it is enlightening and fruitful in corresponding the aesthetical and the interactional level of analysis.

Participatory interactivity makes a user's actions a personal contribution to the work. The user participates with something of his or her own in the construction of the outcome, as well as with other innumerable users, scattered across the Net in different times and physical spaces. His or her contribution can be valued, mediated or even manipulated by the artist (or artists), and it can be collected in a predetermined structure. The user's contribution is somehow directed, it has its a priori structural or conceptual location inside the whole developing of the artwork. Usually the contribution is "sent", and exists as a text, a graphic or multimedia file previously created by the user on his or her hard disk, in a stand-alone manner.

Alternatively, with collaborative interactivity artwork comes into being and acquires meaning inside, and through the very process of collaboration. Creation is based on dynamics and strategies of interaction and collaboration working on interpersonal relationships, collective mechanisms or any other pattern of relations (Giaccardi, 1999). Artwork appears and disappears, leaving sometimes only documentation, a

[116]In another paper of mine addressing different typologies of artistic agency on the Web, it emerges how these qualities may blend. SITO (www.sito.org), for instance, is clearly based on a community agency that can mix participatory and collaborative interactivity without interruption. See (Giaccardi, 1999).

trace, a generational path. It is basically a shared creative experience, where authorship shifts towards relational processing and new agencies.

Indeed, the theoretical difference between participation and collaboration (and then between participatory and collaborative interactivity) is supported, not only by the aesthetical distinction recently established by Popper within the frame of a discourse on interactive art, but also etymologically. In fact, "to participate" suggests the idea of someone taking "part" in something that is somehow out there, while "to collaborate" shifts the semantic centre on the suffix that means "with" (from the Latin "cum"), and on the notion of active working (from the Latin "labor"). The word collaboration therefore suggests the idea of working "together with" someone else, and more explicitly suggests the idea of an ongoing process of mutual interaction[117].

3.2.3. Mov.2: Morphogenesis

When an interactivity of content is developed, the artwork is dependant on that interaction, and keeps on changing and generating itself under a neverending morphogenesis. This process of morphogenesis is originated on one side by users' interactive exchange, and on the other side by the peculiar features of cyberspace. In fact, grounding on the new material and environmental conditions of being and consisting that cyberspace provides to the artwork, the creative process induced by the interactive exchange continuously alters the artwork and its status.

---

[117]In the field of CSCW a difference is also established between collaboration and cooperation. Such a difference is conceived as a difference in focusing on the modality or the purpose of the work. So: "To collaborate is to work together or with someone else, and to cooperate is to work or act together for a shared purpose" (Soorgard, 1987, p. 3).

Sometimes these alterations appear to be a growing up of the "body" of the artwork, or an increased complexity of its form and branching. Users' direct or indirect contributions[118], usually brought about in asynchronous times, change the stored data, their manner of linking, and the occupied space of memory. In this way the work is being modified by the time and space of access to the artwork and its semiotic emergence.

Sometimes, these changes are more subtle, less tangible, and they emerge as "wave movements", rather than as visible aftermaths. Clearly from the analysis of projects primarily based on collaborative interactivity (Giaccardi, 2002), the "body" of the artwork is better described as a flow of activity generated by the process of interaction, rather than as an open structure. In this case time and space of creative activity are collaboratively modified by the rhythm of interaction processes, and by their existential duration.

Grounded in processes that are formed by joining information treatment and collaborative activity seamlessly, the "raw material" of the work, morphogenesises, making the artwork fall into an interactional and eventmental field of existence.

3.2.4. Mov.3: Emergence of Meaning

This third movement does not relate to hierarchies of signifying and signified, but to dynamics which incorporate into the artwork the capability of users to produce and

[118]In some cases users' contributions are unintentional, in the sense that they are produced by unconscious and hardly intelligible activities, for instance accessing to a website and browsing it.

share meanings. Again, users deal with processes, where meaning is at stake, as it was a "raw material".

Meaning contributes to the artwork's form. At the same time, meaning is also given by the form; configuring itself as a personal, communal, or collective meaning, and determining recognized and shared contexts. It operates at the level of that "poietic excitement" that is determined by the interactive exchange, and in which it is constantly processed. On a different level, meaning is objectified through the discourses and practices it is able to generate, blurring personal time with collective time, one's own storytelling with collective storytelling.

In such a complex processing, poietic activity and semiotic activity loop and synthesize the cyber and the existential continuum. In fact, this processing involves users' perceptual, social, and cultural systems, and intertwines this meaning with users' wider context of existence.

The unstoppable emergence of different patterns of meaning, not only highlights the intersubjective contingency of meaning, but also its deep irreducibility. Users do not deal only with the interpretative breaks of every artwork. Here meaning "makes" the artwork as well as computational data. In the same process, in the same poietic excitement, matter seems to be constituted of different materials and generations of reality.

From the analysis of the three movements of interactive exchange, morphogenesis, and emergence of meaning, it is clear that the value of a project of Net Art is complex. It can be compared to the value of an architectural space, that is judged not only by being nice or ugly, functional or otherwise, but expresses a value related to its environmental dimension (Zevi, 1993). In the same way, the complex value of a project of Net Art is related to an experiential dimension to inhabit, into which users can plunge.

The complex and irreducible value of Net Art makes it impossible "to judge" the outcome from a traditional and merely aesthetic perspective. Without incurring in the self-referentiality of more codified art forms, Net Art[119] generates unforeseen and unforeseeable outcomes, the value of which is the pleasure or the significance users derive from the experience and meaning that the outcome delivers[120].

3.2.5. Collaboration and Co-Creation

It is clear that both collaboration and co-creation, meant as intersubjective processes, are substantial in the definition of a relational attitude that moves from contemporary art to net art, passing through avant-garde and interactive art. At this point the specific elements that characterize the digital arts[121] can be summarized in the following points.

First, the creative process of the work is primarily based on interactivity. This does not mean that the work is simply "to be completed", or made effective in all its socio-political implications by the active intervention of the audience. It is not a

---

[119] When seen and analysed as a "trans-genre" of course, and not as a codified genre.
[120] It is also true that now many net artists are quite well integrated within an art institutional system and cleverly promote themselves. Nevertheless, a dimension of their work remains that is somehow programmatically "out of control". This dimension lies at the convergence of the three movements described in this work.

relationship between a viewer and an artwork that is, somehow, already there. The fact that the creative process is primarily based on interaction means that it exists in a reciprocal exchange, in a mutual relationship between one or more viewers and a "reacting" artwork, an artwork that is generated by the very relationship.

Secondly, digital arts are based on the premise that computational media and other molecular technologies allow people to operate at the sources of the creative activity. This means that people do not work on "objects", but on "processes". In this way people's perception, which is usually centred on the distinction between objects and subjects, changes, and the subject itself comes to be defined not by the rigid opposition between "self" and "other", but as part of the same creative flow. This allows creative activity to become a flow that is not limited to professional artists anymore. Quoting the interactive artist Toshiro Anzai, we can even radicalize this condition, and assume the idea that creation can only be conceived as co-creation: "You can't create anything by trying to separate yourself from others" (Anzai, 1994). This idea is also presumed by the biophysicist Hiroshi Shimizu, who argues that we cannot create anything by trying to separate ourselves from others, or by trying to separate ourselves from the place that activates people's creative desire (Shimizu, 2001; Yoneyama, 1996; Yoneyama, 2001).

In relation to these points, and in comparison to interactive art, net art seems to produce an empowerment of the collaborative capabilities of the work and an indeterminate end, by exploiting the computational power added to the decentralized structure of digital networks, and profiting from the quality of new

---

[121]Both interactive art and net art are fundamentally based on the computing power of current digital

materials and processes available to participants. Such empowerment and freedom allows users to be "in the heart of creation", and to enact a process of virtualization and actualisation based on the capability of the system, and on the different kinds and qualities of connectivity and interactivity that the system provides. The more people are connected and the more frequent their interaction, the more new relationships rise and new forces are at play. Such a "net condition" increases the scope and complexity of the creation space, and allows users to be effective co-creators, turning the notion of collaboration into one that is highly intersubjective and creative.

3.3. Net Art and Metadesign: Working Hypothesis

Compared to Metadesign, particularly to those applications which are more business oriented or technologically driven, Net Art has been able to answer our new material and existential conditions with an experimentalism, that has allowed it to explore and exploit in greater depth the embodied and intersubjective dimension of human creativity. Nevertheless, both Metadesign and Net Art share some fundamental assumptions and concerns, on the ground of which it is possible to establish a fruitful transdisciplinary dialogue.

3.3.1. A Shared Design Experimentalism

The dismantling experimentalism adopted by Net Art in the effort to answer the material and existential conditions that new technologies have brought about in our

---

systems.

lives, has meant new forms of creative experience. We have seen evidence of such innovation in this chapter[122], along with many fresh and imaginative design approaches.

As Pelle Ehn points out, it is interesting to notice how artists experimenting with new technologies are often at the absolute frontier of design research, exploring for instance new forms of human-computer interaction and new ways of experiencing our virtual and material reality (Ehn, 1999). Even more interesting, is how this experimentalism is often "compromised" with a new approach to the world, and thus to design itself. Such experimentalism seems to have overcome the antinomies derived from the maintenance and reproduction of the art sphere as a culturally split space that belonged to the avant-garde experimentalism:

> The incompleted avant-gardist attitude is the one that, in the first avant-gardes, expressed the project of the universalization of art, the programme of its anthropologically split configuration. This fundamental avant-gardist project is still the deepest limit of our aesthetical horizon. Its stagnation (and not its frustration) cannot be separated from the thought that its practical realization is linked to a complete transformation of the society we live in, of our whole way of living. The historical avant-gardes maintained on the contrary that art was the most powerful force that could modify human life (Jimenez, p.14)[123].

Net Art experimentalism seems to be aware that the space between the apparent dimension of art and the transformation of the world is not only to be found in the

---

[122]As we have seen art experience has also begun to be conceived as creative (poietic), rather than as exclusively perceptual (aesthetic).
[123]Originally: "L'attitudine avanguardistica incompiuta è quella che nelle prime avanguardie formulò il progetto della universalizzazione dell'arte, il programma della sua configurazione antropologicamente scissa. Tale fondamentale progetto dell'avanguardia costituisce, ancora oggi, il limite più profondo del nostro orizzonte estetico. Il suo ristagno (e non la sua frustrazione) risulta indissociabile dalla constatazione che la sua realizzazione pratica è legata ad una trasformazione integrale della nostra civiltà, del nostro modo di vivere nel suo insieme, a differenza delle impostazioni più comuni nel

universe of art, and that the practical realization of this transformation is not based only on projects of expressive, formal and linguistic renewal, but also on the transformation of the cultural, economic, and social structures in which art is set.

It is in this kind of experimental disposition that I see the promise today for a transdisciplinary hypothesis between art and design. Metadesign and Net Art respectively express a movement "beyond design" and "beyond art" in the light of a response to shared material and existential conditions, mainly due to computational malleability, interactivity and connectivity. It is in this movement that I see a mutual and interesting convergence between the two, and the groundwork for some working hypothesis.

3.3.2. Further Analogies, and Some Differences

Having accepted the premise for a transdisciplinary work, we can compare closer Net Art and Metadesign, and notice that they show some overlaps and differences. Their overlaps confirm the legitimacy to establish a connection between the two, and to set some working hypothesis. Their differences give an indication of the points where their connection might be fruitful.

Both Net Art and Metadesign concern the expansion of human creativity. The shift or, more correctly, the possibility for the user to transform from viewer or consumer to co-creator or co-designer, represents a call for an expansion of the creative process in art and design. It is hence evident that both Net Art and Metadesign deal with co-

---

dispiegamento storico delle avanguardie, le quali limitavano alla dinamica esclusiva dell'arte la forza di creation, because they both aim to activate collaborative processes that allow the emergence of creative activities. In the practice of both Net Art and Metadesign such expansion is supported by open and malleable structures, but the main difference consists in the purpose of the work and, therefore, in the nature of the creative process that is activated. In Metadesign, as in design, the main objective is to solve problems and manage the knowledge necessary to that purpose. In Net Art, as in interactive arts, the approach is not oriented to solve a given or emerging problem, but rather to experience the work itself. From this basic difference it derives that in Metadesign users are mainly prompted by rational motivations and explicit goals, while in Net Art they are supposed to be moved also by playful enjoyment and a personal feeling of value. This is the reason why Net Art has explored the expansion of human creativity in the terms of an expansion of the intersubjective dimension, dealing, although not exclusively, with feelings and emotions.

There are also other interesting, random overlaps between Net Art and Metadesign, which seem to suggest a shared cultural background at the convergence of art and design. If we look for instance at the idea of the interactive artist as a systems designer (Lovejoy, 1997), a clear link appears with the idea of the metadesigner as a systems integrator (Galloway, personal communication). As well, we have seen how the discussion of Metadesign is many times raised within the art field or art-related discussions, by artists that are at the same time designers (and vice versa).

---

maggiore portata nella trasformazione della vita umana".

Another interesting overlap is represented by some points that Metadesign shares with telematic culture, which has contributed significantly to the birth of Net Art. This presents the idea that design has been developed within such a culture:

> Instead of creating, expressing, or transmitting content, (the artist) is now involved in designing context: contexts within which the observer or viewer can construct experience and meaning (Ascott, 1993).

The very idea of "seeding", defined by Roy Ascott as a way of designing that should replace top down designing; the idea of a "non trivial interactivity", conceived as an open-ended and infinite interactivity capable to accommodate always new variables; the idea of "OES", open-ended systems in which interaction takes place within networked, algorithmic or evolutive systems which put the user or the environment in control of the interaction itself[124] (Ascott, 1995b). All these present interesting points of convergence with Metadesign, and they further confirm the validity of the premise on which a transdisciplinary comparison between Net Art and Metadesign can be established.

3.3.3. What We Can Learn from Net Art?

As we have seen in this chapter, Net Art, following a distinctive aesthetical path, has explored the expansion of human creativity in the terms of an expansion of the intersubjective dimension, also termed "in-between" (Ascott, 1999). The exploration and exploitation of the intersubjective dimension, particularly in terms of feelings and emotions, represents instead a weak aspect in the practice of Metadesign,

---

[124] They are considered alternative to "FDS", finite data sets where action is within pre-designed limits, presented as a unitary experience, with the artist in control.

though many theories of Metadesign have addressed this topic as a crucial element in the developing of a methodological framework[125].

In Net Art, the so called "in-between" is experienced through networked processes that allow people to grasp the available intersubjectivity. Relations come about within a place, at the same time physically distributed and interactively connected, where subject and object are relationally "embodied" into the system. The ways in which subject and object are relationally embodied into the system and enabled to interact can be different. Creative processes can arise from interpersonal relationships, group relationships, collective mechanisms or any other pattern of relations (Giaccardi, 1999). Also, intersubjectivity can be extended to comprehend different realms and different planes of relation[126] (Giaccardi, 2001).

Collaborative practices of Net Art open a dimension in which the creative act is not a representative act, but something that allows us to inhabit and act directly in a "poietic" environment. In this environment, where the work originates "by itself" and users perform their creative actions interacting with one another[127], the complexity of the work increases to the point that makes the project itself "explode". Through the network, the order of the components of the work and the attractors activated is theoretically multiplied infinitely, and co-creation is at a maximum degree of virtuality.

---

[125]See in particular 2.2.1., 2.2.4., and 2.4.2.
[126]Human-to-human, interspecies, human-to-artificial, artificial-to-artificial.
[127]It is what has been called interactive exchange (see 3.2.2.).

The question is: how can we design systems and interfaces that enable to explore and exploit the intersubjective and computationally embodied dimension of co-creation? The case studies that this work will examine, by focusing primarily on the dimension of interactive exchange, aim to allow the identification of design principles that can provide Metadesign systems and interfaces with greater intersubjective capabilities, and support computational environments that are effectively co-creative.

The results of the case studies, in view of the transdisciplinary dialogue already established between Net Art and Metadesign in this chapter, can contribute to advance Metadesign conceptual framework and principles, and consequently to define boundaries, scope, and features of a new design space.

4. Methodology

This fourth chapter illustrates the general methodology and the specific methods adopted in this work. It stresses how the construction of the problem represents the fundamental methodological issue of this work, which the author epistemologically assumes and to which she responds by transdisciplinary logic.

The purpose of this chapter is to describe how theory development and case study research integrate in a coherent methodological framework based on transdisciplinarity and phenomenology.

* * *

4.1. General Methodology

This first section describes the methodological issues related to theory development, e.g., general approach, construction of the problem, and applied methods.

4.1.1. Between Art and Design: A Transdisciplinary Approach

In the general development of my work I have adopted a process-based approach, which is applied from the formulation of the research questions to the knowledge synthesis phase and definition of problem resolution strategies, and which can be summarized in the expression "transdisciplinarity".

The concept of transdisciplinarity can be interpreted in different ways. Generaly speaking, transdisciplinarity is concerned with the crossing of boundaries in the production of knowledge. Disciplinary boundaries can be crossed in the same way that the boundaries between theoretical and practical knowledge are crossed. It is not aimed at producing a totality of knowledge, but a "crucial knowledge":

> In order to navigate this exponentially growing complexity we need to develop tools of thought which use different logics, ones that include the subject and allow a wider view which can be used across all disciplines, allowing strategic points and knots of communication to be located. As Edgar Morin exhorts us: "Our effort, then, will not be directed at the totality of knowledge in each sphere, but on crucial knowledge, strategic points, knots of communication, organizational articulation between disjointed spheres" (Henagulph, 2000).

Transdisciplinarity responds to the emergence of a different view of reality and alternatives to bivalent logic. This century has seen the rise of chaos, complexity and the non-linear sciences, but while these concepts are revolutionizing our understanding in different disciplines in science, their fundamental knowledge has not yet made its way to the social and political spheres. Indeed, the concept of a uni-dimensional reality governed by a bivalent logic and linear simplicity seems more entrenched than ever as people search for firm ground on which to stand in a rapidly changing world. The rise of fundamentalist movements (on any side) and increasingly punitive laws are a reaction to the increasing complexity of societies all over the planet (Henagulph, 2000).

The indispensable need for "bridges" between the different disciplines is attested by emergence of pluridisciplinarity and interdisciplinarity around the middle of the 20th century.

Pluridisciplinarity concerns the study of a research topic not in only one discipline, but in several at the same time. For example, a painting by Giotto can be studied not only within art history but also within the history of religions, European history, and geometry. Multidisciplinarity brings a plus to the discipline in question, but we must remember that this plus is always in the exclusive service of the original discipline. In other words, the multidisciplinary approach overflows disciplinary boundaries while its goal remains limited to the framework of disciplinary research.

Interdisciplinarity concerns the transfer of methods from one discipline to another. Such a transfer can be at a level that is applicative, epistemological, or related to the generation of new disciplines. Like pluridisciplinarity, interdisciplinarity overflows the disciplines but its goal still remains the framework of disciplinary research.

Instead transdisciplinarity concerns that "which is at once between the disciplines, across the different discipline, and beyond all disciplines" (Nicolescu, 1996a).

Among the fundamental principles of transdisciplinary research is the recognition of the existence of different levels of reality governed by different types of logic[128]. This is inherent in the transdisciplinary attitude, and any attempt to reduce reality to a single level governed by a single form of logic does not lie within the scope of transdisciplinarity (de Freitas et al., 1994).

---

[128]Reality here means that which resists, according to Henagulph, our knowledge, experiences, representations, descriptions, images or mathematical formalizations.

For classical thought, transdisciplinarity appears absurd because it does not appear to have an object, but in the presence of several levels of reality the space between disciplines and beyond disciplines is full just as the quantum vacuum is full of all potentialities. The discontinuous structure of the levels of reality determines the discontinuous structure of transdisciplinary space. Disciplinary research concerns, at most, one and the same level of reality; moreover, in most cases, it only concerns fragments of one level of reality. On the contrary, transdisciplinarity concerns "the dynamics engendered by the action of several levels of reality at once" (Nicolescu, 1996a).

Instead of a discipline-oriented reduction in complexity, what must be developed is a target and action-oriented complexity reduction, but the discovery of these dynamics necessarily passes through disciplinary knowledge. In turn, disciplinary research is clarified by transdisciplinary knowledge in a new, fertile way. In this sense, disciplinary and transdisciplinary research are not antagonistic but complementary. Transdisciplinarity complements disciplinary approaches. It does not strive for mastery of several disciplines but aims to open all disciplines to that which they share and to which lies beyond them. It presupposes an open-minded rationality by re-examining the concepts of "definition" and "objectivity" (de Freitas et al., 1994).

The transdisciplinary vision is resolutely open insofar as it goes beyond the field of the exact sciences and demands their dialogue and their reconciliation with the humanities and the social sciences, as well as art, literature, poetry and spiritual experience (de Freitas et al., 1994; Henagulph, 2000).

4.1.2. The "Construction" of the Problem

As the sociologist Pierre Bourdieu argues, the fundamental methodological problem for all social inquiry is the "construction of the object". In other words, it is a question of being able to engage in very high theoretical stakes by means of "very precise and often apparently mundane, if not derisory, empirical objects" (Bourdieu & Wacquant, 1993, p. 220).

A work dealing with an inquiry based on cultural and social elements of analysis is not simply reducible to theory. It is expected to take, at some point in the research, a "detour through theory" to find an explanatory framework suitable to the object studied, and then return from "detour through theory" to a new analysis or description of a concrete problem. The point is not to develop a pure theory but, rather, to use theory to help explain different dimensions of phenomena (Sterne, 1999).

The same relation has to be, on a methodological level, between philosophy and scientific enquiry. In "Philosophy of Existence" Karl Jaspers states that philosophizing can neither be identical with nor opposed to scientific thought (Jaspers, 1971). He further maintains that any "serious" philosophy must incorporate knowledge gained through the scientific mode of inquiry.

We could also mention the "bricoleur", as evoking a tension between creativity and conformity (McLeod, 2000). According to Denzin and Lincoln, the image of the "bricoleur" suggests that it is acceptable to look at any possible means of knowledge-generation and discovery that could be relevant to the task of researching the topic that has been chosen (Denzin & Lincoln, 1994). This places a great deal of responsibility on the shoulders of the researcher by forcing them to make higher-level epistemological decisions and find appropriate ways of communicating its "bricolage" in writing.

The adoption and development of the constant comparison method as a form of theory building through all the research, both at a general and specific level, is an attempt to deal with such issues.

4.1.3. Constant Comparison Method

As a mode of analysis the following method is usually applied to qualitative research, such as the analysis of interviews and observations. In my own work I have developed it as a form of theory building through all my research, both at a general (such as the application of the adopted transdiciplinary approach[129]) and specific level. An example of the specific level can be found in my analysis of the results of the open questionnaire used to identify motivational paths to co-creation[130], or at a higher level when I decided to elaborate a cross-case analysis of the results of my case studies and I organized such results into meaningful concepts.

According to Lincoln and Guba, the constant described comparison method follows four distinct stages:

---

[129]In this sense it has been employed in relation both to metadesign (in order to produce an integrated conceptual framework) and net art (in order to identify a relational development in aesthetics and the history of artistic practice), and then in their transdisciplinary comparison.

1. comparing incidents applicable to each category
2. integrating categories and their properties
3. delimitating the theory, and
4. writing the theory (Lincoln & Guba, 1985, p. 339)

Thus, as stated by Dye et al. (Dye et al., 2000), hypothesis generation, meant as a relationship discovery, begins with the analysis of initial observations. This process undergoes continuous refinement throughout the data collection and analysis process, continuously feeding back into the process of category coding:

> As events are constantly compared with previous events, new topological dimensions, as well as new relationships, may be discovered (Goetz & LeCompte, 1981, p. 58).

Categories become the basis for the organization and conceptualisation of the data (Dey, 1993). According to Bruner, Goodnow, and Austin:

> To categorize is to render discriminably different things equivalent, to group the objects and events and people around us into classes, and to respond to them in terms of their class membership rather than their uniqueness (Bruner et al., 1972, p. 16).

This kind of "inductive analysis" means that the patterns, themes, and categories of analysis emerge from the data rather than being imposed on them prior to data collection and analysis (Patton, 1990). According to Patton, the analyst moves back and forth between the logical construction and the actual data in a search for meaningful patterns.

Several resources are particularly useful to the process of category generation:

---

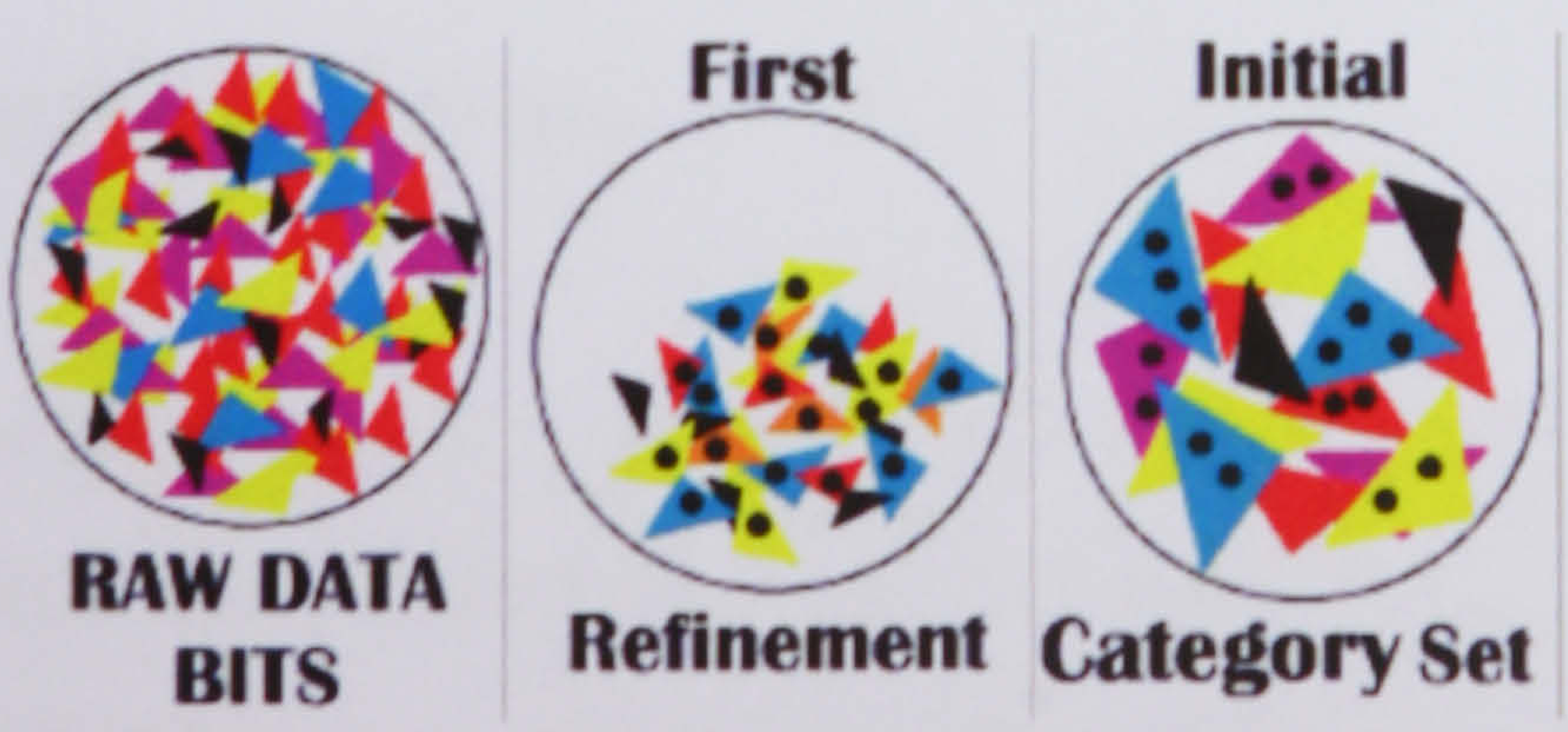
[130] In this case the method was used to cluster keywords relevant to the definition of factors and attractors for each motivational path. See 6.2.1.

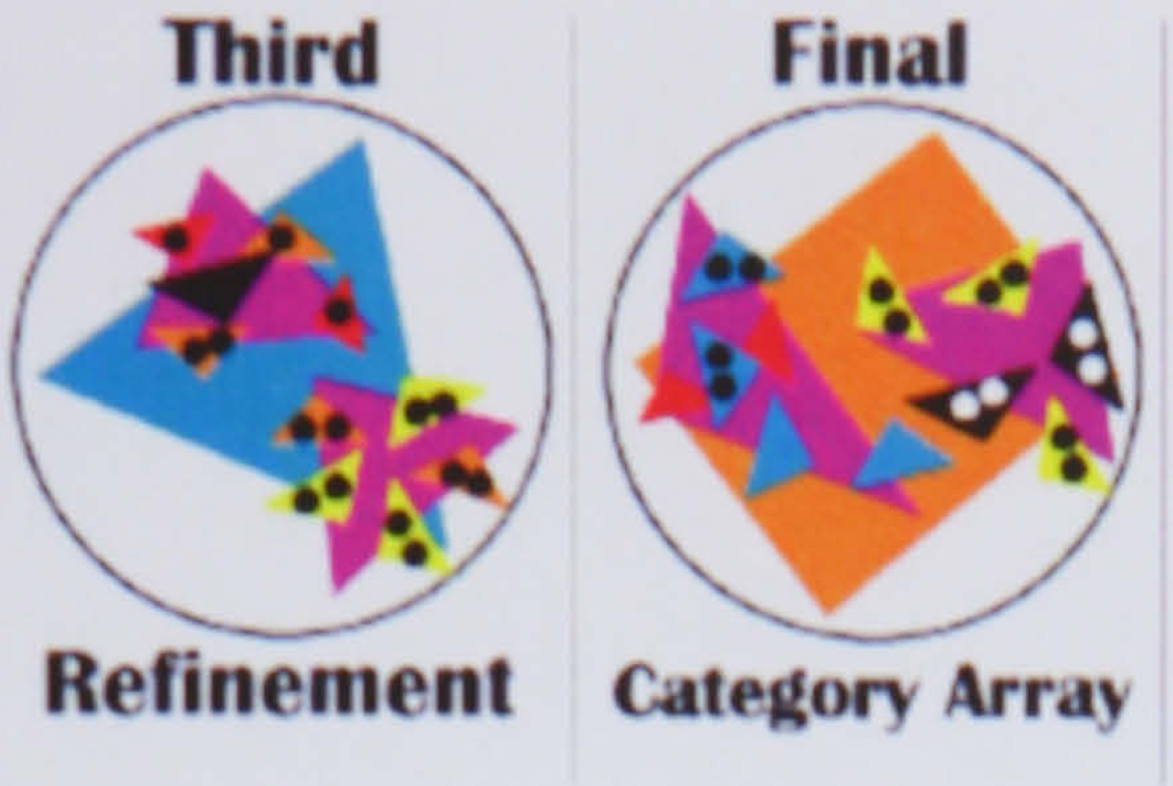
> ...inferences from the data, initial or emergent research questions, substantive, policy and theoretical issues, and imagination, intuition and previous knowledge (Dey, 1993, p.100).

The process of constant comparison "stimulates thought that leads to both descriptive and explanatory categories (Lincoln & Guba, 1985). The fit between data and categories, the process of developing categories, is one of continuous refinement that requires flexibility to accommodate fresh observations and new directions in analysis (Dey, 1993).

To explain better the method, Dey develops the kaleidoscope metaphor (Dye et al. 2000), attempting to explain category development and the use of the constant comparative method as viewed through this metaphor. The images in (Fig. 4) show the process of scrutiny of data bits in categories, the combination of tentative categories and the creation of sub-categories through successive category refinements, in a process of further subsuming and subdividing up to the information of a overarching theme.

Figure 4. Constant comparison method (Dey, 1993).





When specifically applied to a multiple-case study, as in part of this work, the constant comparison method can be related to the mode of analysis described by Yin as "pattern-matching" (Yin, 1994; Trochim, 1989). It can be defined as a special type of pattern-matching, called "explanation-building", whose "goal is to analyze the case study data by building an explanation about the case" (Yin, 1994, p. 110), and "to build a general explanation that fits each of the individual cases" (Yin, 1994, p.112).

4.2. Case Study Design

In this section, it is described in detail the methodological issues and techniques related to the choice and setting of a case study design, in terms of a part of the overall methodology of this work.

4.2.1. Case Study Research Strategy and Theory Building

In order to analyse phenomena in a real time setting, like the process of co-creation in Net Art, where relevant behaviours cannot be manipulated, I have adopted a research strategy based on case studies (Yin, 1994). To work on case studies was a choice (rationale) based on the similarities, characteristics and differences of the

Net Art projects I knew. The projects have been selected on the basis of their suitability, as containing crucial elements that were especially significant for my "theory-building" (Layder, 1993). Case study research is not the only research strategy used in this work, but it integrates the overall transdisciplinary methodology of this work.

The projects that have been chosen as case studies are collaborative systems focusing on visual interaction, and they all share the same aesthetical interest in co-creation. However, they differ in their interaction modalities (that is to say in the interactive system and interface) and in their participation modalities (that is to say in the more or less extemporary and communicative dimension of the project[131]). Finally, they are Net Art projects that do not belong to any specific definition of the genre (see 3.2.1.) and that have been active for several years[132]. I followed these projects- and, in some cases, I also took part in them[133], from their very beginning. I know the artists involved personally and, over the years and especially on this occasion, gave me all their trust, support and collaboration.

4.2.2. Integration of First-, Second-, and Third-Person Descriptions

As is usual (Yin, 1994), my case study research strategy is based on a mix of qualitative and quantitative data, which rely on multiple sources of evidence. In

---

[131]As we will see, SITO is a real virtual community, which the Générateur Poï étique is not (even though it can count on habitual and passionate followers and on more or less regular sessions). Open Studio, after its first promotional phase, lives in an anonymous dimension, temporally suspended and floating in cyberspace.
[132]The Générateur Poï étiquehas been active since 1986, SITO since 1993, and the concept of Open Studio, properly activated in 1999, comes from previous designs on which Andy Deck has been working since 1997.
[133]I refer to Générateur Boutique and Open Studio.

particular, my case study research strategy aims to integrate, through this mix of data, first-, second-, and third-person descriptions.

First-person descriptions provide an account for phenomena relevant and manifest for a "self" or "subject"; they have a "subjective" side, a direct reference to the "inside". Third-person descriptions instead provide an account for phenomena that are not clearly or immediately linked to the human agents who provide and produce such descriptions; they have an "objective" side, a direct reference to the "outside". Second-person descriptions can mediate first- and third-person descriptions, calling for an empathic position and for an intersubjective validation.

4.2.2.1. First-, Second-, and Third-Person Methodologies

According to Varela and Shear a circulation is necessary between first and third-person descriptions (Varela & Shear, 1999). To build the appropriate links between first-person and third-person studies we need methodologies, and this often implies an intermediate position, a second-person position.

According to Varela and Shear it is the notion of "phenomenal data"[134] (Roy et al., 1998) that can provide a common first-person/third-person ground for this methodological question. Generally speaking:

> A phenomenon, in the most original sense of the word, is an appearance and therefore something relational. It is what something is for something else; it is a *being for* by opposition to a being in itself

[134]It is a basic concept related to terms like subjectivity, consciousness, or experience.

independently of its apprehension by another entity (Varela & Shear, 1999, p. 3).

Phenomenality is therefore crucial in the domain of living beings, but Varela and Shear assume, even if the issue is far from consensual (Shear, 1997), that lived experience is irreducible. That is to say that phenomenal data cannot be reduced or derived from the third-person perspective, and we need the link with the first-person perspective. The assumptions on which Varela and Shear base the irreducibility of experience to the third-person perspective are that: 1) experience has to be accepted as a domain to be explored, because the first-person dimension is a trademark of our ongoing existence; 2) subjective experience refers to the level of the user one's own cognitions, intentions and doings, in everyday practices[135]; 3) experience in human practices is the privileged entry point for change mediated by professional interventions of all kinds, like education, learning, sport training, etc. (where it is the experiential domain which is to be explored).

We need to reflect on the intermediate zone, which acts as a movable line between conscious and non-conscious. We also need to explore the pre-reflexive, still largely unexplored, at a phenomenological level rather than at an introspective one that implies a procedure of attention during a defined task and a validation based on verbal accounts and researcher's mediation.

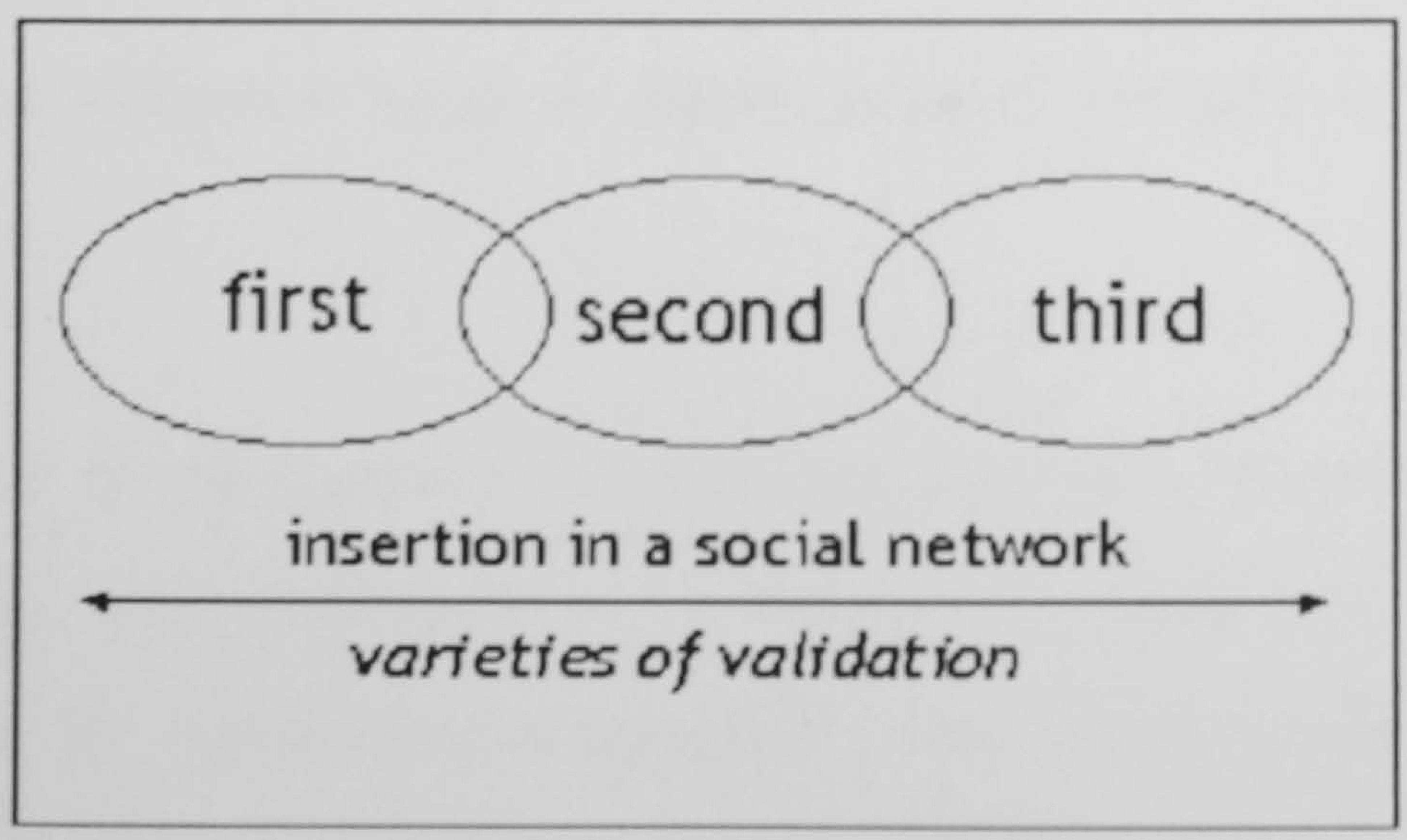
We necessarily need to establish an intermediate position, a second-person position. It is the position of one that is eccentric in comparison to the lived experience but nevertheless takes a position of one who can empathise in some way. So the three positions (first-, second-, third-) are structured, not so much in regards to what content they address, but in the manner in which they appear as a means of expression and validation within a community of observers familiar with such procedures.

As maintained by Varela:

> ...the three positions (first-, second-, third-) are structured not so much in regards to what content they address, but in the manner in which they appear - inserted in the network of social exchanges. [...] We are therefore not concerned with a dual opposition between the private and the public, or the objective and the subjective. We are, however, very much concerned with questions of interpreting the results [...] (Varela & Shear, 1999, p.9).

The matter of how the three positions relate is of crucial importance (see Fig. 5). Each one of them is, in turn, layered as the function the emphasis puts on accomplishing a particular mode of validation.

Figure 5. Relation between first-, second-, third-positions (Varela & Shear, 1999).



[135]The activity of moving my hand appears to me a motor intention as an active agent-user, not as muscle tones , which can only be seen from a third-person position.

First-person descriptions provide an account for phenomena relevant and manifest for a "self" or "subject"; they have a "subjective" side, a direct reference to the "inside". Third-person descriptions instead provide an account for phenomena that are not clearly or immediately linked to the human agents who provide and produce such descriptions; they have an "objective" side, a direct reference to the "outside".

The second-person position is an empathic position:

> ...still partly heterophenomenological, since a modicum of critical distance and of critical evaluation is necessary, but the intention is entirely other: to meet on the same ground, as members of the same kind (Varela & Shear, 1999, p. 10).

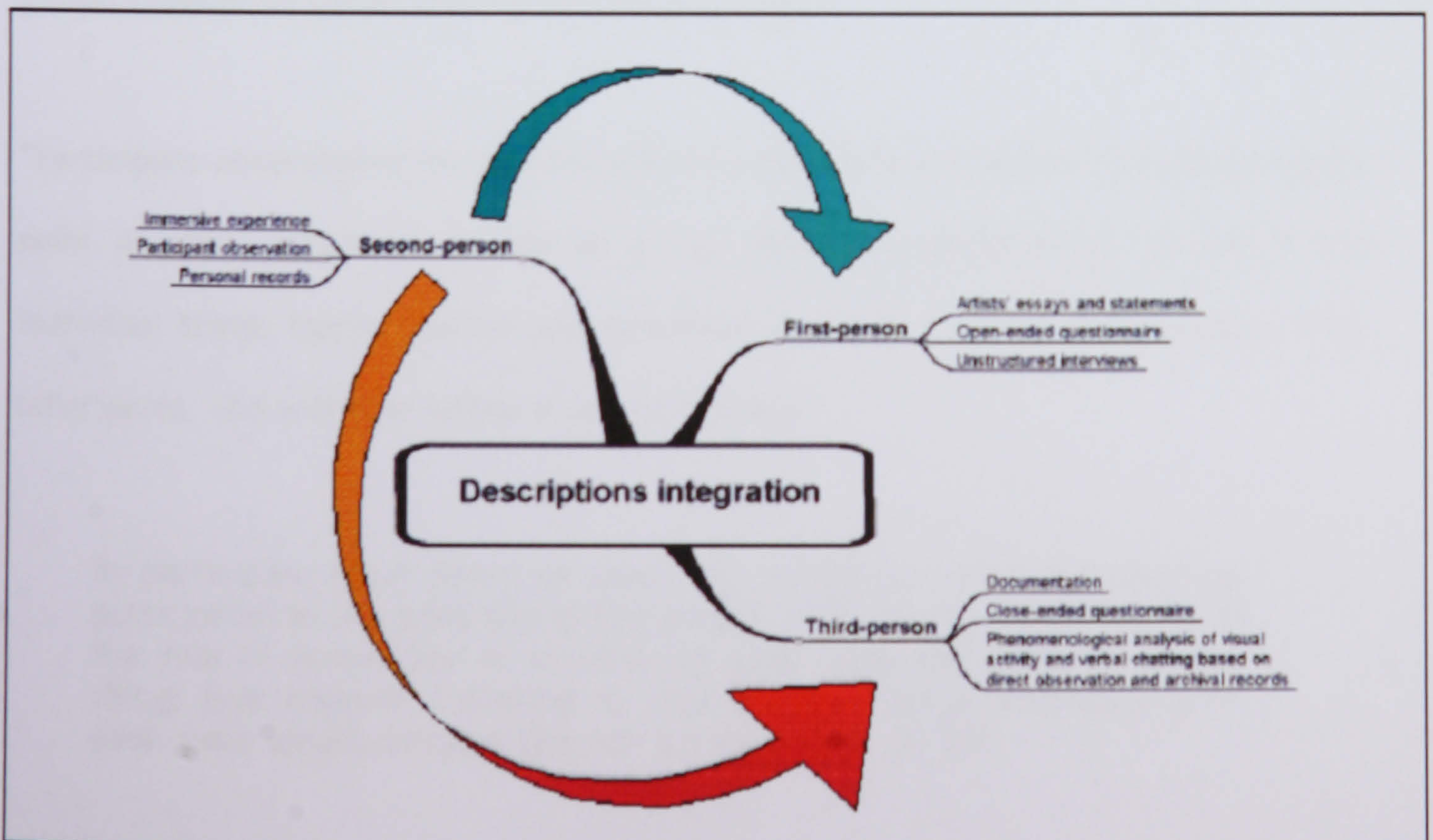
The position here is not neutral, it is grounded on a sensitivity to the "subtle indices of interlocutor's phrasing, bodily language and expressiveness" (ibid). It is first-hand knowledge. Varela also calls the necessary mediation of the second-person position as "phenomenal filling-in". Moreover, the second-person stance can sometimes seem to those on the receiving end of the experience, to be a form of "expression and intersubjective validation" based on explicit accounts amenable to intersubjective feedback.

The objection to the possibility of exploring experience, transforming or even creating what you experience, is philosophically called the "hermeneutical objection" or the "deconstruction objection", based on post-modern philosophical analysis (mostly derived from Derrida). However, descriptions produced through first-person methods are not "facts", they are potentially valid intersubjective items of knowledge, "quasi-objects".

This integrated method aims to position itself in a middle ground with respect to this objection, assuming that: a) the hermeneutical dimension of the process is inescapable e.g. "every examination is interpretation, and all interpretation reveals and hides away at the same time" (Varela & Shear, 1999, p. 14); b) because human experience is not a fixed, predelineated domain, but it is changing, changeable and fluid, "to speak of experience as being standard, raw, or pure generally makes no sense" (ibid).

In my research strategy it is the triangulation of data and methods I have adopted that allows the integration of first-person, second-person, and third-person descriptions. Such integration is fundamental in the light of the nature of the issue inquired (co-creation). The diagram in (Fig 6) describes how I have applied this method to my case studies.

Figure 6. Integration of first-, second-, and third-person descriptions in the present case study research strategy.



Here behavioural data (third-person descriptions) are provided by previous documentation and studies, the closed questionnaire, and the analysis of visual activity and verbal chatting based on direct observation and archival records. The open questionnaire, unstructured interviews, and related artists' statements provide, instead, an in-depth understanding of individual and subjective experience (first-person descriptions). A first-hand knowledge, especially useful to gain a full understanding of the intersubjective and emphatic experience of users (second-person descriptions) is finally provided by immersive experience and personal diaries (researcher point of view), and by participant observation (participant point of view).

A user research method that allows researchers to "immerse" themselves in the user experience is called "immersive experience", or direct participation. Also known as empathic research, this form of data gathering fosters an understanding for how the individual feels emotionally and socially in a specific situation. It is a form of first-person experience (Aldersey-Williams et al., 1999).

"Participant observation" is also considered a form of experience from the insider's point of view. Emphasis is placed on an holistic understanding, in which the individual things being studied are examined in terms of their relationships with other parts, and with the whole event or culture:

> By participant observation we mean the method in which the observer participates in the daily life of the people under study, either openly in the role of researcher or covertly in some disguised role, observing things that happen, listening to what is said, and questioning people, over some length of time (Becker & Geer, 1957, p. 28).

4.2.2.2. Qualitative and Quantitative Data

In order to integrate first-, second-, and third-person descriptions, I have adopted a mix of qualitative and quantitative data, that rely on multiple sources of evidence. This is not unusual in a case study research strategy (Yin, 1994), but here it is particularly relevant both epistemologically and practically.

While examining the qualitative "versus" quantitative debate, Olson focuses on the definitions put forward in the library and information science literature (LIS), and identifies the characteristics attributed to the two, assessing whether or not there is a fundamental difference between them (Olson, 1995).

If we look at the Oxford English Dictionary, says Olson, definitions of "quantitative" are considered with respect to the quantity or quantities involved. Obviously, the definitions of "qualitative" are related to quality or qualities, but imply and express opposition to quantitative. Similarly, many definitions in the literature of qualitative research are based on the definition of what it is not. These definitions echo the OED definitions by defining "qualitative" vaguely, except in its opposition to "quantitative".

According to Olson, the question of a fundamental difference is, therefore, addressed in terms of ontological and epistemological assumptions. In fact, quantitative and qualitative exist in a research paradigm, rather than in a method (Westbrook, 1994). The difference between them is the difference between positivist and interpretative paradigms, where the former recognizes an objective reality not dependent on the researcher, and the latter views reality as subjective and socially constructed (Wildemuth, 1993).

According to Morgan and Smircich the ontological and epistemological difference is crucial (Morgan & Smircich, 1980). As accounted by Olson, they devised a spectrum from subjectivist to objectivist approaches that expresses the assumed relation between the knowing subject and the studied object. Objective research as practiced in the social sciences separates the researcher (the Cartesian knowning subject) from the respondent (the object of the research), while subjective research requires the researcher to be immersed in the context of a situation to understand it. The separation between subject and object is diminished when an object becomes an active participant in the knowing process.

The relationship between subject and object is an indicator of the ontological and epistemological assumptions on which a given study is based:

> I suggest that as researchers we ought to be much clearer on our epistemic and ontological stances. Do we need, then, to decide whether we should be ontologically and epistemologically objective or subjective? (Olson, 1995).

The following table illustrates how Olson re-examines and adapts the spectrum developed by Morgan and Smircich.

Figure 7. From subjectivist to objectivist approaches (Olson, 1995).

	Subjectivist approaches	<	<>	>	Objectivist approaches
Ontological assumptions	multiple realities	reality as a social construction	reality as a contextual field of information	reality as a concrete process	reality as a concrete structure
Epistemological stance	to uncover the underlying assumptions of our realities	to understand how social reality is created	to map contexts	to study systems, process, change	to construct a positivist science

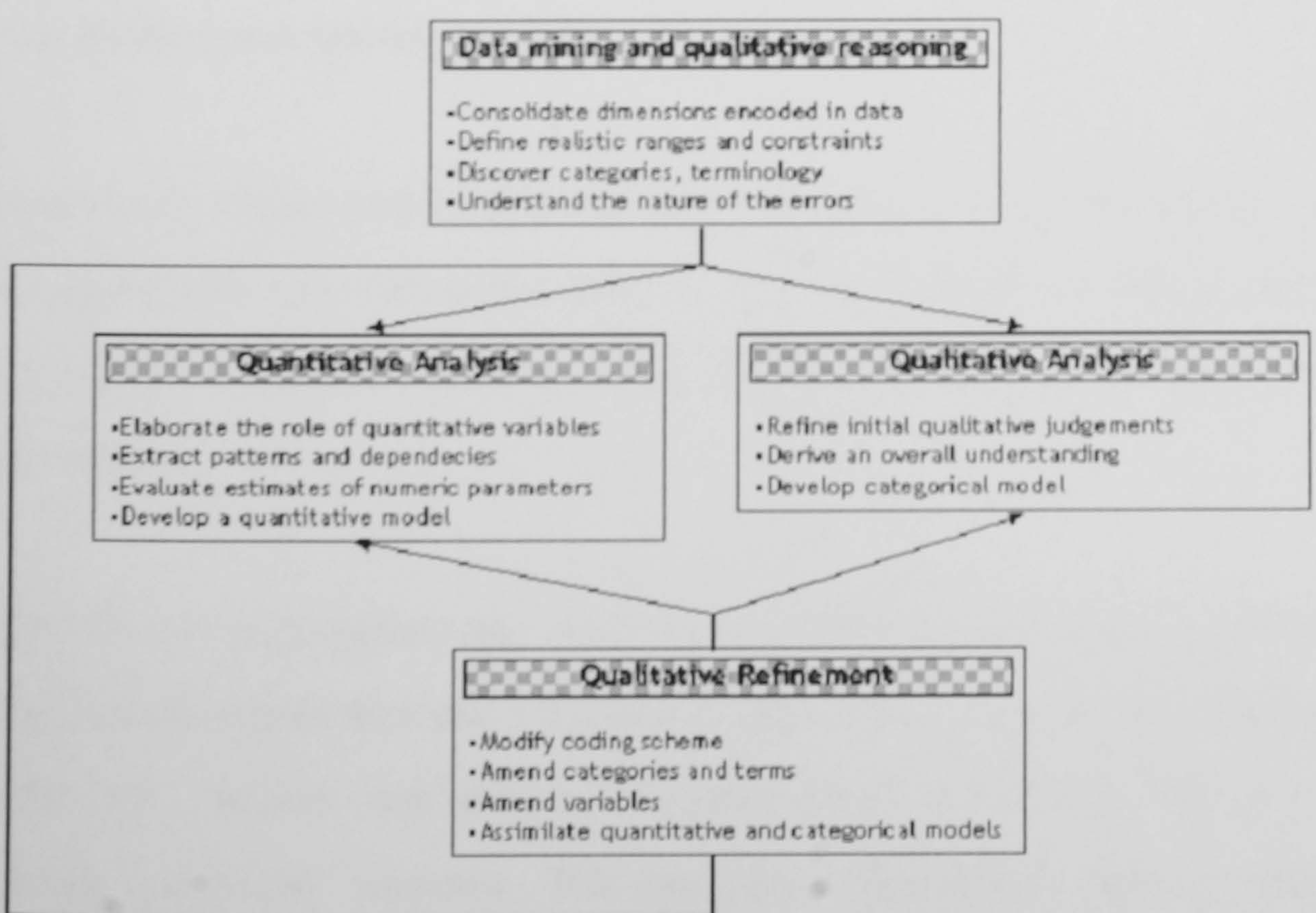
According to Olson, we need to be open to and cognizant of our ontological and epistemological standpoints and those of existing research, so that users of our research will have the opportunity to be partners in our work and for our own self-knowledge. We can then feel free to choose our methodology, as is appropriate to the problem, without needing to declare allegiance to either side of the qualitative "versus" quantitative debate.

Thus, the adoption of a mix of qualitative and quantitative data in this research responds to epistemological need to integrate first-, second-, and third-person descriptions in order to better understand the reality and dynamics of processes of co-creation.

Philosophical assumptions of an ontological, epistemological and human nature influence the researcher's opinion of what constitutes an acceptable research methodology (Sudweeks & Simoff, 1999). Practically, the basic assumption in quantitative methodology is that observations and experiments can be replicated. In qualitative research, the researcher is faced with data in the form of loosely structured descriptive texts or dialogues, images, and other illustrations rather than in the form of well-structured records.

Within the field of computer-mediated communication (CMC) and Internet research, Suweeks and Simoff propose an integration of both quantitative and qualitative methods that they call Complementary Explorative Data Analysis (CEDA), due to the complex nature of the studied object. CEDA employs quantitative methods to extract reliable patterns, whereas qualitative methods are incorporated to ensure capturing of the essence of phenomena (see Fig. 8). In my research I have adopted a similar approach when dealing operationally with quantitative and qualitative data, as it will be clear in the description of the specific methods I have applied.

Figure 8. Complementary Explorative Data Analysis (Suweeks & Simoff, 1999).



4.2.2.3. Triangulating Data and Methods

I have employed two different types of triangulation. I have triangulated both data and methods (Patton, 1987; Yin, 1994). Thus, I have adopted multiple sources of evidence in data collection and multiple methods of research. For each of the two types of triangulation I have adopted the same strategy. For the triangulation of data, I have integrated first-, second- and third-person methodologies (thus quantitative and qualitative data, and subjective, objective and empathic positions). For the triangulation of methods, I have chosen methods whose common features (e.g. high capability for the visualization of the data, aspects of immediateness, local/global dimension of the information, etc.) allowed me to gather quantitative and qualitative data able to be effectively triangulated by integrating first-, second- and third-person positions.

4.2.2.4. Method and Deconstruction

In the same way, I have worked on the fabric of relationships made by the artists and by the participants involved in the projects and the sessions, by structuring and deconstructing the adopted methodologies in the joined phases of collection and first analysis of data.

Research on the relationships and motivations at the bottom of processes of co-creation had not only to face and solve the epistemological issue of the relationships between first-, second- and third-person descriptions, but it also had to be an intrinsically "relational" research. This has been fundamental, both to the role played by the collaboration and relationship with the artists and their direct collaborators as key informants (Yin, 1994), and the importance of unstructured interviews, which were realized through an informal exchange of e-mails. Such a relational approach provided useful indications about how to work in the phase of collection and first analysis of the data, and also provided precious and otherwise irrecoverable data. The datum itself was precarious, due to its extemporary nature.

Nevertheless, all requirements have been satisfied (Yin, 1994; Kidder & Judd, 1986) in the use of multiple sources of evidence and key informants during the phase of data collection and composition construct the general validity of the strategy. Internal validity is provided by the process of explanation-building in the phase of data analysis (see chapter 6), external validity by the replication logic in the phase of research design (see 4.2.2.), and reliability by the setting of a case study protocol and databases in the phase of data collection.

4.2.3. Description of Applied Methods

In this section the methods applied to the analysis of data are described in their common features and specificities. A detailed reasoning for their adoption is also provided, and some limitations are highlighted.

4.2.3.1. Common Features

Rather than a descriptive, close-up and detailed observation tool that attempts to avoid prior commitment to any theoretical model[136] (Yin, 1994), a phenomenological approach has been adopted that is not only descriptive and analytical, but also helps

[136]For instance, an ethnographic method.

explain the close "relationship" between the subject and its body (Roy et al. 1998). Such an approach has been translated here at an applied level (the analysis of case studies).

Broadly speaking, we can say that the methods that have been adopted match the complexity of the data examined from a visual approach which enables the exploration of the information both from a local and a global point of view, without altering or omitting the complexity of the relationships. These methods also give shape to the problem offering a certain spatiality. These are non-linear methods, in which the surface of the image is placed in opposition to the linearity of the discourse, as the representation of the individual is opposed to that of the group.

Additionally, if we want to find both a practical and an etymological justification, according to the Indo-European root, vision and knowledge are strictly related. From the Greek "idein" (in English "to see") it comes the Latin "idea" and "videre", from which the English words "view" and "evidence".

Quantitative methods have been employed in data collection in order to extract reliable patterns, whereas qualitative methods have been incorporated to ensure capturing the essence of the phenomena. These methods have been integrated in a sort of methodological loop, based on the epistemological premises of this work (as explained in the previous paragraphs).

4.2.3.2. Abaque de Régnier

The Abaque de Régnier was created in the 1970s by François Régnier, and it is a method that is well known in the field of Human Resources.

Olivier Croisier purposefully developed a script for an Internet development of this method in collaboration with Olivier Auber, between May and June 2002. It is the first development of the Abaque de Régnier on the Internet.

How does it work?

a) *It uses an ordinal and coloured scale, whose data are represented in a board.* The colours, suggestive of the traffic light, are green, orange and red and, in addition, light green and light red. The five-coloured scale moves from the most favourable (green) to the most unfavourable (red). In addition, the colours white and black are also used. White indicates that respondents do not have any opinion about the problem and black indicates that they have refused to answer. These colours are "opaque" compared to the other five colours, defined as "transparent".

Figure 9. The Abaque de Régnier scale.

b) *It consists of both the combination of a logical and a statistical representation.* The logical system calls for a coloured scale to allow an evaluation. The statistical representation arises because the matrix can be reorganized. The colours green, light green, orange, light red, red, white/black are converted in numerical values (5, 4, 3, 2, 1, and 0) and so they can be processed. Many permutations can be derived from the original matrix of raw data.

The classification in lines is obtained through a calculation of the average of the colours' conversion. Tendencies toward "favourable consensus" are located at the top of the board, whilst tendencies toward "unfavourable consensus" are located at the bottom. Problems are located in the middle where there is a significant diversity of colours ("dissensus").

Why this method?

The reasons why this method has been chosen are related to the fact that a representation of values by colours matches the concept of a "spontaneity of judgement" (Régnier, 1989). This seemed to match the requirement of obtaining data by respondents about the subjective perception of their own creative experience.

Another reason is that this method highlights elements and structures of information. It provides an instantaneous and dynamic visualization method for judging patterns, and it lets information be explored at three different levels: local, regional, and global. The individual level is represented by the cell at the intersection of a column with a raw. It shows the opinion an individual holds about an item. The regional level is represented by columns or rows, showing the overall positions of all participants on a single item or of a single individual on all the items. The global level is represented by all the coloured positions on all the items, and is expressed by the whole table.

Limitations in the application of the method to this research

A powerful characteristic of this method is its ability to empower respondents to refine their answers in the light of first results, and the interviewer to refine his or her questions. Such a process offers new elements of understanding on problematic areas of dissensus through time ("temporal dimension"), but this cycle was impossible online, due to the lack of control on my sample. Therefore, areas of dissensus have been investigated in more depth through other methodologies, more appropriate to the medium.

4.2.3.3. Attractors and Pathways

This method was developed by Luca Dal Pozzolo at Fondazione Fitzcarraldo in 1973, and applied to the research "How Networking Works" realized in 2001 by Fondazione Fitzcarraldo, Informal European Theatre Meeting (IETM), and Arts Council of Finland.

How does it work?

a) *It is based on qualitative information*. In this case, information was obtained from an open-ended questionnaire and unstructured interviews. The qualitative information that could not be grasped by the closed questionnaire was collected by the open-ended questionnaire and supported with unstructured interviews. The information obtained served as a model for the reconstruction of certain global behaviours and attitudes, as well as dynamics triggered by individual action.

b) *It defines a number of different pathways according to different attractors.* The qualitative information collected through the open-ended questionnaire and the unstructured interviews has been analysed, and information regarding the individual questions has been collected and organized. In addition, three different flow-charts have been drawn-up which reflect similarities of participants according to a set of common factors.

Why this method?

The reasons why this method was chosen is because this method allows us to understand different attitudes and motivations by which creative experience is perceived and evaluated. The identified "attractors" do not stand in strict opposition to each other. Rather, they represent different keys to understanding, different attitudes by which creative experience is perceived and evaluated.

Another reason is that this method, along with the general methodology that has been adopted, allows us to explore information, both from the "inside" (point of view of the individual) and from the "outside" (emerging phenomena).Lastly this method visually emphasises diversities of subjective interpretations and show different paradigms.

4.2.3.4. A Phenomenological Analysis of Visual Activity

A phenomenological analysis of visual activity is used to understand the "processes-material"[137] at stake within the process of interaction, that is to say the relations

---

[137]According to Duchez "processes-material" are the kind of perceptual and cognitive material that a composer deals with in computer music (Duchez, 1995). The attempt of this study is to understand how,

between participants' perception/action, feelings/goals, and computational features of the environment.

How does it work?

a) It is based on *phenomenological data*[138] that relate to the visual activity within the system. This activity is produced by the interactions of participants with one another, and that derive from direct observation, video recording, and immersive experience. These data are supported by remarks and feedback from participants' answers to the previous open-ended questionnaire and unstructured interviews.

b) The *triangulation of sources* from which phenomenological data are derived allows the combination of: 1) descriptive data about the dynamic interactions of the participants' interplay with one another (direct observation and video recording); 2) first-hand knowledge about how participants feel, that is to say their intersubjective and empathic experience (immersive experience); 3) in-depth understanding of participants' actions and motivations, that is to say their subjective and individual experience (open-ended questionnaire and unstructured interviews).

c) Data derived from the triangulation of these sources are analysed in order to link *first-, second-, and third-person descriptions*[139] (Varela & Shear, 1999). Methodologically, it is a phenomenological approach in the light of a basic

---

in a computationally mediated environment, intersubjective processes are at stake, when the process of creation is shared between many participants.

[138] In spite of the variety of the terminology being used, a sort of consensus seems to have emerged around the idea that Nagel's expression "what it is like to be" succeeds in capturing what is essentially at stake (Varela, 1999).

[139] See 4.2.2.

assumption on the irreducibility of lived experience, as expressed by Roy and other researchers (Roy et al., 1998). The same epistemological assumption of the irreducibility of lived experience and its fundamental intersubjective nature (Thompson, 2001) underlies the play between qualitative and quantitave research methods adopted in this chapter.

d) Collected data refer to *visual modalities* of participants' interaction, including form, colour, texture, position, motion, and orientation. The focus on visual modalities of participants' interaction is based on the assumption that such modalities are both perceptual and cognitive (Gianni , 1993; Feininger, 1972; Arnheim, 1954). Colour for example can be considered either on it own terms (colour appearance) or as one of many attributes of our perceived world (colour perceived attribute). Our experience of colour is not only perceptual, it is also cognitive: we organize colour in linguistic and cultural categories. Colour is the product of the mutual specification of world and perceiver (Varela et al., 1991; Thompson, 1995). In summary, according to Thompson: "The look of an object is constituted by the interaction of the object and the perceiving-acting subject, and so is essentially relational" (Thompson, 1995, p. 298). From this perspective, according to Kandinsky and Johnson (Kandinsky, 1947; Johnson, 1987), motion and other visual modalities can also be seen as relational, referring to structures in our perceptual interactions in which we trace out relations among various elements.

How does it work?

The hypothesis that such a phenomenological analysis of participants' visual activity can help to understand nature and the features of creative environment grounded in the assumption that, as argued in the previous paragraph, phenomenological data and visual experience are essentially relational.

a) *Phenomenological data are essentially relational* (Varela & Shear, 1999; Roy et al., 1998):

> A phenomenon, in the most original sense of the word, is an appearance and therefore something relational. It is what something is for something else; it is a being for by opposition to a being in itself independently of its apprehension by another entity (Varela & Shear, 1999, p. 3).

b) *Visual experience is essentially relational*. According to Thompson: "The look of an object is constituted by the interaction of the object and the perceiving-acting subject, and so is essentially relational" (Thompson, 1995, p. 298). As we have seen, colour is one instance (Varela et al., 1991; Thompson, 1995). Also, motion and other visual modalities can be seen as relational, referring to structures in our perceptual interactions in which we trace out relations among various elements.

c) On the basis of the previous two points we can assume that a phenomenological analysis of the visual activity generated within a computational environment can enable us to study and explore intersubjective processes of collaboration and creation in terms of *a link between perception and action, sensorium and motorium*, at the level of the perceiver-participants' embodiment in visual interaction (Varela et al., 1991; Dreyfus, 1979; Johnson, 1987; Lakoff, 1987). It is, therefore, possible to study how the perceiver-participant can act and create, in terms of intersubjective interactions, whilst being modulated by visual events (Varela et al., 1991; Merleau-Ponty, 1965).

Notes

In order to focus better on ongoing visual activity and dynamic emergent phenomena at a basic perceptual and cognitive level, rather than taking into an account the wider social level of interaction (as would be necessary in the visual analysis of SITO), the analysis has been performed on Générateur Poï étique and Open Studio only.

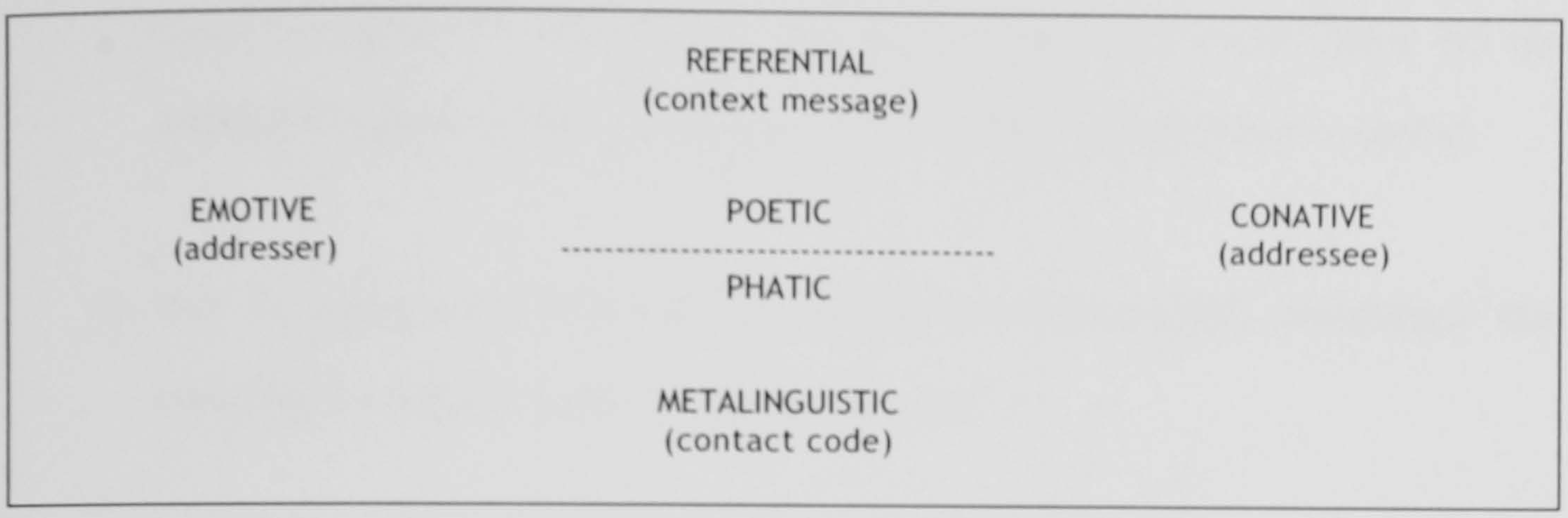
4.2.3.5. A Phenomenological Analysis of Verbal Chatting

Even if it is not particularly relevant statistically, the analysis of verbal chatting gives some indications that seem to confirm observations emergent from the analysis made with the Abaque of Régnier. These indications can be taken into account to help an understanding of the connection between verbal chatting and visual activity.

How does it work?

a) It is based on *Roman Jakobson's constitutive factors model* (Jakobson, 1960). According to this model, language can be analysed through six different functions. Though a verbal message rarely only fulfils one single function, according to Roman Jakobson the dominant function determines the structure of the message. Functions identified by Roman Jakobson are: 1) the emotive function; 2) the conative function; 3) the phatic function; 4) the referential function; 5) the metalinguistic function; 6) the poietic function (Jakobson, 1963; Holenstein, 1976).

Figure 10. Jakobson's Constitutive Factors Model (1960).



They can be described as following:

1) *The emotive function.* The emotive or expressive function centres on the personal attitude, status, and emotional state of the speaker. It indicates the attitude of the speaker towards the words spoken. The purest specimens of the emotive status in language are interjections.

2) *The conative function.* The conative function finds its purest grammatical manifestation in the vocative (noun) and in the imperative (verb). It expresses an orientation toward the addressee.

3) *The phatic function.* It designates those linguistic messages whose primary purpose lie in establishing, prolonging, checking out, confirming, or discontinuing the communication. Examples of a communication involving the phatic function are checking or simple noises.

4) *The referential function.* It dominates ordinary discourse, and designates objects by bestowing them with meaning. In his diagram of six linguistic

factors, upon which the theory of functions is based, Jakobson uses the term context instead of reference in view of the observation that there are no isolated referents without a context in which their designation is rooted.

5) *The metalinguistic function.* Metalinguistic explanations paraphrase the meaning of words in order to reveal the code.

6) *The poetic function.* Characteristic of the poetic function is the tendency toward the message, and toward the linguistic medium in all its aspects and facets. It is the domain of style and rethoric.

b) Data analysed according to Jakobson's functions are relative only to Générateur Poï étique and Open Studio, and were collected during the sessions set at the University of Boulder from June to July 2002[140]. These sessions produced a total of 164 messages for Générateur Poï étique, and 279 messages for Open Studio. Data relative to SITO were abstracted from Lenara Verle's BA thesis "Novas Imagens Para Um Novo Meio: Um Estudo de Caso do Website de Arte Interativa SITO" (Verle, 1999), and are the result of an ethnographic study.

Why this method?

This method can be seen as a form of *phenomenological analysis*[141] (Holenstein, 1976). It is therefore coherent with the phenomenological analysis of visual activity,

[140]Messages are not usually recorded. Artists recorded their messages on the occasion of these sessions only, through a special setting of the log file (Générateur Poï étique), or snapshots of the ongoing chatting (Open Studio).
[141]In Jakobson's work the link between structural linguistics and phenomenology is pursued on the relationship between form and function, meant as a shift from the examination of phenomena as a

in order to get an understanding of the creative environment with which participants deal.

system rather than as a mechanical agglomeration. Whilst for Husserl the form of a non mechanistic-causal principle for examination of phenomena was motivation, for Jakobson it is function.

5. Scope of the Case Studies

This fifth chapter presents three Net Art projects, and shows the motivation behind their selection as case studies. The art projects that are described in this chapter are: Générateur Poï étique, Open Studio, and SITO Sinergy Gridcosm.

The purpose of this chapter is to present these three case studies, not as instances of Metadesign, but as co-creative environments which allow the identification of design principles capable of empowering the practice of Metadesign in relation to the exploitation of networked intersubjective processes.

* * *

Chapter three ended with a question: How can we design systems and interfaces that enable to explore and exploit the intersubjective and computationally embodied dimension of co-creation?

The case studies that this chapter will present, and that will be analysed in chapter six, aims to allow the identification of design principles that can provide the practice of Metadesign with greater intersubjective capabilities, and support computational environments that are effectively co-creative.

In order to understand the experience of co-creation, the motivational paths and the features of the creative environment that underlie it, I have identified and analysed three projects of Net Art as case studies. They are: Générateur Poï étique, Open Studio, and SITO Synergy Gridcosm.

I have focused on collaborative systems for visual interaction, assuming that digital images are an opportunity for an object to exist and a way to witness its creation, transformation and manipulation (Ferraro & Montagano, 1994; Couchot, 1998; Quéau, 1986). In such a synthetic universe, the formal structure does not mark boundaries as the representative image does, but instead shows passages. It is simply a phase in the continuous process of alteration of the image itself and hence, of the creative process. This causes a strong isomorphism between language and image. For users it is an embodiment of a language that is, in a way, pre-linguistic. Such embodiment allows users to explore form as collaborative relationship and meaning as intersubjective event in a condition that is networked and computationally mediated.

5.1. Net Art Projects

I have chosen these case studies because of the similarities, characteristics and differences existing among them. They are collaborative systems focusing on visual interaction, and they all share the same aesthetical interest in co-creation. However, they differ in their interaction modalities (that is to say in the interactive system and interface) and in their participation modalities (that is to say in the more or less extemporary and communicative dimension of the project[142]). Finally, they are Net

[142]See note 130.

Art projects that do not belong to any one definition of the genre (see 3.2.1.) and they have been active for several years[141].

5.1.1. Générateur Poï étique

The Générateur Poï étique is a project by Olivier Auber (http://poietic-generator.net). It is a distributed interactive system that enables a large number of people across the world to participate in real-time in the emergence of an ever changing and ephemeral virtual image. The global image is the result of local images, each one controlled by a single participant through an easy and simple palette of pixels and colours. Participants can join or leave the collective drawing process at any time. Each new connection causes the automatic rescaling of all local images contained in the global one.

5.1.1.1. History

Olivier Auber[144] has been working on the Générateur Poï étique since 1986. At the beginning he used the French Minitel system, and then in 1995 transferred to the Multicast Backbone. The current web version of the project was developed in 1997 (http://poietic-generator.net)[145].

---

[143]See note 132.
[144]Olivier Auber was born in Le Havre, France, in 1960. He is an engineer, who graduated from the Ecole Nationale Supérieure des Arts et Métiers (ENSAM), Paris. Since 1984, he has been involved as a consultant in the creation of many exhibitions, museums and international cultural projects focused on science or arts. As an artist, he is carrying on research on collective behaviour and speed, and to this end he has built experimental devices for the Internet.
[145]Up to this time, only owners of Unix/Linux platforms accepting Multicast IP were able to take part in the experiments.

Started by Olivier Auber, the Génerateur Poï étique evolved through many contributions. The Internet version of the system has been developed with the support of the Ecole Nationale Supérieure des Télécommunications of Paris, whilst the former Minitel system and other, small alterations was made by Laurent Oksenberg and Jean Paul Couder. A more reliable and more functional Java 1.3 version[146] is planned, thanks to a collaboration with the computer engineer Olivier Croisier and the digital artist Mickaël Puiravau.

The idea of the Générateur Poï étique arose in 1986, following the conception of diverse interactive experiences for museums, and the reading by Olivier Auber of "Valisystem", a book by Philip K. Dick.Before being installed on the Internet, the Générateur Poï étique was presented onseveral occasions, using locally the French Minitel system. It was set up at the Georges Pompidou Centre in 1990 for the exhibition "Communication and Monumentality", and then at Cité des Sciences et l'Industrie in Paris in 1992, for the exhibition "Machines à Communiquer". A few years earlier, in 1988, it had been the core concept for a monument to Communication called "Poietic Ring" and the laureate of the France-Japan Symbol contest.

In 1995 several researchers at ENST contributed to the project and Sun Microsystems also decided to support the research. The Mbone version provided, for the first time in the world, a non-centralized real time collective interaction experiment. The Mbone version was presented "en avant premiére" at the "Etats Généraux de

[146]These functions offer 256 colours, and a real time preview of the global image, which can be displayed in any web page. This preview will be the launcher of the applet. It will also display a count down for the next session. Moreover the network protocol of the GP should be edited in order to let

l'Ecriture Multimédia" organized by ART3000 at the Paris Vidéoteque in 1995. For its concept, the Poietic Generator received the first "Art and Science" award given by ArtTechnica/ARSLAB in Turin in1995.

5.1.1.2. Concept

The project is described by Olivier Auber as both a "real-time graphic interaction experiment", and an "art & science research on real-time collective phenomena". This refers to the idea of "poiesis", which, according to Plato in the Symposium, converts anything that we consider from non-being to being.

The project is based on Olivier Auber's idea of "temporal perspective" (Auber, 2003a). Thanks to the Java applet, the escape point can be constituted by all of the computing points representing the agents of the process. This theoretical construction of the representation is, according to the artist, the only system able to represent (even though this representation will be necessarily irreducible) a social body decentralized by networks and communicating by the light speed.

The Générateur Poï étique provides a clear illustration of the revolution produced by networks in our representations of space, time and social body. This revolution also leads us to rethink ethical issues, as ethics provide the necessary condition of society, culture and economics. Showing the mutation in progress, the Générateur Poï étique also becomes an instrument of thought with the purpose of favoring the emergence of an appropriate individual and collective behaviour.

---

other developers make their own client software (to build statistics, 3D representations, robotic

The Générateur Poï étique's general concept is based on some key aims. It aims to be: (a) an instrument of creativity and aesthetic research; (b) an object open to scientific studies; (c) a tool for philosophical thinking.

Realizing on a scale model what should become the major sociological phenomenon of this late century, that is "real-time", the Générateur Poï étiquetests the network capacity to instantly assemble in one single time the thoughts and attention of a great many number of people, and to make out of each participation one single event in a continuum. While information acceleration due to networks unifies all domains, it smashes all traditional representations and destroys even the most solid landmarks, so that a sort of "reality crisis" arises. Deliberately placed at the core of "real time", the Générateur Poï étiquepresents a living laboratory and a tool for aesthetic research, scientific studies, and philosophical thinking.

The Générateur Poï étique makes us focus on the way we represent the world andour place in this world. It allows us to experience a virtual space of extraordinary complexity in a rather simple way. The abstract and minimalist character of individual telepresence actually allows us to gather a great number of signs on a single image[147]. The interpretation of this image by the authors who create it produces global/local action and retroaction phenomena of great immediacy. Moreover, the lack of a personal expression filter, and the non-imposition of definite

participants, meta-robotic participants, etc).

[147]In the present state, there are 200,000 billion possibilities per individual sign.

forms of expression or narration[148] push this interpretation to high levels of complexity and dynamism.

Olivier Auber likes to imagine the Générateur Poï étique as a great visual orchestra, a musical metaphor that stresses how the value of the Générateur Poï étique lies in the participants' ability to "tune up" the instruments at their disposal and produce an infinite number of combinations and expressions.

While the status of the people I have focused on in these case studies is that of participants, of course other people with different statuses are also involved in the image making process, like those contributing materially and morally to the development of the project[149]. This is true for all the projects I examined, but it is an issue of collaboration that is not relevant to the aim of this research and therefore, it will not be taken into account in this work.

In the Générateur Poï étique participants are the physical persons contributing to the overall experience and the real time image making. They know that everybody sees the collective image, that it is not possible to rewind, erase or modify a sign already memorised, and that participation is anonymous. They also know that they do not own the result[150].

---

[148]As we will see, the Générateur Poï étique is based on the simple pixel-sign, common to any digital image.
[149]For instance authors of programs, interface designs, systems and processes that concretely translate the concept into an actual project, and all the moral persons and entities involved in the process, even also only for their data transmitting like sites proposing Internet access, network owners and operators, on-line providers and services, television stations, etc.
[150]Olivier Auber owns the property of the data and the images.

Each participant is responsible for a specific part of the global image that he or she can modify at will. In this way the global image results from the juxtaposition of all the personal sub-images (or local images) controlled by each single participant. The collective interaction produces an uninterrupted sequence of abstract or figurative shapes that can be observed and modified at will by any of the participants, but of course not globally controlled. The image evolution usually starts with different chaotic forms, something like moving "fruit salads". Then, rather quickly, the phenomena of shape recognition begins to take place. One person starts something interesting, a sign, for example a house, using colours or graphism somehow different, and consciously or not, through mimetism, his or her neighbours start to imitate him or her. Whether a vague imitation or a faithful copy, all of a sudden a relation of translation emerges, with one theme here and similar images there. The human eye is quite apt at reading analogies throughout the chaos and organising this information meaningfully, so it is not infrequent to see geometric figures in embryo that often become figurative (Auber, 2003a; Borillo & Goulette, 2002; Sauvageot & Léglise, 1999).

Some mechanisms are more complex, the mirror symmetry in particular. A sign inversely copied just right or left of the original, for example, creates an immediate axis of symmetry in the image, immediately recognizable. This creates a very powerful process of shape recognition and projection on the image. Says Auber: "it is almost like looking at clouds: one identifies a shape and quickly it is recognized by all" (Auber, 2003a).

The evolutive mechanism of the Générateur Poï étique rests upon the successive and entangled combination of mimetism phemomena, symmetry, recognition, association, projection and communication to others of this projection. On this basis, a consensus is quickly reached as to the profound meaning carried by the image. It is a slow process: contrary to the cloud movement depending upon the wind, here every one contributes to the shape or the background, to the clouds or the sky. Everyone can modify their own sign to confirm or contradict, for example, a horse shape. Everyone works on a subjective shape which becomes objective for all. The horse finds a life of its own, the life of a horse representation: its head moves, changes colour, before mutating into a Taurus or, something else. Little by little, signs mutate while telling a story, and a collective narration emerges from the interaction, an unpredictable and autonomous animated image in a continuum.

According to Olivier Auber, the shapes and complex dynamics produced by the Générateur Poï étique translate phenomena of selforganization that are similar to those observed in some biological organisms (like cellular automata or simple biological organisms) and social communities. Participants are involved in some kind of retroactive loop. While performing modifications on his or her personal subimage, each user is generally influenced by the image as a process, and conversely his or her own modifications will probably affect other users drawings.

5.1.1.3. Functioning

System and Interface

The Générateur Poï étique is an interactive distributed system. It enables a large number of people across the world to participate in the emergence of an ever changing and ephemeral virtual image. This global image is the result of local images, each one controlled by a single participant. The number of participants does not have any theoretical limitation. New participants can join or leave the collective drawing process at any time. Each new connection causes the automatic rescaling of all local images contained in the global one. This mechanism makes possible to increase the number of participants while still displaying the collective image in a fixed-size area on the screen. The individual sign of the first participant will, initially, take up the whole global image. Then, the part devoted to this sign will decrease in size as long as other participants connect themselves to the current session. Moreover, the program automatically determines the location of new local images inside the global one. These are either set side by side in a spiral-like shape or are set in such a way that they will replace the image of a user who has recently left the session. By default, the system gives to a new participant a place as central as possible (Auber, personal communication[151]). See (Fig. 11).

Figure 11. Illustration of the setting of local images in GP.

5	6	7
4	1	8
3	2	9

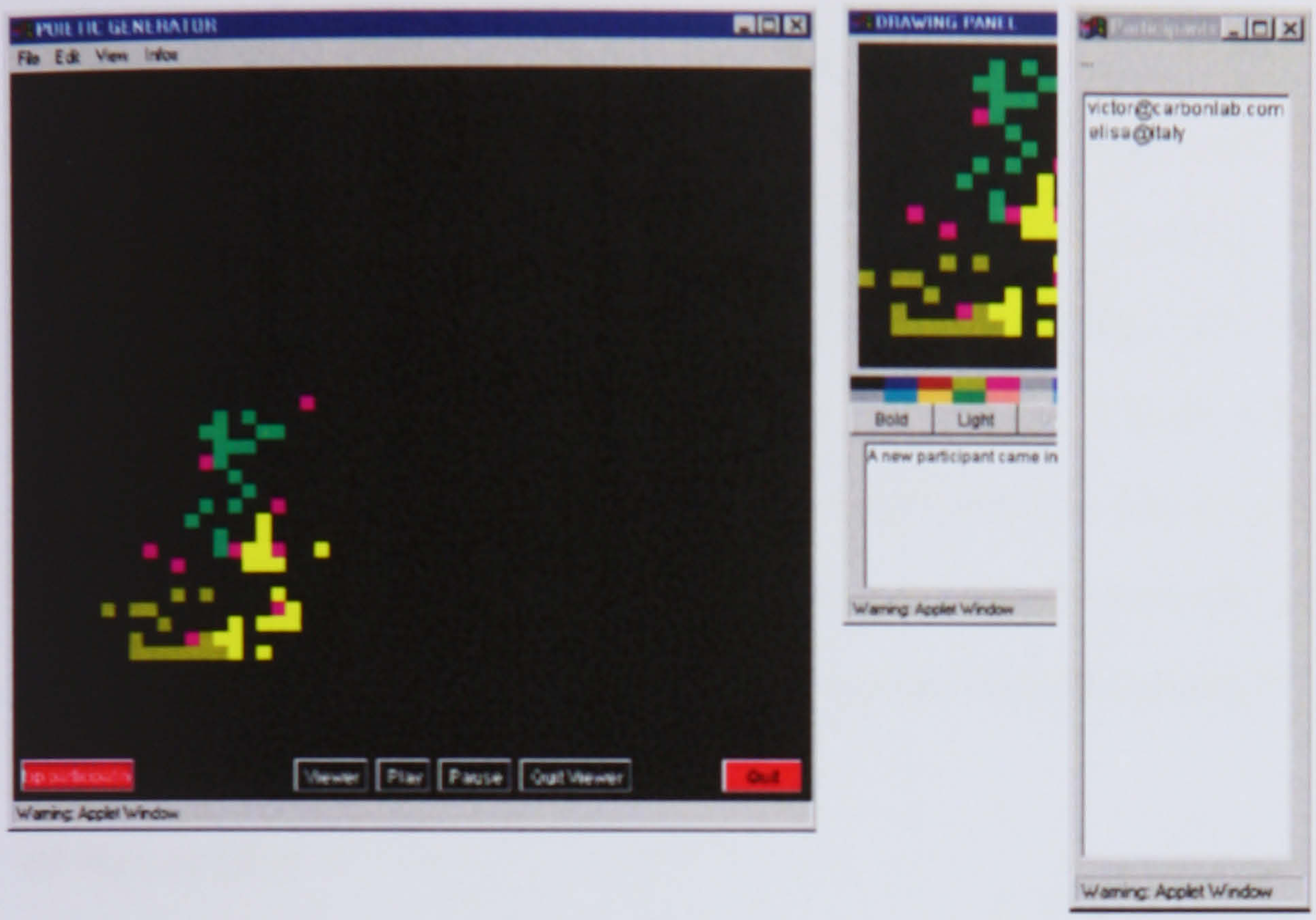
The current technical limit for the participants is 70-100. The limitation has no connection with the Java version, but comes from the server. A server farm like the ones used for online games would allow the Générateur Poï étique to reach 1000 participants or more (Auber, personal communication).

[151]Email dated 25 May 2002.

Once launched, the program continuously offers a double view of the interactive drawing process. The first view shows the current state of the global image and is updated in real-time. The second view shows an enlargement of the users local image. This picture can be modified at will by means of a simple graphical palette. The subsequent modifications are immediately propagated to all the global images currently displayed on the Net so that the collective image is ever changing in the same way for all participants.

The interface is created by three windows: (1) Poietic Generator, (2) Drawing Panel and (3) Participants (see Fig. 12). The window (1) visualizes the globality of the local images, that is the global image. Each local image takes a square portion. These portions are adjoining and they do not overlap. They grow smaller as the number of participants increases. This window can be enlarged at will, depending on the restrictions of one's screen. The window (2) provides the space for drawing, or the local image, the drawing tools and an area of communication. The drawing tools are a palette of 20 colors (10 light and 10 dark) and 4 buttons (bold, light, undo, erase) that permit users to define the size of the pixel, undo, and erase. The drawing tools allow users to draw the local image pixel by pixel. The communication area also allows users to visualize those who are connecting or disconnecting, and to read messages that are being sent by another participant to the owner of the local image. These are private, one-to-one messages, that can be sent by clicking either on the name of the participant listed in window (3) or directly in window (1) on the part of the global image that corresponds to personal sub-images, and then writing the message in the pop-up window that appears after clicking. Finally, the window (3) gives the list of the participants of the current session (e.g. name@location).

Figure 12. The Générateur Poï étique interface.



The evolution of the poietic image is saved event by event, pixel by pixel, and it can be replayed instantly after the session, both speedily and in slow motion (by using the pause bottom). Nevertheless, when you access the archive and see again the recorded movies the pace of visualization of interaction is not reliable:

> The speed may change according to the net congestion, your machine, etc. A slow but important change in the global image may be replaced very quickly. In the next version the idea id to conceive a way to store the time of every event in order to display it in real time (Auber, personal communication[152]).

GP Sessions

There are two kinds of sessions in which people can participate. They are announced sessions and ongoing sessions. The announced sessions are those announced on the

---

[152]Email dated 21 May 2002.

website and the GP mailing list. They are often related to public events like conferences or workshops, and they have been organized in collaboration with the artist. The ongoing sessions are those that take place without notice, without the telepresence of the artist, and usually without any advanced planning. Before 1997, when the Générateur Poï étique was implemented over the Web, Olivier Auber estimates the following number of sessions occurred: 10 sessions in public spaces between 1986-1994 (Minitel version); and 10 worldwide sessions between 1995-1997 (Multicast version). Between 1998-2002 the system automatically counted and archived 78 sessions, of which more than 10 were announced sessions[153].

GP Mailing Lists

According to Olivier Auber it is very difficult to get people only from the Web:

> It is an experiment, not a net community (I don't like so much large groups, that's why maybe, I'm doing such experiments ;-) (Auber, personal communication[154]).

Instead, people need a "real world event" to grab their attention (Auber, personal communication[155]), and this is why there are announced sessions and a mailing list. It is also true that some people, subscribed to the list, sometimes propose to launch a session not related to any public event or workshop, but this is very rare. As well, it is true that there are some regulars, meeting occasionally on the Générateur Poï étique, but they cannot be identified: "I know there are some, but I don'tknow who!"[156].

---

[153]The list of the announced sessions is still to be fully completed by the artist.
[154] Email dated 14 June 2002.

Sessions are managed and announced through two moderated lists. The first (preparation-gp@km2.net) is for the artist and his closest collaborators and supporters. It serves to propose and organize the sessions. The second list (poietic-generator@km2.net) is for all those that request to be updated about the sessions of the Générateur Poï étique, and itusually serves only to announce the sessions. One thousand people are currently subscribed to this list.

5.1.2. Open Studio

Open Studio is a project created by Andy Deck (http://draw.artcontext.net/). It is founded on a Java-based drawing system, which concurrently links all the users up to a single pictorial surface and enables them to collaborate in a dynamic drawing. As in multiple folds of real and recorded time, graphical space is given by users interplay and its products resemble time-lapse studies.

5.1.2.1. History

Andy Deck[157] activated Open Studio as a reworking of previous designs using similar collaborative drawing processes which he has been focusing on since 1997. The last design before Open Studio was GraphicJam, released in 1999 in cooperation with Mark Napier and The Thing, and in many respects very similar to Open Studio, though less stable. GraphicJam in turn was based on an early program called "The

---

[155] Email dated 21 June 2002.
[156] Email dated 21 June 2002.
[157] Andy Deck was born in 1968 and lives in New York City. He works on the development of collaborative process in the context of art and connectivity, making public art for the Internet. Pre-empting regular programming and leveraging accidental freedoms, he attempts to demonstrate alternatives for Internet

Blackboard", and on another earlier version of the collaborative drawing tool that was made in 1997 with Till Kreuger[158]. The software DraWarD, that Andy Deck developed in 1995 at the Ecole Nationale Supérieure des Arts Décoratifs in Paris, can also be considered an old prototype . This Java program is not collaborative in the same sense as Open Studio, however it laid some of the groundwork for the aesthetics and techniques used in the present project:

> When I began seriously to paint, I became interested in the way my mind, in the creative process of image-making, would construct familiarity from randomness. Since the process of change in the image was what concerned me, I was not satisfied to produce still, static images. It became necessary for me to work in a time-based medium. And by chance, I encountered computer programming at that same time, so the computer became the vehicle for exploration (Deck, 1999).

Andy Deck started producing softwares that combined drawing and time-based sequences of drawn images. The World Wide Web and Java language have matched his objective to make a popular art form that would be easily accessible and would allow people to intervene collaboratively in the image-making. It was the experience of producing this earlier software, together with the feedback he received from people who used it, that led him to make a spontaneous and multi-user drawing space:

> I became fascinated with the way my programs encouraged and made possible interactions that were unpredictable. My conviction, as a result of these experiences, is that the most interesting virtual spaces are those that engage the imaginations and participation of real people (Deck, 1999).

---

interactivity and interface design. Andy Deck has made art software since 1990, and since 1994 he has worked with the Web using the site http://andyland.net and, more recently, http://artcontext.com.
[158]None of these older project remains fully networked, but they are available online for documentary purposes.

5.1.2.2. Concept

Andy Deck's work can be understood through his idea of "malleable aesthetics", the essence of which is a profound reconfigurability in response to feedback from interested participants (Deck, 1998). According to Deck, whereas the beauty of most existing hypertexts and hypermedia is supposed to reside in the masterful interplay of prospective narratives, wired in by the author, instead the allure of malleable aesthetics is the potential digression and development in almost any direction.

Inspiring participation in something useful or fun or enlightening, says Deck, is okay, but the paramount question is how to involve people in meaningful events, and orchestrate contributions to something that lasts beyond the event itself, adding an historical dimension. Ultimately, in view of computer systems obsolescence, malleable aesthetics must lead to the inclusion of the public in the process of coding. Moreover, due to the manipulative capacity of interactive systems, designs itself should be open to revision and debate.

The term "malleable aesthetics", as Andy Deck uses, refers to this ability to accumulate not only statements, or data, but also the structural changes brought about by the users of the system. The resulting synergy, by which the space and its underlying structure are gradually reinvented, can open unanticipated paths. According to Deck, Internet art can encourage participants to resolve their own differences, as tends to happens outside of digital channels, rather than pre-emptively or automatically stifling behaviour:

> Using [the Java language] to implement a collaborative drawing system, I have become fascinated by the possibilities of networked interactivity. In spite of the limitations of the mouse, the programming language, and the browser context, I've become involved in a relationship with a public imagination that interests me. The things that have been made, things that have happened in this unusual space keep me focused on overcoming the looming exclusion and insipidity that haunt tomorrow's Internet. Many times I have corresponded with people in strange and surprising non-verbal dialogues (Deck, 1998).

Open Studio comes from such an aesthetic. So, "Open" means an encouragement to visitors' participation and refers to the "Open Source" movement[159], while "Studio" is Andy Deck's studio in New York, where the software is written and the server resides. Open Studio seeks to occupy and articulate a middle ground between art and interactive entertainment, between communication and creativity, and between independent and collaborative expression.

Open Studio is based on a concurrent Java-based drawing system, where the graphical space is acted by participants' interplay. As in multiple and overlapped folds of real and recorded time, saved drawings can be quickly "played back" in the same sequence of strokes and marks originally used, and be edited.

Resembling time-lapse studies, Open Studio links all the users up to a single pictorial surface and it enables them to collaborate to a dynamic drawing. Participants can choose to interact using the material that has already been made, that is to say drawing on the recent Open Studio history, or they can choose to interact from scratch. Participants can also choose between a synchronical and diachronical time,

[159]Generically, "open source" refers to a program in which the source code is available to the general public for use and/or modification from its original design free of charge. Open source code is typically created as a collaborative effort in which programmers improve upon the code and share the changes within the community. "Open source" sprouted in the technological community as a response to

affecting in this way the nature of their relationships. Because it is impossible to identify one participant from another, only on the basis of his drawing activity, when someone interacts with other participants while drawing on the recent Open Studio history, he or she is not able to say whether the strokes and marks appearing on the canvas are recorded or drawn in real time. Some participants will be "real", some will be "phantasmic", but regardless of when the action took place, any private action on Open Studio becomes part of a public drawing. Realized by the means of drawing tools that have been designed to be expressive and reactive to participants' movements, it conveys a persistent visual and physical quality that goes beyond a linear measure of time.

Just as GraphicJam borrowed action from graffiti and its aesthetics from jam sessions, in which musicians create music playing by improvisation, so Open Studio investigates interactivity and computational expressivity as a mean for collaborative creation:

> No images will be of a very good quality, but when the beholder turns into a fellow co-creator it turns interesting anyway. Andy's page invites you to play with the clichés of art and to realize the fact that art has to be something more than effectual images of forms borrowed from somebody else.
>
> Besides this, you have to cope with being not the only creator. While you're watching the image you just made, it's starting to change; and yes, you suddenly notice that the program has got two users, and now three... It's no use to swear or protest. Somewhere in the cyberspace somebody else is sitting in this moment and painting over your creation, in his or her own fantastic or terrible way (Lundell, 1999).

---

proprietary software owned by corporations. Open Studio is an expression of the open source movement in art. Its source code is available to schools, universities, and non-profit organizations.

5.1.2.3. Functioning

System and Interface

Open Studio is a Java applet that connects through the Internet to a server running on a host computer. This connection is what enables Open Studio applet in a participant's browser to talk to the other applets currently connected. In this way drawing can be shared by several people who may be in different countries.

Sometimes, due to high traffic, load on the server, or a technical problem, the applet may not be able to connect to the server. In this case it is still possible to draw, but not to see the current drawing activity. However, it is always possible to see the various saved drawings from the Open Studio archive[160].

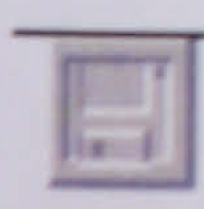
Once a participant is connected, the recent history of activity of Open Studio can be viewed using the "Play" button. These drawings are stored on the server, and redraw on the participant's applet. Once the full history of previous drawings have been shown the participant sees the present state of Open Studio, but there are no guarantees that a participant sees exactly what other participants who are connected are seeing. The participant can also stop the history by clicking the "Stop" button. The history has a finite length, and so it changes as people continue to draw. Anything a participant draws on the applet surface is automatically added to Open Studio.

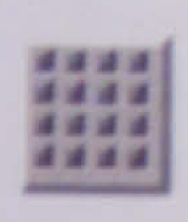
[160]Participants can choose whether to save or not their drawing session (that will correspond to the drawing activity they participated in).

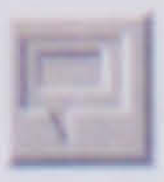
In order to create graphic marks and textures, participants use the drawing tools, a colour picker, and a size control provided with the interface and designed to be easy to use and intuitive. Most of the interface is, therefore, self-explanatory (see Fig. 13 and Fig.14).

Figure 13. Open Studio canvas.

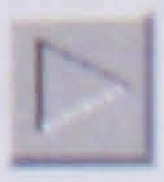
Figure 14. Open Studio interface.


Save Button: click to save current drawing into a file in the server's archive.

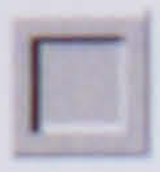

Open Button: click once to view a selection of archived drawings.



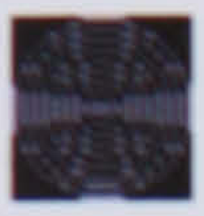
Chat Button: click once to open the chat window.



Play Button: click once to start redrawing the recent Open Studio history.



Stop Button: click once to stop drawing the history.



Size Picker: click and drag to change the width of the current drawing tool (Note: some tools react to had gesture and speed, and in this cases the effect of the size tool is less obvious).

Colour Picker: click and drag in the red, green and blue columns to adjust the current colour (Note: clicking on the lower square will reveal a palette of recently used colours).

Tool Picker: click to choose your current drawing tool (Note: the tab at the top can be clicked to browse different drawing tools).

Open Studio Sessions and Mailing List

Open Studio works only on ongoing sessions. According to Andy Deck there are some "regulars", but because of the anonymous nature of the space it is almost impossible to identify them. Says Maya Kalogera[161]: "I've never known anyone personally" (Maya

[161] Maya Kalogera is an artist that participated regularly for almost one year in Open Studio drawing activity as a member of WOWM.org. She is the only "regular" I was able to meet and get in contact with. She also provided me with pictures from the WOWM.org archive. The experience of WOWM.org (Wrapping Our Warped Minds) is based on regular sessions of chatters that participated in Open Studio, sometimes working on predefined drawing themes (usually an artists' style). WOWM.org is an online experiment performed by the members of the WOWM.org (visual, multimedia and video artists). It is based on direct communication with the online audience from chat rooms, presenting them (at one

Kalogera, personal communication[162]). Moreover, a mailing list exists, but this is not used to fix and announce sessions, only to send announcements of new work (Deck, personal communication[163]).

The amount of people present on Open Studio fluctuates over time, and it is connected mainly to the promotion activity of the project. After an initial promotional stage, there are fewer links, BBS postings, and references to the project than at the launch of the project. However, there are clearly a lot of people still visiting Open Studio, as we can see from the animations they leave behind. The anonymous dimension of cyberspace, temporally suspended and floating, constitutes the environment where Open Studio is available to the participation and the collaborative activities of all the users of the Net.

5.1.3. SITO Synergy Gridcosm

SITO is an art community that was born in 1993. It is a virtual community, where "image-makers" and "image-lovers" meet, exchange ideas, and collaborate. SITO.org is a non-profit website. It exists to promote art, artists, and the development of new artforms through collaboration and creative interpretation of dynamic data. Since SITO's inception, the two major sections of the website have been the "Artchive", a collection of over 500 artist portfolios edited by the artists themselves, and the "Synergy" projects, a growing set of on-going collaborative art projects. "Synergy" is therefore SITO's name for collaborative art projects, which are proposed and

---

person at the time) specific art projects with intention to explore "healing" through art. The nature of its specificity, means that such an experience will not be analysed specifically in this work.
[162]Email dated 12 July 2002.
[163]Email dated 11 June 2002.

experimented by artists from around the world participating in the community and called "articipants" (artist-participants). "Gridcosm" is the most popular "Synergy" project, where there is nearly constant activity.

5.1.3.1. History

SITO, originally OTIS, comes from the anagram: "the Operative Term Is Stimulate". The project started in 1993 by Ed Stastny, and today involves about a hundred virtual artists from all over the world. "Synergy" is SITO's name for collaborative art projects, in which anyone can participate by using a personal SITO ID (a three-letter code used to identify themselves across SITO). Collaborative projects have been a very important part of SITO from the beginning.

Within "Synergy" there is a group of projects, called "grid projects", that started in 1994. These projects evolved conceptually and structurally, diversifying, until the latest generation project "Gridcosm", which was activated in April 1997 and is still the most popular project.

The start of this generation of project can be traced as far back as 1993 with "Revolt" and "Crosswire". "Revolt" was the very first project of 'Synergy". It consisted of the creation of an individual image, that was then manipulated by another participant and so on, following a linear sequence. "Crosswire" was the next project. It was an evolution of the previous one, and allowed participants to manipulate and complete any image they found interesting, without following necessarily a forced linear progression. Only those images chosen could evolve to the next generation and mutate. These first collaborative art projects took place through email and FTP, and involved serial manipulation of images by different artists, in which several "generations" of images were created, starting from "seed" images provided by different artists (Verle, 1999).

The opportunity for the first "grid project", namely "Grids", was given by the "Panic" sessions. "Panic", another "Synergy" project, started as an occasional "party" set in order to collaborate and manipulate images in real time in conjunction with a rave called "smartBOMB", which took place in a nightclub in Minneapolis. Images were taken at the rave and sent to the FTP site, from which participants could download and, after manipulating them, could send the images back, so that anyone in the world, especially people at the rave, could see them. However, things did not go as planned and so artists that were participating in "Panic" started to send their own images to manipulate, and they found this so exciting that they decided to make it a weekly artistic and social event.

"Grids" was born in the spring of 1994 from the "Panic" experience, as an attempt to create new forms of structured interaction over images. Instead of modifying an existing image, the grid worked by adding adjacent images to previous one, blending them together in one seamless, larger image. The idea was to use grids of images, where each square is linked to the one which is near and was produced earlier. There are two kinds of grids: static and dynamic. Static grids are "finite" grids and they can be easily represented in bi-dimensional space. Original grids, those of "Grids", were static. Dynamic grids are composed of a set of images that are correlated and continuously growing, as in the case of the successive generation of projects: "Infinite Grid", "HyGrid" and "Gridcosm".

In "Grids" each artist fills up a portion of the grid with an image, which is placed in relation to the other images, and then interconnected with them, through a collaborative process. These processes can take a few hours or many days, according to the time dedicated by the participant and the rate he or she can realize the piece. Each collaboration works in stages. At first a participant sends a starting image, which is placed in the centre of the grid (there can be also other configuration versions). Then four other participants create images in the adjacent portions of the grid, which blend with or somehow relate to the starting image. When this stage is completed, the next stage is started, and so on, until the completion and naming of the grid.

With "HyGrid", in embryo in "The Infinite Grid" of June 1994, we leap into hyperspace. It is November 1995. The "HyGrid" process, based on the same principle as all the "grid projects", is automated by means of a CGI script that recognizes IDs, names of files, configuration patterns, and so on. Differently though from "Grids", "HyGrid" develops on to the World Wide Web and becomes a real, hyperdimensional space. Each square, each portion, has a parent and three children (each square has four "neighbours"). The parent is the image on the basis of which another image is created. We could say it is the image "over" which another image is created, in a hyperspatial perspective. The children are the images linked to the parent. The only exception is the so called "mountaintop", which constitutes the origin. It is a three-linear process, a set of quadrangular images that constantly branch in three directions and are connected to one another within the informational space of World Wide Web. In fact, as Stastny admits, it is no longer correct to call them grids, because they are rather "a built in beauty system that tweaks the exploratory nerve". To go 'right' and 'up' is not the same as to go 'up' and 'right', as it is in bi-dimensional space. In the World Wide Web space, "perhaps it is better described as 'hyperinformational'... meaning that that information isn't intrinsically linked together, but linked by a force that seems 'outside' or 'beyond' the information itself. That force, ideally, is 'context'" (Ed Stastny, personal communication)[164].

In fact, when an artist chooses to create an image to connect two other images, linking the left side of one and the right side of the other, the "bridge" built connects many other images, producing a bond of mutual links. The bridge can be created between two, three or four separate quadrangles, establishing arbitrary and unexpected "HyGrid" paths. In this kind of space it is no longer possible to trace the evolution of "HyGrid" generations simply by counting the amount of quadrangles that are between the current quadrangle and the "mountaintop". Without comparing the dates of creation it is not possible to trace any path of lineage. To cross "HyGrid" means to place oneself in the centre of the pattern, by clicking time and time again on the image you want to put in the centre. Many are the possible patterns, and each of them provides a particular "cross-section" of images and, since June 1996, sounds have been attached to the images.

"Gridcosm" is the latest generation project, active since 1997. To contribute to the evolution and expansion of this cosm is simple, and it works in a similar way to all the other "grid projects": one reserves a space-image, realizes an image, and sends it by FTP. Compared to "HyGrid" what has changed is the time, which has been reduced to just four hours, the time at which it is possible to realize one's own image, and beyond which reservation expires. Concentration and reagency, the

[164] Email dated 27 November 1997.

capability to think quickly and to grasp the creative stimulus, are therefore very important. A fragment of sentence is required in combination with each image, which one can compose choosing among three different possibilities of syntactic sentence, so to create a sort of "loose-form prose" that accompanies the images. Another difference is that "Gridcosm" is constituted by a set of 3x3 grids. When a 3x3 grid is completed, it is reduced to the size of a single portion of the grid and it is placed at the centre of a new empty grid. The process repeats ad infinitum, and currently there are more than fifteen hundred levels. To cross this cosm one must proceed by zooming in and out from the constellations of images, grids, and links. As one goes "down", one more goes back in the history of the cosm, towards its origins, and when it is not possible to go any further there appears an obscure link to "HyGrid".

5.1.3.2. Concept

SITO expresses a sort of "collective art", a place where it is not only possible to produce art and exhibit it, but where a social community of cooperation is active for twenty-four hours and is open to anyone.

Synergy, collaboration and community are the key words to understand the SITO project. As we have seen, "Synergy" is the section of SITO that houses all of the collaborative art projects. These collaborative art projects are designed "to integrate input from multiple sources into a whole that is greater than the sum of its parts" (from SITO.org). They have been a very important part of SITO from the beginning. The first collaborative art projects took place through email and FTP, but as the World Wide Web became more widely accessible, other projects have been developed specifically for that medium.

Synergy is a core principle. In an email quoted by Lenara Verle, Ed Stastny describes it in the following way, while operationally wondering about time parameters in SITO collaborative art projects:

> There is a goal rather than a gauge. The focus can be shifted from observation for collaborative phenomenon to the shaping of collaborative synchronicity. Literally, SYNERGY. With the parameters of a project set and time to work within those parameters, time to hone and weigh prospects, we can get to know one-another as well as creating emotion on an abstract, yet undeniable canvas (Verle, 1999).

Another core principle of SITO's collaborative process is "community". Artist-participants ("articipants") are strongly encouraged to communicate with one another by any available means. Every project is linked to a means of communication. They chat, email, post to public message boards, interacting also at the level of conception and creation of scripts and interfaces[165], while the projects themselves play out like visual conversations.

In fact, even though some projects, like "HyGrid" and "Gridcosm", show multimedia features, including text and sounds, interaction remains primarily visual. The visual aspect is therefore predominant, and collaboration is based essentially on the use of images (Verle, 1999).

---

[165] See Verle's study for a description of the levels of interaction within SITO community (Verle, 1999).

Within "grid projects" artists create images adjacent to one another, as if in a visual dialogue. Verle, a member of the SITO community since 1994, describes how each image expresses different meanings, that are interpreted little by little, and to whom participants respond visually. In this dynamic process, it is possible to identify themes that emerge and develop visually. Often references can be traced, that are linked to particular situations internal to the group, or to local or international events appearing in newspapers or on TV. Sometimes, one or two artists predominate in turn, creating long sequences of images. Other times a visual dialogue does not take place, and images which seem disconnected from one another in a sort of "visual cacophony". Over time, it is also possible to discover "styles" of particular artists, or attempts to simulate or imitate others' style, as if they were playing hide and seek (Verle, 1999).

When an image is launched, this can be developed by other participants, deviated from, or refused completely. An example given by Verle is that of an image which suggests the figure of a human body. Another artist can decide to complete the figure by following the initial form, or to modify it slightly (turning the male features into female features) or completely (changing the human figure in a house or in an abstract drawing).

Interaction between participants takes place usually in an asynchronous way. Participants are not even necessarily connected at the same time in order for interaction to happen. The "rhythm" of projects (Verle, 1999) is induced by the time in hand to create images. In "Gridcosm", for instance, each artist has four hours to create and send images. The rhythm is therefore rather fast (faster than "HyGrid", where participants have 24 hours to complete their own image). The fast pace of Gridcosm constitutes a sort of synchronicity, during which participants remain connected at the same time and follow the rapid progress of images, reacting to them and creating new images as a response. In her study, Verle defines such a synchronicity as "contingent synchronicity", and she compares it to the kind of conversation that occurs by email, a tool of communication asynchronous, but also informal and colloquial because of its immediacy.

Lastly, we can say that the experience of "HyGrid" and "Gridcosm" revolves around the idea of matrix. The loop of actions and retroactions that occurs within the real time of the Générateur Poï étique and that is constitutive of the work gives way to a different mode of collaborative relating. A sort of 'tradition' emerges as each square connects directly to the near squares only, generation by generation. Instead of loops of actions and retroactions, we see influences and explorations. Only in "Gridcosm" is the contribution of all participants processed, and we can talk of indirect actions and retroactions. Within the community, open to the larger Internet community, but aware of a sense of membership that is typical of any social group, collaboration is evolution, generational growing. SITO 'Synergy" drives the exploration of creative collaboration into a dimension that is strictly connected to the nature of the World Wide Web, and into a generational perspective that somehow, compared to the Générateur Poï étique and Open Studio, brings back the work to time, to the history of a community.

5.1.3.3. Functioning

System and Interface

Synergy projects, except for the oldest ones (working on FTP), are based on the World Wide Web and on scripts that function constantly and automatically, and that guarantee the interaction and the integration of new contents into whole projects.

Gridcosm is one of the many Synergy projects based on the grid metaphor, and like the other Synergy projects it allows artists to work on their own image within a predefinite time frame. The way it works is that each level of Gridcosm is made up of nine square images arranged into a 3x3 grid of images. The middle image is a version, one-third the size of the previous level. The images surrounding the centre are created by various people from around the world. The pieces are created sequentially and interlockedly, taking care to insure that the image they create blends visually and thematically with the pieces already in place on that grid level. When a level is complete, it shrinks and becomes the basis for the next level. This process creates an ever expanding tunnel of images, the newest level being a direct result of the previous level, which is a result of the previous level, and so on, in a process that goes on indefinitely.

New pictures can be added in a zooming process. When the topmost level is reached it is possible to enter into the "collaborative mode". Depending on the stage of completion, we can see some finished images, some blank squares, and also some reserved squares. To add an image we choose the space we would like to fill, and then we reserve it using our SITO ID. We need to create the image and upload it to the SITO server in the next four hours; otherwise the space will be made available to a new artist. To upload the file and add the textual fragment we use the tools provided by scripts programmed by SITO participants. These scripts allow us to make the process wholly automated.

There is also a textual element to Gridcosm. At the same time that an artist uploads a new image, he or she also writes a short text as a fragment that will join the other eight to form a text paragraph in the same way that images fit together in that level.

Of course, we can also navigate through Gridcosm in different ways, without entering the collaborative mode. Clicking the zoom in button we can see more details, clicking the zoom out button it reveals the image borders, and clicking the level button we can jump to the top level.

Figure 15. A completed level, and the next completed level in the Gridcosm project (Verle, 1999).

Figure 16. Working progress in the Gridcosm project (Verle, 1999).

SITO Sessions and Communication Channels

In "Gridcosm" participants tend to be connected at the same time within what Verle has called "contingent synchronicity".

They use all the communication channels available to them, from web forum to email, to chat systems. These communication channels are parallel, that is to say they are not an integral part of the interface of the specific collaborative system represented by the project. During the visual interaction systems of synchronous communication are the most used.

5.2. Setting, Sessions, and Players

Visual data used for analysis comes from public and private archives[166], and from sessions in which I participated and that I contributed to during the organization of public workshops, since 1999[167]. These workshops, particularly a first questionnaire tested at the University of Montpellier, were useful when trying to elaborate on the questionnaires used in this work.

The sessions I organized, during my stay at the University of Boulder, Colorado as visiting researcher, presented an opportunity to promote the collection of data related to the questionnaire I had prepared, and also the beginning of a continuous process of feedback with my key informants (artists and regular participants)[168].

I organized two sessions. The first session took place on 11 June 2002 from 11.00am to 1.00pm (Mountains Time), and it involved the participants of the Générateur Poï étique. The second session took place on 25 June 2002 from 9.00am to 10.00am (Mountains Time), and it involved the participants of the Générateur Poï étique again, as well as those of Open Studio. SITO's members were involved and invited to fill in my questionnaires during the period June/July 2002. In all three cases artists accepted to arrange a link on their websites to my questionnaires, inviting those who were going to participate in the sessions I had organized or those that were regular and active member of the community (as in the case of SITO) to respond.

---

[166] I particularly want to thank the artists, and also Lenara Verle and Maya Kalogera, for their important contribution.
[167] Workshops at Golem Videofestival, Torino, November 1999; University of Montpellier III, Montpellier, June 2000; Fondazione Pistoletto/Cittadellarte, Biella, April 2001.

Sessions were promoted through the communication channels usually adopted by each project (mainly through mailing lists), and according to the policies of the artists. The sample, therefore, reflects the nature of those who normally participate to those projects. Even though some new participants were linked to the sessions I had organized (for instance staff and students of the University of Boulder, Colorado), this falls within the usual dynamics of the projects and responds to their artistic experimental nature[169]. On the occasion of these sessions the maximum number of participants connected at the same time was 16 for Générateur Poï étique, and 8 for Open Studio.

It was possible to retrieve identities thanks to the open questionnaire, notwithstanding some problems with database integrity when attributing an identity to the questionnaires for the Abaque de Régnier. This then allowed me to proceed with unstructured interviews useful in refining some observations.

The number of answers in relation to the first questionnaire (Abaque de Régnier) received at the Boulder sessions is expressed by the following: 27 for the Générateur Poï étique; 16 for Open Studio, and 12 for SITO. Thenumber of individual respondents was 50. The number of answers in relation to the second questionnaire was as following: 20 for the Générateur Poï étique; 10 for Open Studio, and 11 for SITO. The number of individual respondents was 37.

---

168 See note 146.
169 This is true for the Générateur Poï étique, and also for Open Studio, while SITOsuggests a different discourse that reflects its nature as a community.

6. Results of the Case Studies

In this sixth chapter the results of the case studies are presented and discussed. They provide an understanding of the experience of co-creation, a grasp of the motivational paths to co-creation, and a description of the features of the computational environment that can sustain co-creation.

The purpose of this chapter is to identify some specific principles for the design of relational settings and affective bodies, seen as a weak aspect in the practice of Metadesign.

* * *

The cross-case analysis of the results of the case studies allows us to understand the event of co-creation, and how the collaborative system and the interface can support this event. Such analysis combines with the understanding of co-creation provided by the aesthetical analysis produced in chapter three, and contributes to identify what specific intersubjective and embodied processes of co-creation can be enabled by networked computing into visual environments.

6.1. Collaboration and Co-Creation

The first part of the analysis enables us to understand the creative experience of participants, and to define the event of co-creation within the collaborative system.

This analysis has revealed a relationship, in the perception of participants, between collaboration and the event of co-creation.

The method adopted for this analysis is called Abaque de Régnier, and it is based on a closed questionnaire and on visual representations of the results[170].

6.1.1. Mosaic of Individual Perceptions

By putting the answers to the questionnaire in lines and the respondents in columns, we get a coloured matrix, representing the central issue. This matrix represents a mosaic of individual perceptions.

About GP - The global colour distribution of the 513 elements of the matrix (27*19) is already indicative of underlying disturbances: green (25, 73%), light green (25,73%), yellow (21,44%), light red (11,11%), red (10,53%), white (2,34%) and black (3,12%). From green to red there is a distribution that decreases quite harmoniously. The coupled green and light green, and red and light red, show values that are very similar when not identical (for instance in the case of green and light green), that is to say they identify areas of "positive consensus" and "negative consensus" that are internally homogeneous. The sum of green and light green is more than 50% of the matrix, more than double of sum of red and light red. A large yellow area (about 20%) is also clear. The sum of white and black (which represents the opaque areas of the image) is just a little more than 5%. See (Appendix IV, illustration I).

About OS - The global colour distribution of the 304 elements of the matrix (16*19) is already indicative of underlying disturbances: green (20,72%), light green (26,64%), yellow (20,07%), light red (9,87%), red (13,16%), white (8,55%), black (0,99%). From green to red there is a non-homogeneous distribution, showing rather significant gaps between red and light red, and especially between green and light green (more than 6%). These gaps identify areas of "positive consensus" and "negative consensus" that are internally non-homogeneous. The sum of green and light green is almost more than 50% of the matrix, more than double the sum of red and light red. Again, a large yellow area is evident (about 20% again). In this case the sum of white and black (that represents the opaque areas of the image) is near to 10%, showing a clear predominance of white. See (Appendix IV, illustration II).

About SITO - The global colour distribution of the 228 elements of the matrix (12*19) is already indicatory of underlying disturbances: green (25,88%), light green (28,51%), yellow (22,81%), light red (8,33%), red (8,77%), white (5,70%), black (0%). From green to red there is a distribution that decreases quite harmoniously. The coupled green and light green, and red and light red also show values that are very similar, that is to say they identify areas of "positive consensus" and "negative consensus" that are internally homogeneous. The sum of green and light green is more than 54% of the matrix, more than triple the sum of red and light red. The values of light red and red are in fact the lowest of the three matrices. A yellow area that is bigger than in the other two matrices is evident (almost 23%). The sum of white and black (that

---

[170]See 4.2.3.2. for a description of the method and the reasons of its adoption; see Appendix I for the questionnaire.

represents the opacity of the image) is near to 6%, but with a complete absence of black. See (Appendix IV, illustration III).

6.1.2. Attitudes of Participants

The distinction between white and black allows us to segment the attitudes of participants within the "opacity" of the matrix. The distribution of colours allows us to do the same within its "transparency". This is possible through analysis of the columns that correspond to the answers of each participant.

From the analysis of the matrix of participants, one can infer that, generally speaking, most participants did not use either white or black. Nevertheless this is not always true, as in the case of Open Studio, but it is true that most participants show a distribution of the colours attributed to the answers that is consistent.

About GP - Most participants (18 among 27) do not use either white or black. Twenty-four participants show a continuous distribution, that is to say their answers do not lack colours between the extreme green (green or light green) and red (red or light red). One only participant (ID30) shows a discontinuous distribution, which shifts from light green to red. Two participants (ID2 e ID124) show a partial distribution, failing to use the red extreme (red or light red). See (Appendix IV, illustration IV).

About OS - A little less than the half of participants, seven among sixteen, use neither white nor black. Thirteen participants show a continuous distribution, where all the colours between the green (green and light green) and red (red and light red) extreme are used. Three (ID60, ID53, ID54) show a discontinuous distribution, passing from light green to red (ID60 e ID53), or from green to red (ID54). See (Appendix IV, illustration V).

About SITO - No participants ever use black. Seven among twelve do not even use white. All participants show a continuous distribution, using colours between the extreme green (green or light green) and red (red or light red). See (Appendix IV, illustration VI).

6.1.3. Permutations

Processing the raw data on the basis of the answers, we can see a consensus in relation to the experience of creativity, which reveals a relationship in the perception of participants between collaboration and the event of co-creation. Subsequently, there is also a dissensus (that is to say a problematic area) about the motivational paths and the nature of the creative environment as affected by the collaborative system and the interface.

6.1.3.1. Favourable Consensus: Co-Creation

A positive trend emerges ("favourable consensus") in relation to the set of questions 2, 6, 8, 16, 18, and 19. According to these answers participants feel they created something that was different than they would have created alone (8). They felt they interacted creatively with others (answer 2), on the basis of the visualization of their activity (6), and they felt that they experienced a creativity that went beyond their interaction with the computer (16). Such an experience was, for them, more important than the outcome (18), and they felt satisfied (19).

These results are provided by an analysis that merges all the answers given for each single project. A singular analysis of each project would reveal the different distribution of values attributed by participants to each project. Nevertheless, a joint analysis, like the one elaborated here, allows us to identify shared areas of consensus that are meaningful and comparable with the results of the aesthetical analysis of chapter three[171].

About item 8 - "I created something that was different than I would have created alone". A joint analysis reveals a clear favourable consensus. Black is absent: green (54,55%), light green (23,64%), yellow (9,09%), light red (3,64%), red (1,82%), white (7,27%), black (0%). Looking at the single projects, two in three do not show the red extreme at all (OS and SITO) or even the yellow (SITO). This item is the only one to appear within the area of positive consensus in each project.

About item 18 - "The experience is more important than the outcome". A joint analysis reveals a clear favourable consensus: green (36,36%), light green (40%), yellow (10,91%), light red (3,64%), red (3,64%), white (1,82%), black (3,64%). Looking at the single projects, this item has its most favourable consensus in relation to OS.

[171]By means of this kind of comparison it is also possible to solve some controversial issues, like the meaning of those items that in a single project found a place within the central problematic area (called "dissensus").

About item 19 - "I feel satisfied". A joint analysis still reveals a clear favourable consensus. The value of yellow increases, while red disappears completely: green (45,45%), light green (25,45%), yellow (21,82%), light red (1,82%), white (3,64%), black (1,82%). Looking at the single projects, this item has its most favourable consensus in relation to GP.

About item 6 - "My interaction with other participants was guided by the visualization of their activity". A joint analysis still reveals a clear favourable consensus: green (30,91%), light green (36,36%), yellow (18,18%), light red (5,45%), red (1,82%), white (5,45%), black (1,82%). Looking at the single projects, this item has the highest favourable consensus, particularly in relation to GP and OS.

About item 16 - "I felt there was a creativity that went beyond my interaction with the computer". A joint analysis still reveals a clear favourable consensus, but opacity is high: green (32,73%), light green (32,73%), yellow (10,91%), light red (7,27%), red (5,45%), white (7,27%), black (3,64%). Looking at the single projects, this item has the highest favourable consensus, particularly in relation to SITO.

About item 2 - "I felt that I interacted creatively with others". A joint analysis still reveals a clear, favourable consensus. Opacity is very low (white is almost absent): green (38,18%), light green (25,45%), yellow (21,82%), light red (10,91%), red (1,82%), white (0%), black (1,82%). Looking at the single projects, this item has its most favourable consensus in relation to SITO.

Looking at the single projects, positive trends are distributed as following:

- GP: items 19, 8, 6, 18 (see Appendix IV, illustration VII);

- OS: items 18, 8, 2, 6 (see Appendix IV, illustration VIII);
- SITO: items 2, 8, 16, 19 (see Appendix IV, illustration IX).

6.1.3.2. Unfavourable Consensus: Co-Creation

A negative trend emerges ("unfavourable consensus") in relation to the set of questions 17, 7, 9, 14, and 13. According to the answers participants deny that their interaction with other participants was guided by their chatting with other participants (7), or was significantly affected by previous knowledge of the people they were interacting with (9). Users also deny that the outcome is predictable (17), but not all of them are sure whether the outcome was mainly determined by the computational features of the system (14), or whether their relationships were mainly affected by the time of interaction (13).

These results are provided by an analysis that combines all the answers given for each single project. A singular analysis of each project would reveal the different distribution of values attributed by participants to each project. Nevertheless a joint analysis also, in this case, allows us to identify shared areas of consensus, that are meaningful and comparable with the results coming from the aesthetical analysis of chapter three.

The joint analysis shows that within the area of "unfavourable consensus" values tend, in some cases (particularly 13 and 14), to slide towards the central problematic area. This is due partly to the missing polarisation that an evaluation from users about the answers previously given should produce[172]. In fact we can see that in SITO, where the community dimension gives to participants a deeper awareness, polarisation is more definite. Partly, this is due to the thematic closure of some of the following items that have been identified as clear problematic areas (see the following two sections).

About item 7 - "My interaction with other participants was guided by my chatting with them". A joint analysis reveals a clear negative trend. Black is absent: green (3,64%), light green (12,73%), yellow (20%), light red (25,45%), red (30,91%), white (7,27%), black (0%). Looking at the single projects, this item has its most unfavourable consensus in relation to GP.

About item 17 - "The outcome is predictable". A joint analysis reveals a negative trend. Black is absent: green (14,55%), light green (12,73%), yellow (16,36%), light red (23,64%), red (27,27%), white (5,45%), black (0%). From green to red there is a harmonic decreasing distribution, but looking at the single projects, this item has a clearer polarisation in relation to SITO (0% green and 0% light green).

About item 9 - "Previous knowledge of the people I was interacting with was relevant". A joint analysis reveals a negative trend. White opacity is more than 12%. Values of transparent colours are: green (14,55%), light green (14,55%), yellow (10,91%), light red (12,73%), red (32, 73%), white (12, 73%), black (1,82%). Looking at the single projects, this item has its highest favourable consensus particularly in relation to GP and OS.

---

[172]See 4.2.4.2.

About item 13 - "My relationships were affected mainly by the time of interaction". The sum of red and light red does not express a univocal negative trend: green (14,55%), light green (14,55%), yellow (34,55%), light red (20%), red (10,91%), white (5,45%), black (0%). Looking at the single projects, this item has an unfavourable consensus only in relation to SITO. So even though visually it occurs in the area of unfavourable consensus of SITO, and it should be considered as part of the set of negative trends given by a joint analysis of the projects, it will be considered within the next section.

About item 14 - "The outcome of interaction was determined mainly by the computational features of the system". The sum of red and light red does not express a univocal negative trend: green (9,09%), light green (27,27%), yellow (27,27%), light red (10,91%), red (16,36%), white (5,45%), black (3,64%). Looking at the single projects, this item has an unfavourable consensus only in relation to SITO. So even though visually it occurs in the area of unfavourable consensus of SITO, and it should be considered as part of the set of negative trends given by a joint analysis of the projects, it will be considered within the next section.

Looking at the single projects, negative trends are distributed as following:

- GP: items 9, 7 (see Appendix IV, illustration VII);
- OS: items 9, 7, 17 (see Appendix IV, illustration VIII);
- SITO: items 13, 14, 17 (see Appendix IV, illustration IX).

6.1.3.3. Dissensus A: Relationships, Feelings, and Goals

Dissensus has been divided into two areas. The first is related to the motivational paths that sustain co-creation, and the second is related to the environment provided by the collaborative system and the interface. In the first area dissensus emerges as an issue of perception and understanding of the relationship between participants, their feelings and goals, but the questionnaire on these topics gives an unsatisfactory result, because answers need to be better articulated. The results of the open questionnaire (see 6.2) will provide further insights.

This first problematic area ("dissensus A") emerges in relation to the set of questions 1, 3, 4, 5, and 15. According to these answers, participants disagree about how they felt influenced by other participants (1). They also disagree about how and to what extent they were emotionally coupled to other participants (4), and whether they were able to imagine what other participants had the intention of doing (5). Lastly they disagree about whether they were following their own goal (3), or whether they perceived the outcome as determined mainly by the active relationship among participants (15).

6.1.3.4. Dissensus B: Creative Environment

A second problematic issue is related to the perception and features of the creative environment, both in terms of the "place" determined by the processes-material at stake (here produced by the relation between feelings/goals, or individual factors, and computational features of the environment), and in relation to the specific aspects of the collaborative system and the interface. A more close visual analysis of the answers given in relation to the items under the theme "Place"[173] can help to provide some insights, but a phenomenological analysis of the visual activity of the participants will be necessary in order to provide further elements of understanding (see 6.3).

The second problematic area ("dissensus B") emerges in relation to the set of questions 10-11/20-21/22-23, 12, and 13. Although different for each project, participants are not to tell clearly whether their activity was coupled to the activities of their neighbours or to the global activity (20-21 in GP); whether their activity was influenced by colours or by strokes and marks (10-11 in OS); whether their activity was influenced by the pictures of their neighbours or by the whole of all the pictures (22-23 in SITO); or whether their relationships were affected mainly by the space or by the time of interaction (12 and 13 in all the projects). It seems difficult for participants to be able to perceive the level of resolution of their interaction and objectify stimuli and external factors. The hypothesis, that has also led me to adopt an open questionnaire and later a phenomenological analysis of visual activity, is that the level of resolution of participants' interaction, and the stimuli and external factors contributing to the process are not easily perceivable and understandable by participants when "detached" from the process. They are experienced intersubjectively and, as such, they affect the process of interaction and must be analysed.

[173]See Appendix I for the list of questions and their organization in themes. The software scripted to apply the Abaque de Régnier gives visual representations for the whole set of questions, and also for each thematic set of questions ("Agency", "Place", Processes-material", and "Outcome").

If we look closer at these questions (10/11, 21/22, 22/23, 12, 13) in relation to the theme "Place", so relativizing the visualization on one specific topic, we can see that while for each project some features seem to emerge specifically (like space for GP, colours for OS, and the whole picture for SITO), it also seems to emerge as true for all that time is not perceived as a factor particularly relevant. This is curious if we consider the fact that two of these projects (GP and OS) are in real time, and that for Gridcosm the time of interaction is constrained by fixed temporal frames. See (Appendix IV, illustrations X, XI, and XII).

The first inference that can be made is that time, like space, colours, or the collaborative "canvas", are intersubjective factors, rather than mere aspects of the interactive system, and as such they are perceived.

6.1.3.5. Anomalous Positions and First Insights

If we combine the matrix of questions with the matrix of participants we can see anomalous positions emerge, such as red cells on green fields and vice versa. An analysis of these positions and their correlation with other answers from the same participant, or from other participants with a similar profile, allows us to identify some first insights that will then be confirmed by the results provided by the open questionnaire in the next section (see 6.2). Not all the anomalous positions emerging from these matrices reveal significant correlations, but some interesting positions emerge. The most interesting correlations can be found in GP and OS, and respectively they place in opposition (a) verbal chatting and creative relationships, and (b) mere computation and emotional tone.

(a) Verbal Chatting vs. Creative Relationships

In GP, the polarisation between the green and the red field is not so clear. Nevertheless some anomalous positions are quite visible at the extreme of the two fields (see Appendix IV, illustration XIII). Among these positions, the most meaningful correlation can be traced from the answers of participants ID112 and ID120. As we have seen in 6.1.3.1., there is a favourable consensus on the fact that interaction was guided by the visualization of the activity of participants, but in an anomalous way participants ID112 and ID120 responded to the question 7 saying that their interaction was guided by their chatting with other participants (7*112: light green, 7*120: green). Both these participants show a lack in the perception of a shared creative experience (they didn't feel that they interacted creatively with others: 2*112: light red, 2*120: yellow; they deny imagining what other participants had the intention of doing: 5*112: red, 5*120: red; they refuse to express their judgement about whether the outcome of interaction was determined mainly by the active relationship among participants: 5*112: black, 5*120: black). Furthermore, participant ID112 responds in an anomalous way to the question 9, sustaining that a previous knowledge of the people she was interacting with was relevant (9*112: green).

An initial conclusion is that focusing on verbal chatting and on previous acquaintances, rather than on visual activity, seems to distract from experiencing an active and creative relationship with other participants.

(b) Mere Computation vs. Emotional Tone

In OS, the polarisation between the green and red fields is clearer. Some anomalous positions are clearly visible (see Appendix IV, illustration XIV). Among these positions, the most meaningful correlation can be traced from the answers of participant ID53. She answered that her relationships were affected mainly by the space of interaction (12*53: green), that they were affected mainly by the time of interaction (13*53: green), and that the outcome of interaction was determined mainly by the computational features of the system (13*53: green), while she answered red or light red to the remaining questions concerning the experience of creativity.

We can infer that where the participant more strongly perceives the features of the collaborative system than the emotional tone of interaction, that is to say the presence of and the relationship with other participants (independently from the fact that this happens due to the nature of the collaborative system or to the temperamental characteristics of participant), co-creation does not seem to take place.

A further insight can be inferred from the only anomalous position visible on the SITO matrix (see Appendix IV, illustration XV). This matrix does not show particularly significant correlations, but it confirms the good homogeneity in the answering of participants, and reveals an understanding that is largely shared between participants belonging to the same community for a long period of time.

6.2. Relationships, Feelings, and Goals

Following the results obtained with the Abaque de Régnier, it remains to clarify what motivational paths and what kind of environment are provided by the collaborative system and the interface, and how they sustain co-creation. In this section, the results obtained through the "Attractors and Pathways" method (see 4.2.3.3.), and concerning the motivational paths of participants are presented.

6.2.1. Categories, Keywords and Attractors

Starting with the answers to the open questionnaire used within this method (see Appendix II), clusters of keywords have been defined for each of the seven items put in the questionnaire. They are: (1) Relationship quality; (2) Relationship factors; (3) Goals; (4) Feelings; (5) Context features; (6) Motivations; (7) Habits. From these clusters a consistent set of elements have been identified for each item. The elements referring to the items concerning how the relationship with other participants was perceived (relationship quality), and what motivations to interaction were subjectively perceived (motivations) emerge as crucial. In relation to these elements a number of different pathways can be defined, according to three different "attractors"[174]. These attractors lead to the identification of three different "pathways" or behaviours, corresponding to the three different flow-charts (see Appendix IV, illustrations XXIV, XXV, and XXVI). They are:

A. *Emotional-existential*,

the pathway of which tends toward the left side of the chart (18 respondents);

B. *Explorative*,

the pathway of which tends toward the middle side of the chart (18 respondents);

---

[174]In this method the term attractor is borrowed from differential topology. An attractor state is generally defined as the state towards which a system spontaneously shifts: "So what does a general dynamical system do in the long run? It settles down to an attractor. An attractor is defined to be... whatever it settles down to!". (Stewart, 1997, p. 99; quoted in Fondazione Fitzcarraldo et al., 2001).

C. *Productive*,

the pathway of which tends toward the right side of the chart and represent an intermediate combination of emotional and explorative elements (5 respondents).

The three flow-charts presented and discussed in this section are a result of merging the flow-chart of each single project. Each single project shows similar attractors and pathways, and they can be merged. Of course, each project has its own singularity (as it can be observed from the illustrations from XVI to XXIII in Appendix IV), but what this research is attempting to produce is a general understanding of co-creation.

The flow charts offer a graphical representation of the forty-one people interviewed. The items that represent summaries of the questions are located to the left of each heading. The boxes to the right contain variables that have been derived by clusters of keywords, identified on the basis of the answer received for each question. Each line represents a single individual, and was drawn by tracing the path of the answers given by each participant. To each project corresponds a different family of colours (red for GP, green for OS, and blue for SITO). Before describing the three paths and giving some quotations from the answers of participants for each of them, the next section will explain each different item and set of variables on the flow charts.

6.2.1.1. Relationship quality

Relationship quality refers to the nature of the relationship among participants, as perceived by the participants themselves. The question was: "How would you define your relationship with other participants?".

(a) Emotional: if the relationship is perceived as friendly or intimate. This kind of relationship is perceived as something intense, dealing with a range of emotions going from love to hate.

(b) Explorative: if the relationship is perceived as playful, dealing with fun and curiosity.

(c) Productive: if the relationship is perceived as oriented to the "making".

(d) Alienated: if the relationship is perceived as alienated.

6.2.1.2. Relationship factors

It refers to the factors affecting the relationship, as perceived by the participants themselves. The question was: "What factors affected your relationship with other participants?".

(a) Emotions: if participants feel affected by their own emotions;

(b) Inter/activity: if participants feel affected by their own or other participants' activity.

(c) Visual stimuli: if participants feel affected by visual inputs like colours or strokes.

(d) Interface: if participants feel affected by the tools provided by the collaborative system.

(e) Personal attitude and abilities: if participants feel affected by their own or other participants' attitudes and abilities, like intelligence, stupidity, sense of humour, cooperative style, and communicative skills.

(f) None: if participants did not feel affected by, or aware of, any factors.

6.2.1.3. Goals

It refers to the conscious goals participants maintain to have during the process of interaction. Here goals are meant both as purposes and/or objectives. The question was: "What were your goals during the process of interaction?".

(a) To relate: if participants feel focused on relating to each other, and being personally connected.

(b) To create together: if participants feel focused on collaborating, and building something that can be meaningfully shared.

(c) To explore: if participants feel focused on playing and experimenting.

(d) To produce: if participants feel focused on the outcome.

6.2.1.4. Feelings

It refers to what participants consciously feel during the process of interaction. The question was: "What were your feelings during the process of interaction?".

(a) Love: if feelings are strictly related to loving or hating and conflicting, and they deal with a range going from joy to despair, from ecstasy to agony.

(b) Surprise: if feelings are wonder and surprise, and they deal with a range going from enchantment to "vacuum".

(c) Fun: if feelings are playful and relaxed.

(d) Concentration: if feelings deal with individual absorption and attention.

(e) Frustration: if participants feel limited or stuck.

6.2.1.5. Context

It refers to the characteristics of the context of interaction, as perceived by participants themselves. The question moved from a comparison with games, asking participants to stress differences. This angle aims to clarify the distinction between co-creating and playing a game (that is usually one of the most common comparisons established in relation to collaborative systems that do not satisfy specific "real world" problems). The question was: "What are the differences, if any, between (*title of the project*) and a game?".

(a) Openness: if the context is perceived as showing multiple meanings, and open rules. Participants perceive the context as dealing with imagination and creativity.

(b) Unpredictability: if the context is perceived as not having clear rules or goals. Rules and goals are perceived mainly as being unspecified and unpredictable.

(d) Cooperation: if the context is perceived as self-organizing and based on cooperative dynamics. There are neither conditions of victory nor competition, and control is not important.

(e) Artistic purpose: if the context is perceived as specifically designed for an artistic purpose.

6.2.1.6. Motivations

It refers to the conscious motivations which prompt participants to participate. The question was: "Why do you like to participate in (*title of the project*) sessions?".

(a) Emotional-existential: if participants feel motivated by a spontaneous wish to interact with people, or to share with them their creative experience.

(b) Explorative: if participants feel motivated by curiosity and fun.

(c) Productive: if participants feel motivated by being constructive and concrete.

6.2.1.7. Habits

It refers to the habit that participants have of taking part in collaborative online projects. This question aims to allow a correlation between attitude and practice. The question was: "What other net art projects do you like to participate in?".

(a) Practice: if participants are normally used to take part in artistic interactions.

(b) No practice: if participants are not normally used to take part in artistic interactions.

Any of these variables also present "no answer" items, and are mapped on the flowcharts at the far right.

6.2.2. Emotional-Existential Path

In the emotional-existential path (see Appendix IV, illustration XXIV) goals are to relate and to create together ("Blend the images together, say something with my image, respond to something with my image, incite something on others with my image", Lenara/SITO).

Co-operation is felt as crucial and is connected to the perception of a creative environment as open and unpredictable ("There is no winner. It is not competitive.

There are neither rules nor precise directives. It is auto-organisation, like for ants"[175], Mickael/GP; "Imagination"[176], Giulia/OS).

Participants are moved by emotions and by a wide range of intersubjective feelings that are mainly related to the existential dimension ("Love/boredom/hate", Bob/SITO; "Agony, ecstasy, silly", Thomas/SITO).

Their conscious motivations are coherently connected to such emotional-existential dimension ("Feeling people", Olivier/GP; "To create equally and collectively. No more to be one, but many. Something connected to a momentary dispersion"[177], Mickael/GP; "Creative procrastination", Mark/SITO; "It affords me a chance to be creative in ways which I had not previously been", Nick/SITO).

Their personal traits, emotional behaviours, and interactions are strictly interrelated and embodied in their drawing activity. Most participants have experience in collaborative online projects.

6.2.3. Explorative Path

In the explorative path (see Appendix IV, illustration XXV) the goal is to play and explore ("To make a sand castle with the other children"[178], Gabriella/GP; "Investigate process", Margaret/OS).

---

[175]Originally: "Ca dépend des jeux mais àcelui-là, il n' y a pas de gagnant. Ca n'est pas compétitif. Il n' y a pas de règles et de directives précises. C'est de l'auto-organisation comme les fourmis".
[176]Originally: "L'imagination".
[177]Originally: "Croire au partage et au collectif. Ne plus être un mais plusieurs. Quelque choçse lié à la dispersion momentanée".
[178]Originally: "Fare un castello di sabbia con gli altri bambini".

Co-operation is felt as crucial and is connected to the perception of an open, creative environment ("Multiple unspecified goals, no victory conditions, collaboration over competition", Michael/GP; "The goals are not clearly specified, there is a wide latitude to define the meaning of the experience", Andy/OS).

Participants are moved by emotions and individual feelings, related mainly to fun and discovery ("I have been pleasantly surprised. I felt immediately something very relaxing, inviting, sweet... poetic... far beyond impulses into silence (does it have any sound?)"[179], Jean-François/GP; "Anxiousness, frustration, elation", Ed/SITO).

They feel related to each other by many different factors, which range from emotional factors, to the features of the environment and the system ("Colour... and especially the coloured horizontal or vertical line ended up to be perceived like a call, an invitation"[180], Jean-François/GP).

Their conscious motivations are coherently connected to such explorative dimension ("I'm learning", Michael/GP; "It was neat to see how other people would interact with your objects. It was also neat to see what people wouldn't interact with. You get to see what is going on", Dan/GP; "The people are interesting, its very alive/dynamic, new things always popping up", Jon/SITO).

Most participants do not have experience in collaborative, online projects.

---

[179]Originally: "J'ai été très agréablement surpris. J'ai resenti tout de suite quelque chose de très relaxant, attractif, doux...poétique...bien au delà des mots dans le silence (y avait il du son?)".
[180]Originally: "La couleur... et surtout la ligne colorée horizontale ou verticale a fini par être perçu comme un appel, une invitation".

6.2.4. Productive Path

In the productive path (see Appendix IV, illustration XXVI), goals range from exploring, to creating together. Thus, the productive path seems to be intermediate between the emotional-existential and the explorative path, but co-operation is functional to the production of an outcome, and the environment is not perceived as open and unpredictable.

Participants are focused on their own activity ("I was much too concentrated on the process to realise what my feelings about it were", Federica/GP), and moved by the visual stimuli coming from the environment, but they feel alienated from other participants ("Blind", Borg/GP).

Their conscious motivations are coherently connected to a productive dimension ("The discovery of the outcome and the process of building it are interesting and compelling enough for participating", Matteo/GP). Participants were varied in their experience of collaborative, online projects.
A note to add is that only GP and SITO express a productive path, while OS does not.

6.2.5. Frequency of Participation

It is interesting to note the frequency of participation in relation to the three different paths (see Appendix IV, illustration XXVII). Although the numbers are not of high statistical relevance, there is a paradigmatic shift in relation to a low level of frequency (that attracts more participants on the explorative path), and a medium level of frequency (that attracts more participants on the emotional-existential path). It is interesting to note that a high level of frequency quite equally attracts participants both on the emotional-existential and the explorative path, while the productive path disappears completely. Beside this statistical observation, on the basis of the answers given by participants it can be added that those on the explorative path and with an high level of frequency show a quality of explorative behaviour that is less oriented to the exploration of the system and more oriented to "explore" the other participants ("The people are interesting, its very alive/dynamic, new things always popping up", Jon/SITO).

A low level of participation has been defined in terms of 1-2 times for GP and OS, or 1-2 years for SITO (because this latter is a virtual community, and therefore expresses a different duration); a medium level of participation has been defined in terms of 3-5 times for GP and OS, or 3-5 years for SITO; a high level of participation has been defined in terms of more than 5 times for GP and OS, or more than 5 years for SITO.

6.2.1.6. First Conclusions

This analysis offers two points of views. The first is that of the individual, of the single participant, which is characterised by subjectivity of action and by the perception of the interaction from the inside; the other is the external point of view, which analyses the impact on interaction at the level of the "system" and the birth of "emerging phenomena".

If one adopts the point of view of the individual, a triple matrix of activity can be observed in the way the single participant explores and experiences the interaction (emotional-existential, explorative, productive). Participants interact in order to relate to each other, to create together, to explore the system (this latter meant both as interactive and interactional[18]), or to produce an outcome.

If one adopts instead the external point of view in order to identify the overall result of a myriad of interactions among the single participants, the analysis shifts from the interdependence between participants to the emerging phenomena, and produces hypothetical models of functioning of co-creation. From this analysis co-creation is defined as a context and collection of interactions of the single participants, which is moulded by these without any central guidance towards specific objectives or determined strategies. As such, it allows the participants to relate and collaborate, and it reveals their individual motivations and strategies of interaction according to their embodied activities and intersubjective dialogues. In this sense, the projects examined do not produce outcomes but meta-outcomes, in other words they are "situated" projects, environments appropriate for open collaborative and creative interactions. For these reasons, an analysis at the level of the entire system produces, in the end, an understanding of co-creation as "place", within which participants act.

---

[18] I mean both in the terms of an exploration of the computational features of the system and in the terms of an intersubjective exploration of other participants.

6.3. Creative Environment

The perception of the creative environment, as expressed by participants in their answers to the closed questionnaire which has been used first to frame the issues at stake - is controversial. Data collected and analysed through the method of the Abaque de Régnier express a dissensus, that is to say a problematic area. I will try to clarify such perception, the nature of the creative environment, and how system and interface supports it by means of a phenomenological analysis of the visual activity and verbal chatting of participants.

6.3.1. A Phenomenological Analysis of Visual Activity

From a diary:

> Limited capability. Colors -32/32 bits wide. I just get a patch with some neighbors. I don't much like the current design/painting (some kind of cartoonish southwestern drawing). What can I do? What are the tools capable of?
>
> I want to do something 3D. That shows volume. A Necker cube? Sure.(not much noticing what other participants are doing for the moment) 2 squares offset. Different colors. 4 connecting lines to vertices at 45 degree angle. Have to reset exact positions of squares to get stuff to match up. Must blacken out and then redraw. Now what are other people doing?
>
> Other designs are changing. My neighbor above seems to have an idea something like mine (or is responding to mine). His is an accordion shape moving down toward my design. Can I respond to him by extending my design. I can't just pick up my current design and reposition it. Ah... I will grow my design by adding accordion panels to reach his design. Add panels. Now he is filling his panels with an off yellow. I reflect his color choices. We seem to be almost working together.
>
> Next I go though a similar process with my neighbor to my left. He doesn't seem to notice me. How can I get his attention? Ah... I will

follow his color patterns extend a line I see he has drawn touching my space. This seems to work, now I have his attention.

But my design seems to be losing coherence. The neighbor above doesn't seem to be responding much anymore. Is there an idea we call all share?

Just now I notice the a distant participant seems to have created an interesting "zoom" design with an interesting 3D effect (A set of "overlapping" and "receding" colored boxes converging on a point it the center). How to get his attention? Can I draw him into a collaboration? Ah... I will replicate his design. Even down to the exact colors used.

Necker cube, accordion, then zooming design three interesting experiments to get volume/3D into an impoverished drawing environment.

[...]

No response yet. His design doesn't seem to be changing. OK, I will now reset the color scheme to see if that gets a response. Still no response.

Something has been going on while I was not paying attention. Now a figure of a naked woman has been created by the 2 players above me and one to the northwest. My zooming design seems to be suggestive (zooming in over the genitalia). I start to fill the background with a matching skin color with the neighbor above.

More playing around. Getting to be over an hour of interaction. Some are dropping out (Mike Williams, personal communication[182]).

The following analysis is based on phenomenological data[183] related to the visual activity produced within the system by the interactions of participants with one another, and derived from direct observation, video recording and immersive experience[184]. These data are supported by remarks and feedback given by participants to the previous open-ended questionnaire, and also from unstructured interviews.

[182]Email dated 14 June 2002.
[183]See note 82.
[184]See note 83.

This analysis refers only to GP and OS, because, as explained in 4.2.4.4., these two projects allow us to focus on the ongoing visual activity in a way that is useful for the purpose of this analysis.

6.3.1.1. Emerging Mediators

Five categories have emerged from interaction as relational mediators. They are: a) Space; b) Colour; c) Visual elements; d) Textual elements; and e) Time. Their analysis was based on the records of the activities of visual interaction that took place during the two sessions set in collaboration with the artist between June and July 2002, and also on the historical sessions available from the archive of the artists[185].

6.3.1.1.1. Space

Lines (GP) and marks (OS) define the space of interaction on the canvas shared by all participants. They tend to express attitude and disposition of participants, and disclose their intentionality within the space of interaction. They can express closure or openness, dialogue or aggression, by their orientation and shape, and through their covering or stratifying action.

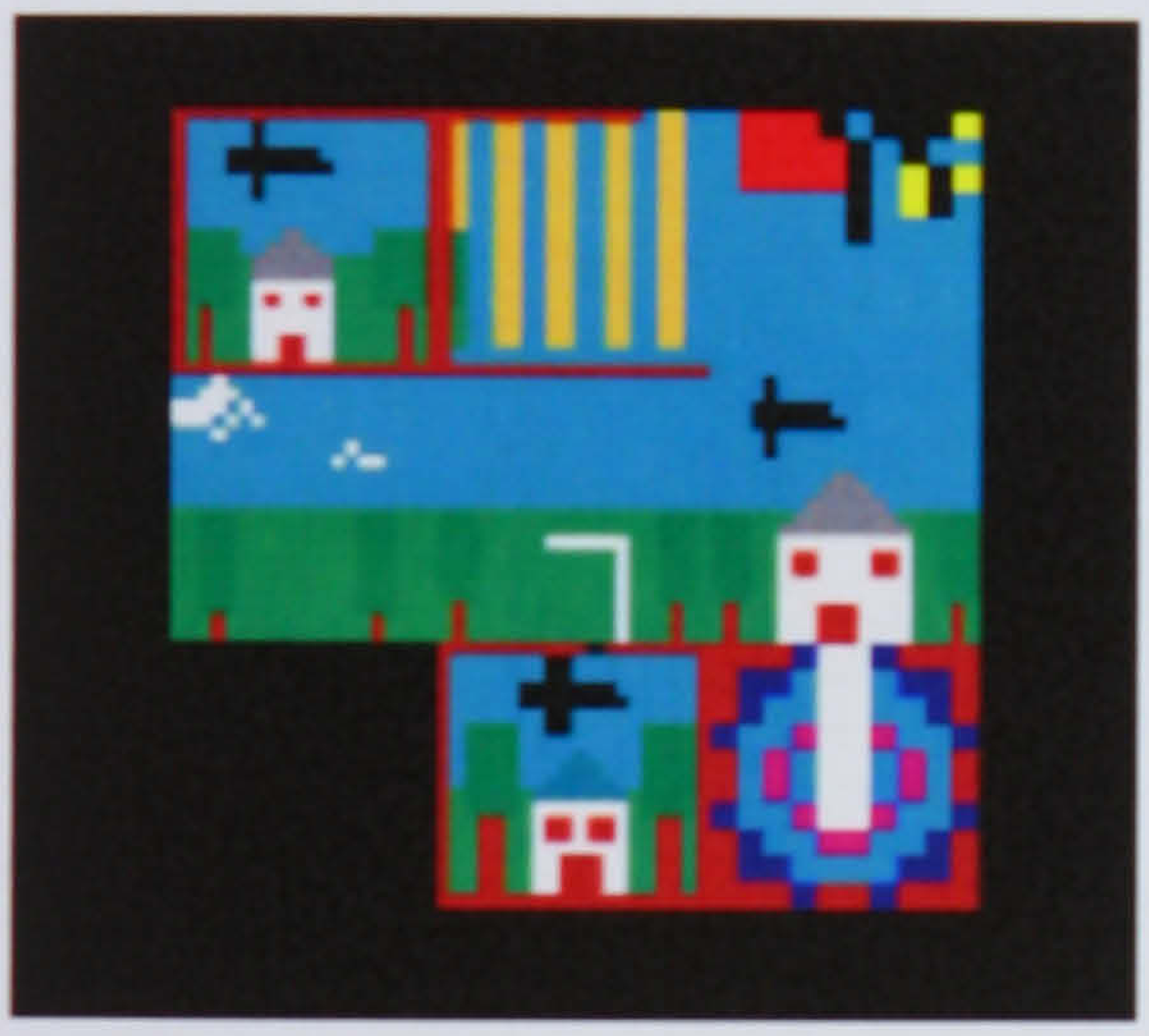
The following (Fig. 17) refers to the Générateur Poï étique. They are frames cut from recorded sessions. As seen in chapter five, represented by a squared portion within the GP canvas, each participant can draw only within that portion of the canvas. So,

---

[185] Artists collaborated as key informants by pointing out archived sessions to the researcher, and highlighting those that were successful or unsuccessful according to their point of view.

in *(a)* there are 8 active participants, and in *(b)* there are 6 active participants. In these frames a disposition toward dialogue and an open attitude are expressed by the use of lines connected among them. For instance, in *(b)* the yellow horizontal line provides a clear invitation to be continued[186], and a similar disposition is given by the linear area of the green field in *(a)*. Instead, a closure is expressed by shapes that stress the borders of an individual area or that spiral on themselves, producing a centripetal movement. For instance, the brown borders in *(a)*, and the figures at the right bottom both in *(a)* and *(b)*.

Figure 17. Closure and openness in Générateur Poï étique.


(a)

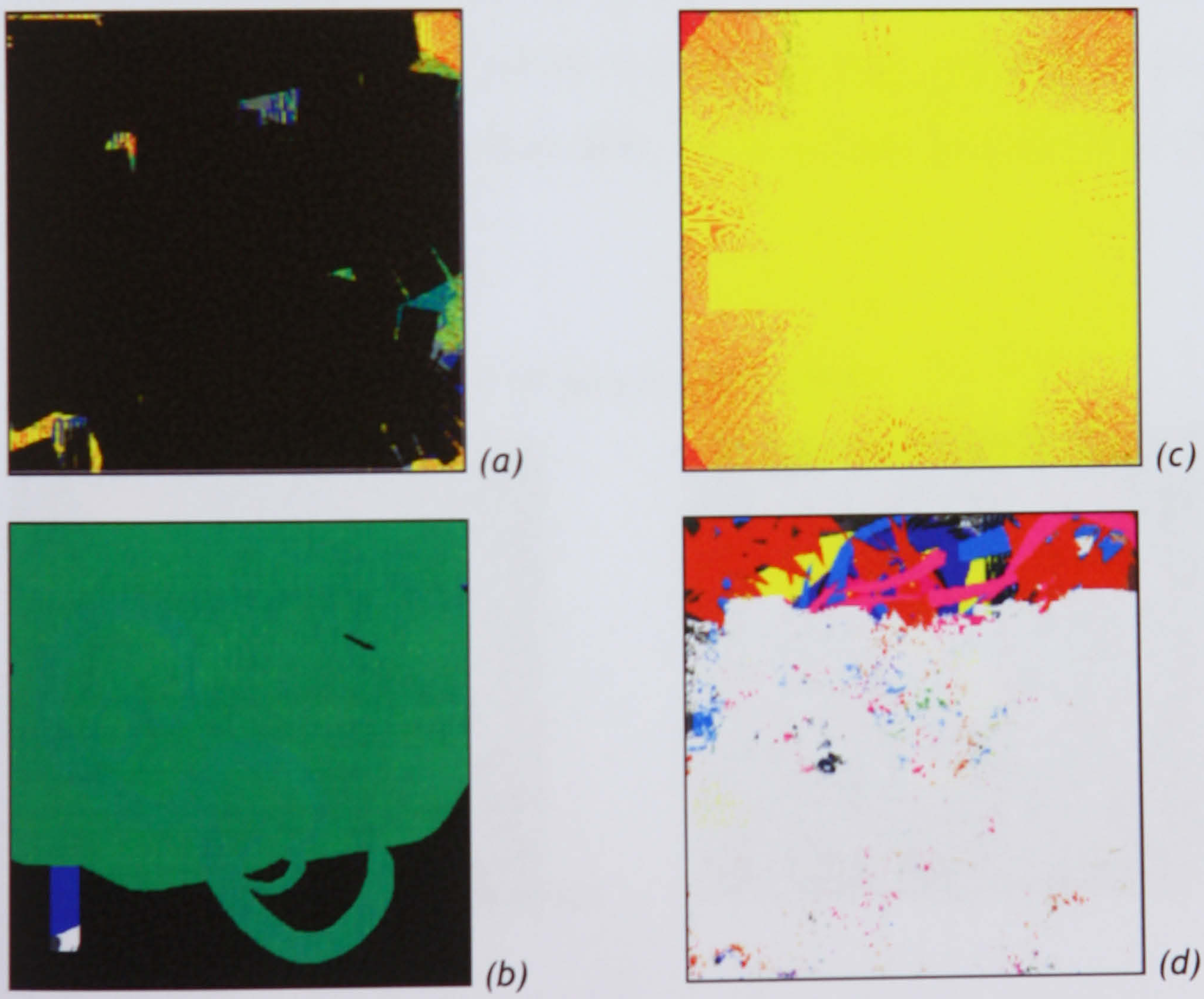

(b)

The following (Fig. 18) refers to Open Studio. These are also frames cut from recorded sessions. As seen in chapter five, here all the participants can concurrently draw on the same canvas, and they are represented, but not individually identifiable, by the marks they trace on the canvas. Looking at the recorded sessions, it is impossible to say how many people in a very precise moment participated in the session. In these frames, a disposition to dialogue and an open attitude are expressed

[186]In fact the line results from the drawing accord of two participants, and in the temporal span this will give rise to the narrative sequence of two people walking on a imaginary path in the sky, and the eagle transforming into a balloon. See (Fig. 38), (c) and (d).

by the use of transparent marks that allow the previous marks to still be visible, while aggression is expressed by thick and heavy marks that completely cover the previous marks. For instance, in *(a)* and *(b)* on one side, and *(c)* and *(d)* on the other side, two different kinds of pictorial algorithms[187] are used to reset the canvas[188]. In the first case, the marks express an aggressive behaviour, and in the second case a more dialogic one. Even though in both cases the canvas will be arbitrarily reset, the way in which this happens affects quite significantly the emotional tone of the interaction.

Figure 18. Dialogue and aggression in Open Studio (canvas resetting).



---

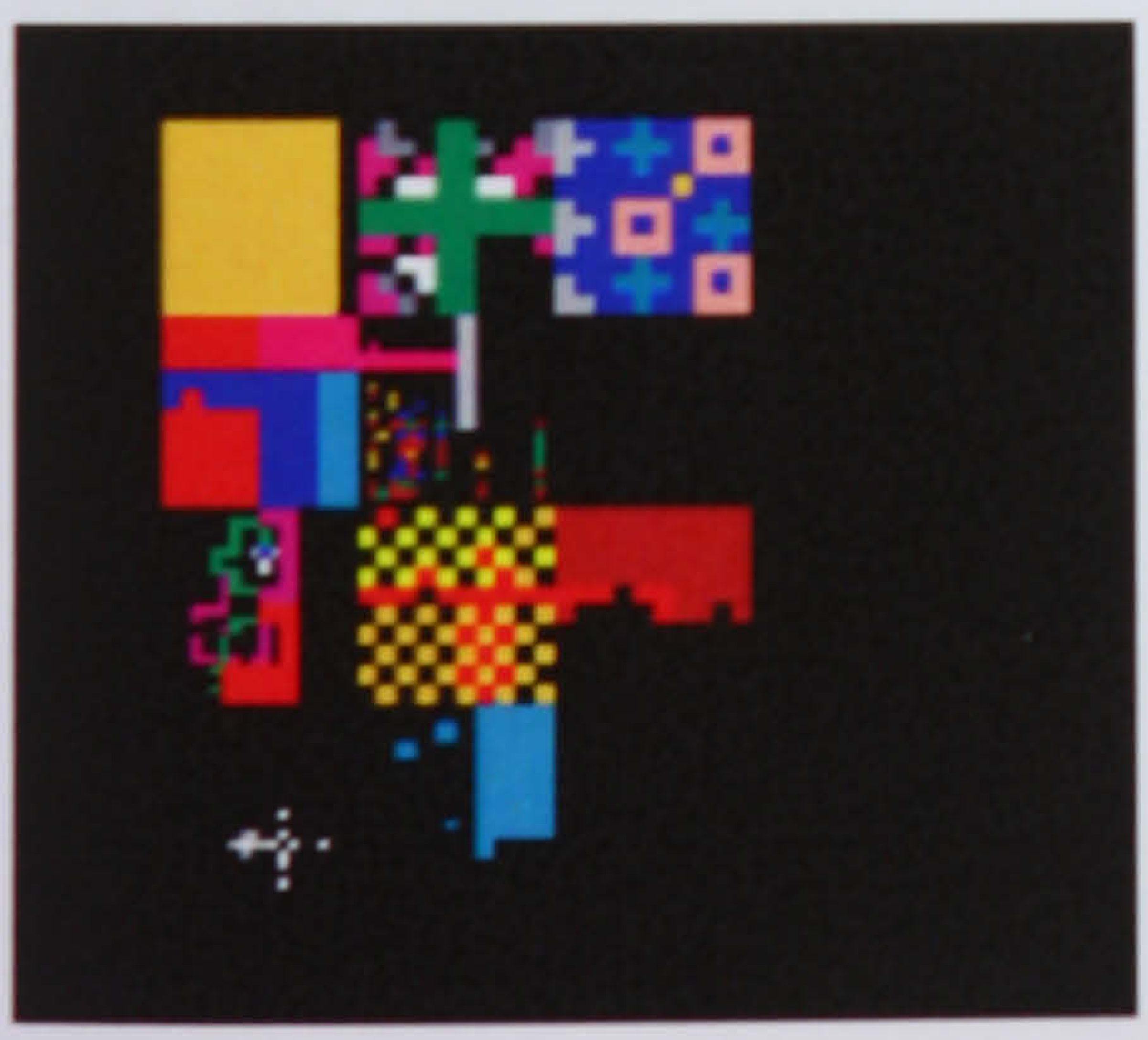
[187]As seen in chapter five, each mark in Open Studio is made by a different and aesthetically designed algorithm.

An account of aggressive behaviour by means of strokes is given by Maya Kalogera, an artist that has participated regularly in Open Studio:

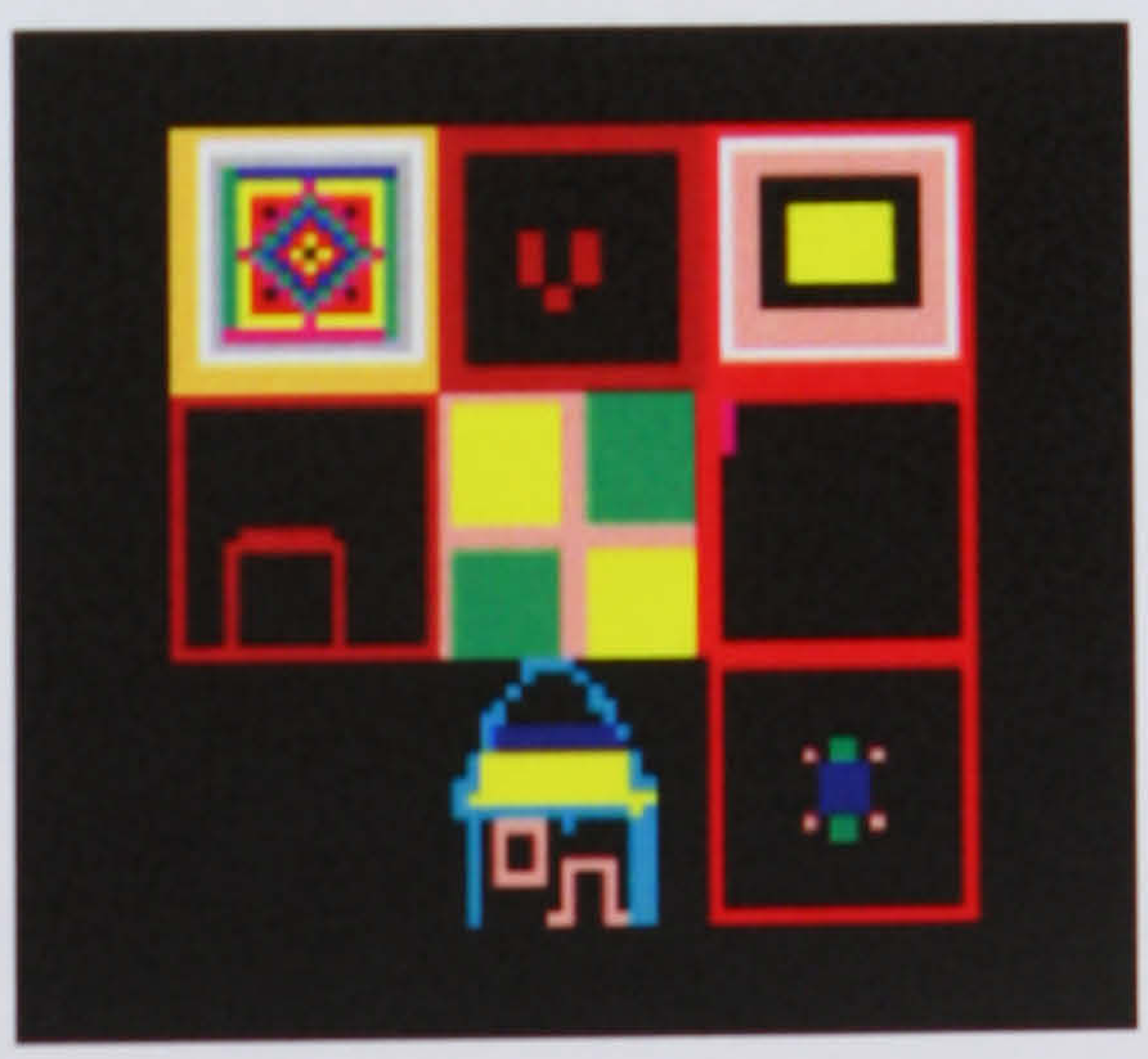
> ...as a painter, when there's written "5 or 6 or whatever people online" i've always been surprised how little the others care what someone else is drawing as "now when i'm here who cares for you"
>
> sometimes you see something very beautiful is developing and then... macho black brush stroke erase everything and things like that...

In the following (Fig. 19), are presented other frames from GP where closure or openness is expressed by space configuration. In *(a)* and *(b)* closure is shown by drawing various kinds of crosses and squares that stress the limits of individual areas and portion the canvas. In *(c)* and *(d)* openness is shown by a state of chaos that blurs and expands the limits of individual areas, and is achieved through a fine-grained use of pixels.

Figure 19. Closure and openness in GP (space configuration).

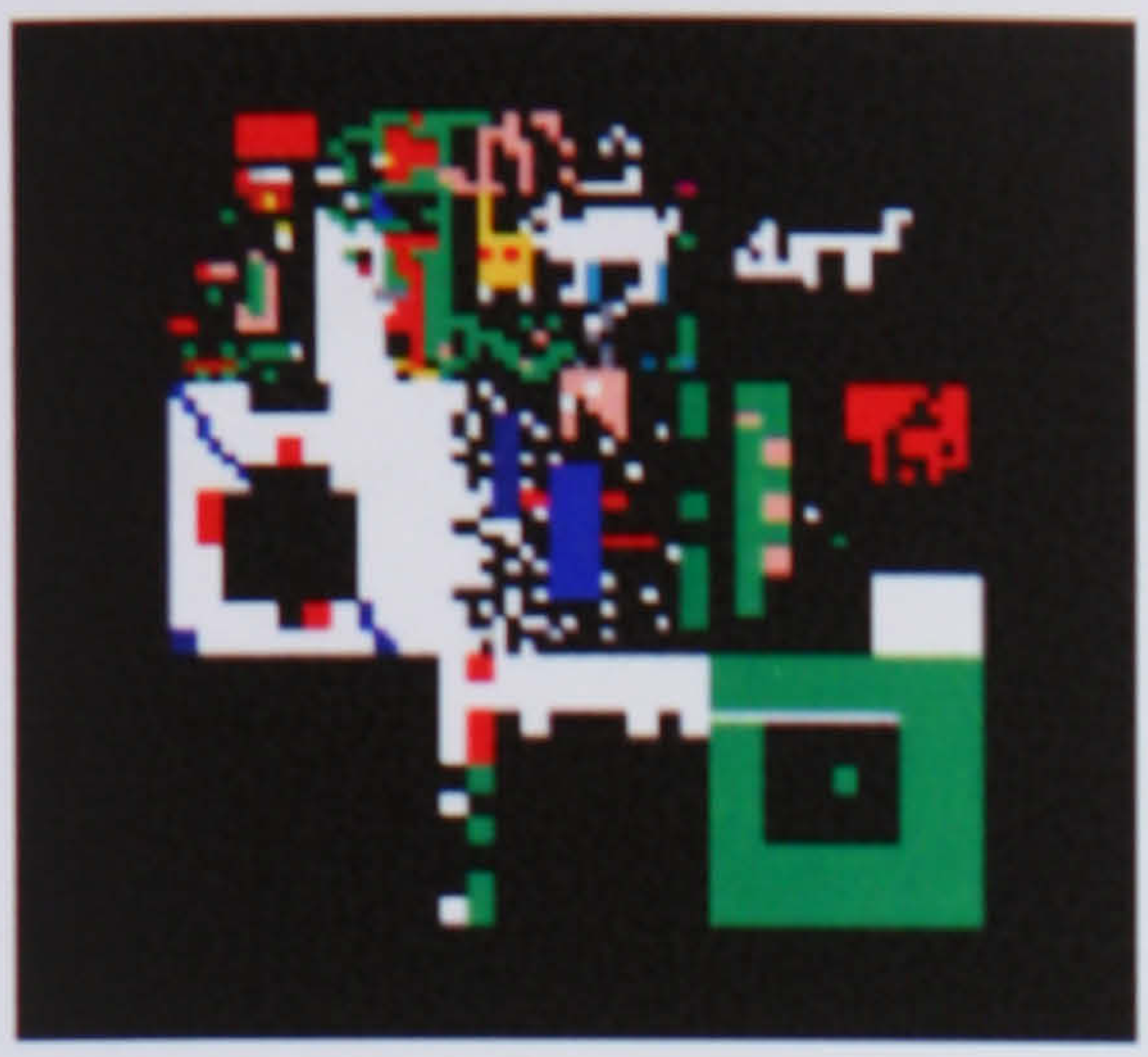


(a)

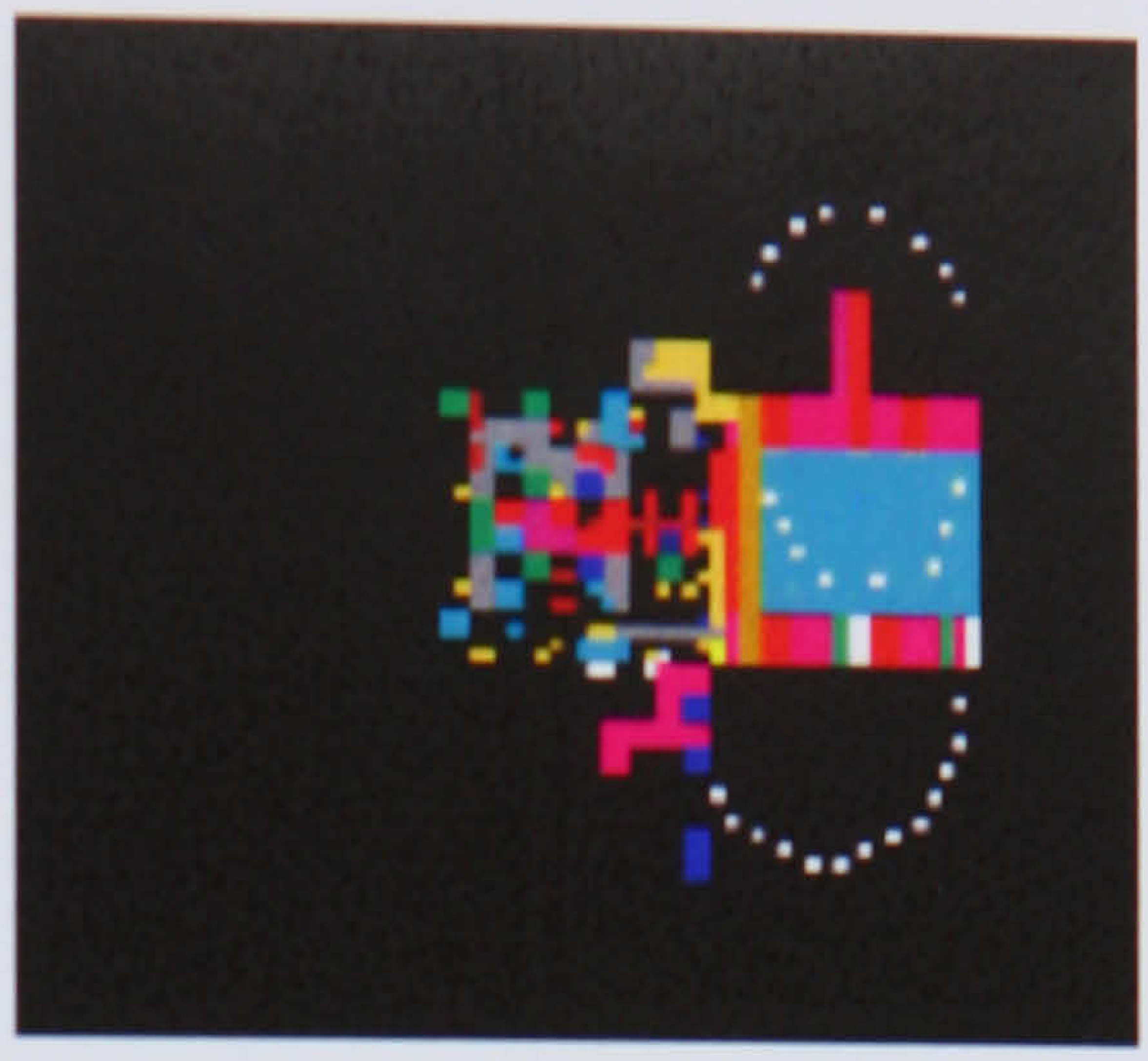


(b)

[188]The arbitrary resetting of the canvas by participants is a cyclic event in Open Studio. It has a varying cycle, and affects quite significantly the emotional tone of the interaction.



(c)



(d)

In the following (Fig. 20), other frames are presented from OS, where the marks used express aggression *(a)* or dialogue *(b)*, according to their covering or stratifying strength.

Figure 20. Dialogue and aggression in OS.

(a)

(b)

The lines' and marks' mode is pre-verbal and based on sensori-motor perceptions. Affecting the emotional tone of the interaction, they trigger the outcome, and encourage or discourage its emergence from chaos[189].

Space seems to be perceived and experienced as a proximal field where lines and marks embody the intentional movements of participants. For some participants, the experience of such a space is "almost like touching"[190].

6.3.1.1.2. Colour

Like lines and marks, colours also disclose the intentions of participants, significantly affecting the emotional tone of the interaction. Their mode is pre-verbal and intrinsically relational. In fact, like motion and other visual modalities, colours can refer to structures in our perceptual interactions in which we trace out relations among various elements (Kandinsky, 1947; Johnson, 1987; Thompson, 1995).

From the analysis of these properties it emerges that colours can: a) determine static or dynamic fields and relationships between participants on the ground of their relational nature[191]; and, b) work as "boundary objects" or transitional states for the emergence of collective phenomena[192] and shared narratives.

In relation to the point a), we may note that in GP colours can sometimes encourage or even discourage forms of visual empathy. This can be like the seamless extension

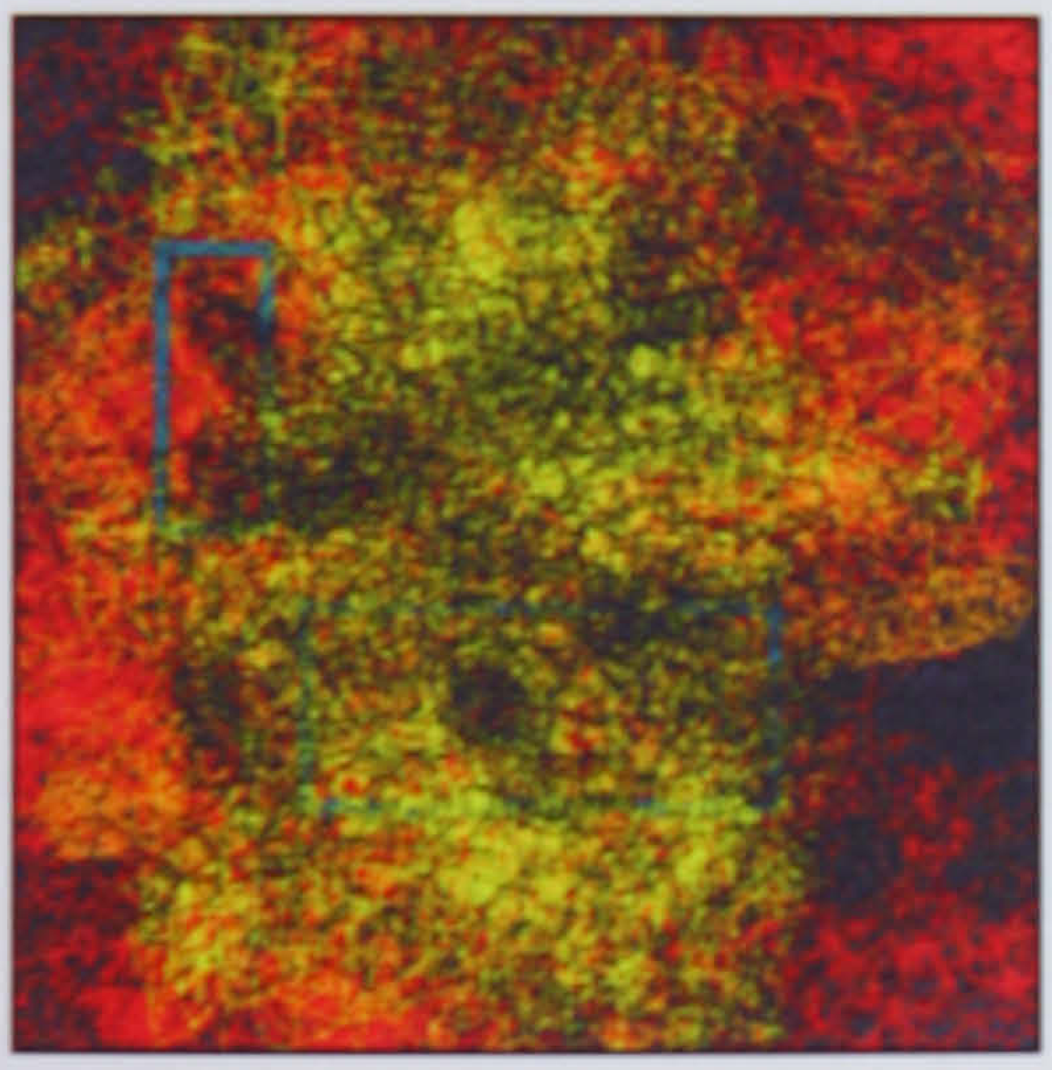
---

[189]Of course lines, marks, and colours can work together (and they normally do). Here they are distinguished in order to describe better the categories emerged as relational mediators.
[190]Excerpt from the chatting occurred during the OP session on the 25th July 2002.
[191]According to Eugenio Gianni , colours neither express nor represent anything per se. According to Gianni 's theory, there are relationships between colours that make them static or dynamic, according to the relationship itself. In fact, any colour has its own quality that makes it red, yellow, green, etc. Expansion or contraction of such quality allows the colour to evolve and dissolve or encloses it in a separate and silent world. Therefore a relationship is "dynamic" when the quality of a colour - as a force - passes to the adjacent colour (i.e. red-orange-yellow); it is "dynamic-static" when the movement effect is stopped (i.e. red-purple-yellow, where purple connects to red but not to yellow); it is "static" when the process does not take place (i.e. red-blue).
[192]For instance, phenomena of contagion, mimetism, and pattern recognition.

of a coloured line beyond the border of individual areas in a sort of empathic movement, or the drawing of an identical coloured field, like a green pasture or a blue sky, even before the possibility of a pattern recognition.

The following (Fig. 21), refers instead to OS. In the frame *(a)*, colours give rise to a dynamic field (red-orange-yellow), while in the frame *(b)*, they give raise to a static field (red-blue). Such chromatic configurations are here enhanced by the marks that have been used, and they seem to induce a more *(a)* or less *(b)* relational disposition.

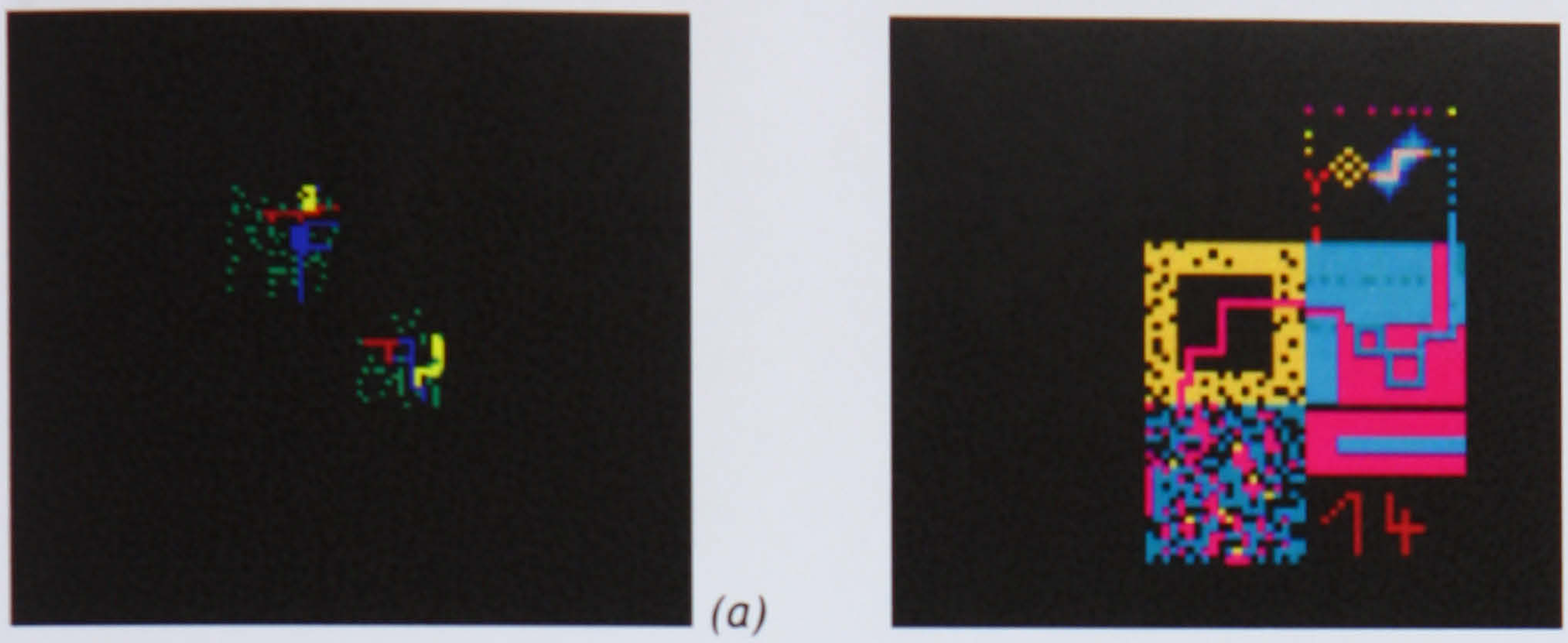
Figure 21. Dynamic and static fields in OS.


(a)


(b)

In the following (Fig. 22), we notice how a harmonious or contrasting effect is not given by colours in a dynamic or static relationship (like in Fig. 21), but rather by their spatial correlation. For instance, in *(a)* and *(b)* expansion is achieved by the adoption and eventual connection of identical colours from different participants in order to create relationships between their individual areas. In *(a)* an expansion of colours follows a symmetric mechanism, while in *(b)* a mimetic one.

Figure 22. Spatial correlation of colours in GP.



(a) *(b)*

We have said that colours can also, b) work as "boundary objects" (Star & Griesemer, 1989), or transitional states for the emergence of collective phenomena[193] and shared narratives. They basically catalyze the knowledge of the world of participants (a sky, a sea, a flower, etc.), acting as elements through which the very participants negotiate the world they are creating and constantly transforming. In this sense, colours can be seen as states that trigger transitions from an "object" to another "object".

In the following (Fig. 23), the same colour (blue) suggests to participants different environments, triggering the phenomena of pattern recognition. In *(a)* the light blue suggests a sky standing sunny over Paris, while in *(b)* a slightly darker blue suggest a sea populated by octopuses, fish and seaweeds.

---

[193]See previous note.

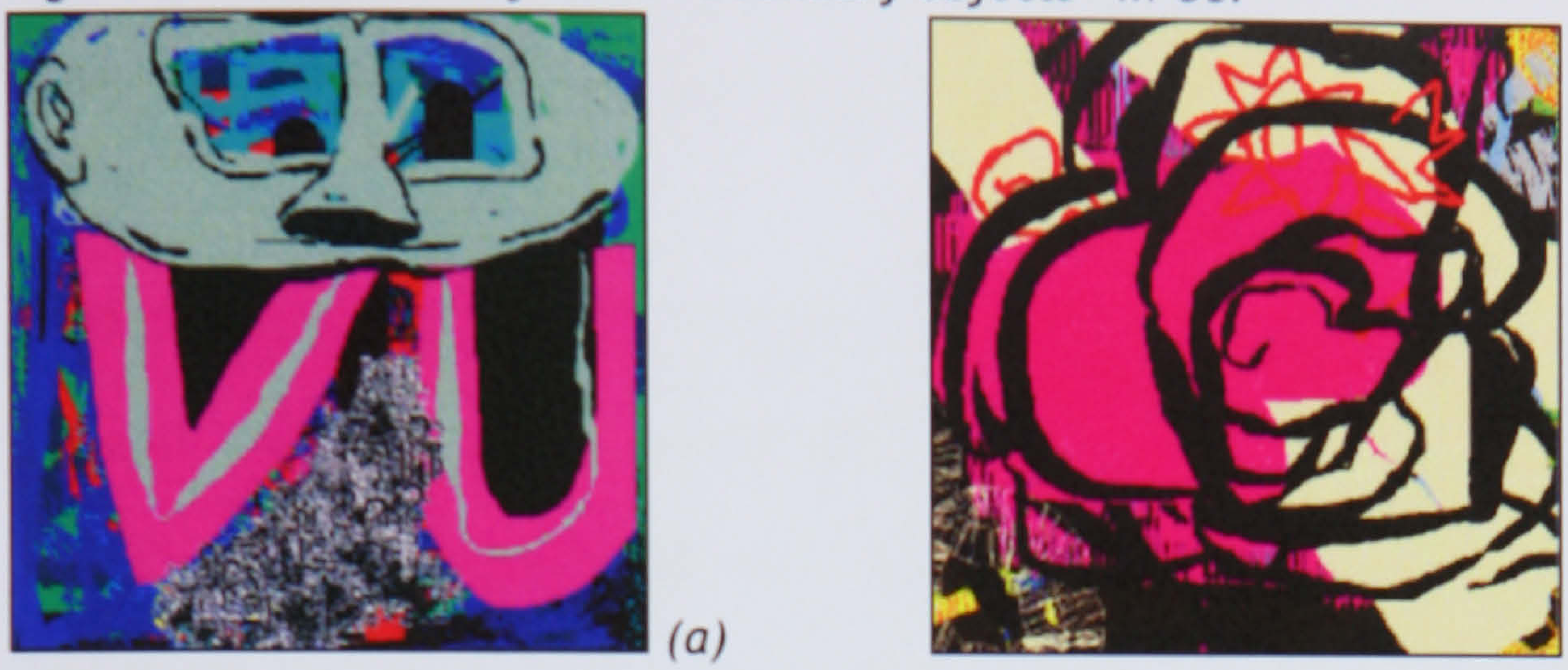
Figure 23. Colours as dynamic "boundary objects" in GP.

(a)

(b)

In the following (Fig. 24), we can notice how colours work in OS in relation to their capability of acting as dynamic "boundary objects" and triggering the phenomena of pattern recognition. As we already know, OS is based on concurrent drawing. Colour fields appear and disappear one upon the other, interweaving very easily, and not lasting for long. In order to let a colour field be used as a ground for the emergence of a figure, participants frequently use a black line. Upon the chaotic layering of colours, black seems to be very powerful in temporarily stabilizing a colour field as a recognizable pattern. For instance, in *(a)* the grey, light blue, and black colour fields are fixed as a pattern for the emergence of a head by means of a thin black line, respectively suggesting in this way the face, eyes and sides of a strange head. In *(b)* instead it is the colour pink that evokes a rose, rather than a pattern of colours. In this case black is used like a pencil, and it fixes the suggestion given by the colour.

Figure 24. Colours as dynamic "boundary objects" in OS.



(a) *(b)*

Colours affect on the one hand the emotional tone of the interaction, and on the other hand they act as a trigger for the outcome, encouraging its emergence from chaos.

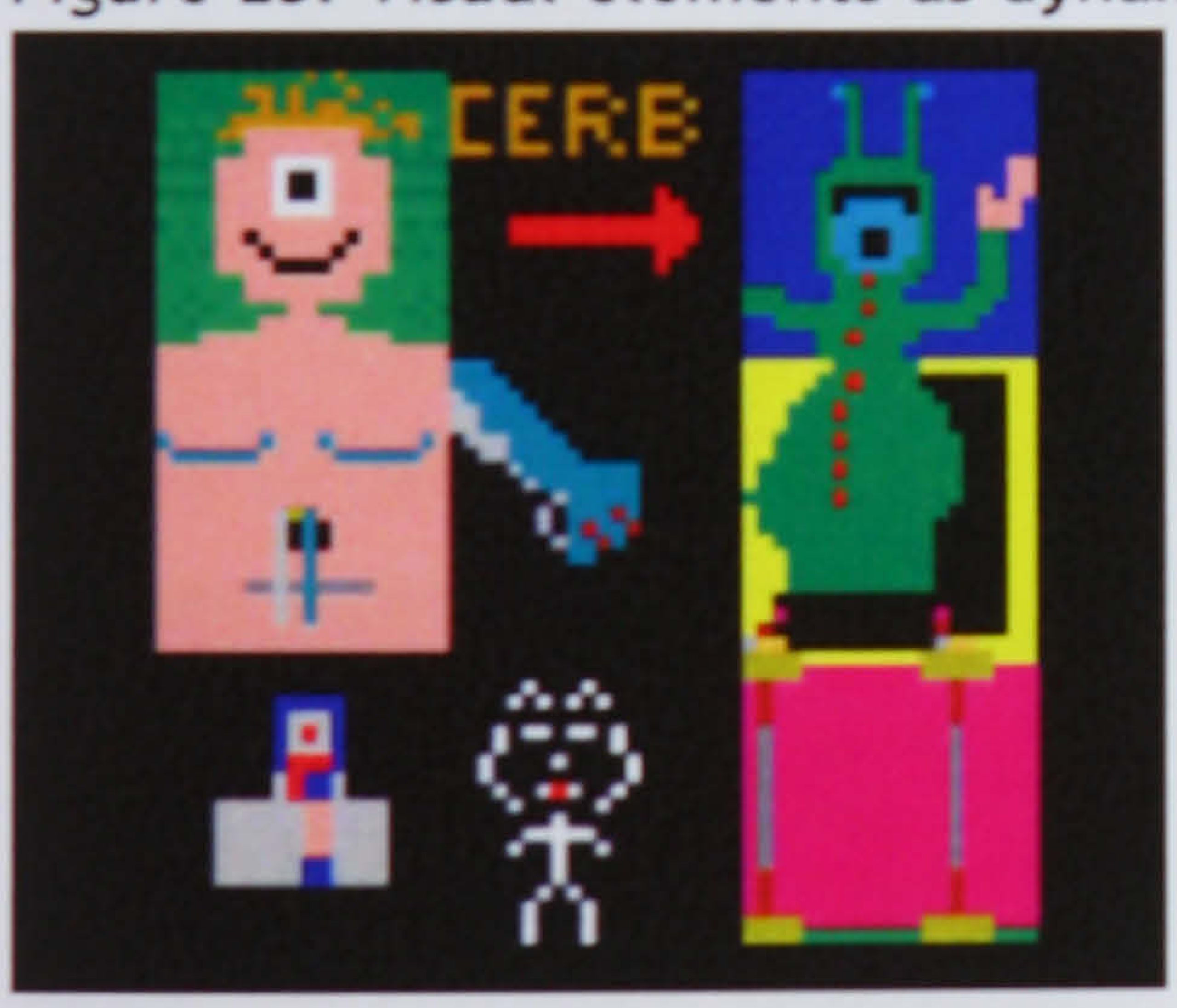
6.3.1.1.3. Visual Elements

Visual elements are archetypal and recursive, for instance faces, bodies, animals, monsters, natural elements, etc. They can: a) work as dynamic "boundary objects", triggering phenomena of pattern recognition or narrative sequences; b) express emotions, thoughts or requests of participants; or c) allow the embodiment of participants through elements of auto-representation.

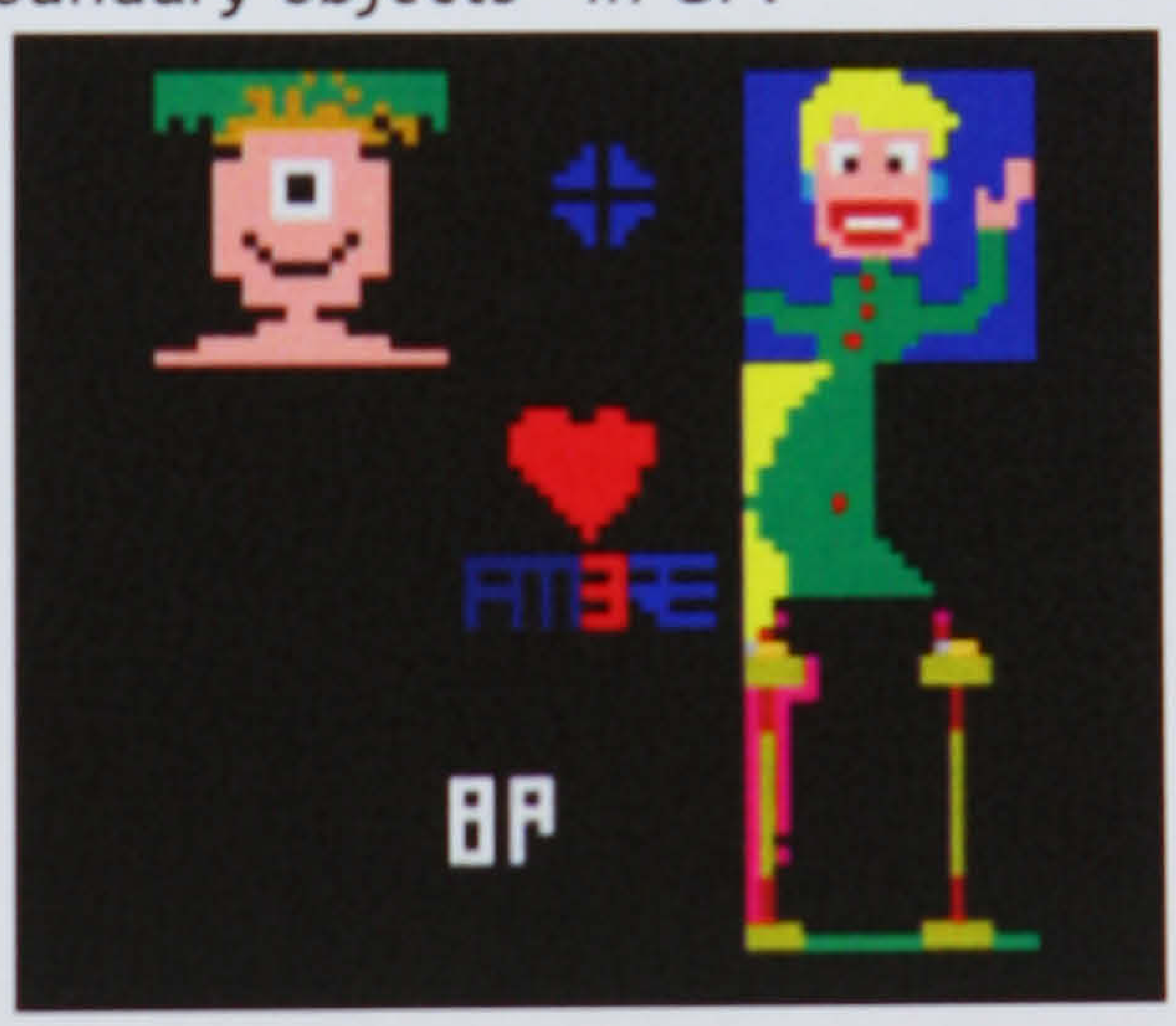
Visual elements at a different level, like colours, catalyze the knowledge of the participants, acting as an impetus which creates "objects", through which the participants build their world. In this sense, visual elements can be seen as states that trigger transitions from one "world" to another.

In the following (Fig. 25), the transition is initially triggered by the visual element of a large, single eye. First, it was the Martian that we can see in *(a)* on the right, then it was the monster (that recalls the mythological Polypheme) in *(a)* on the left, and last it was the woman in *(b)*. According to the progression of visual elements, and colours[194], participants transform their frame of reference from an extra-terrestrial being, to a mythological character, to a human being.

Figure 25. Visual elements as dynamic "boundary objects" in GP.



(a)



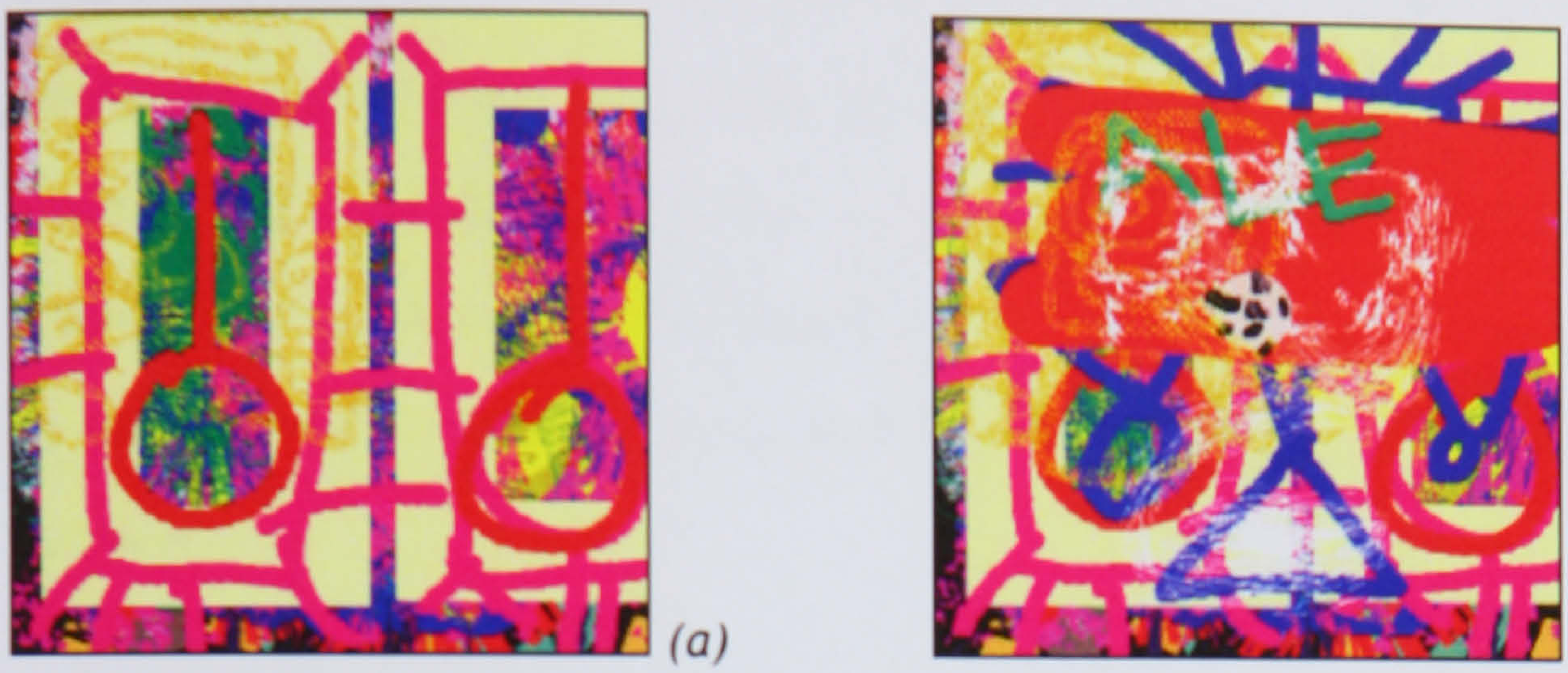
(b)

In the following (Fig. 26), a sexual reference is built on the pattern recognition of a penis *(a)*, and it is subsequently transformed into a sporting reference by the creation of a soccer ball *(b)*.

---

[194]As the colour pink can indicate the human skin.

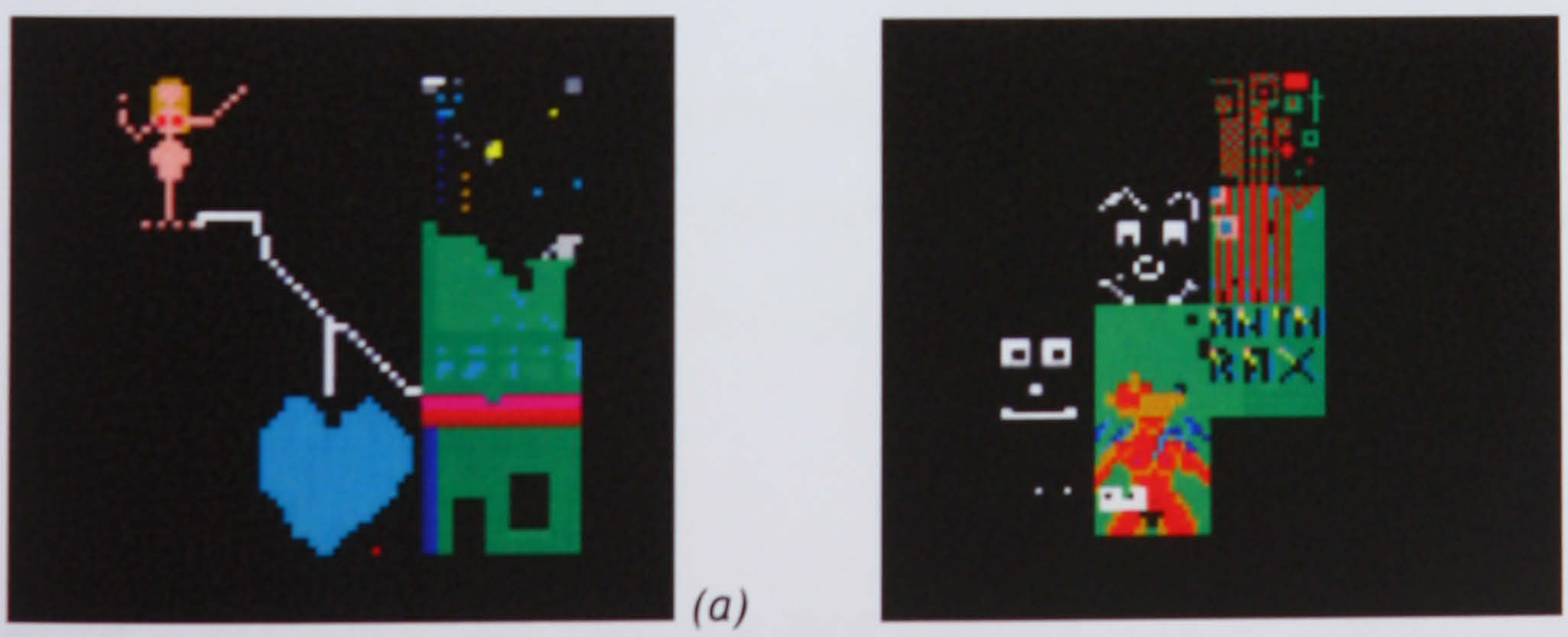
Figure 26. Visual elements as dynamic "boundary objects" in OS.



(a) *(b)*

As we have mentioned, visual elements can also: b) express emotions, thoughts or requests of participants. In the following (Fig. 27), the blue heart, *(a)*, is connected to the woman at the top left, and expresses an emotion related to the presence of such a figure. Also, in *(b)* the two white faces comment on the naked woman at the bottom.

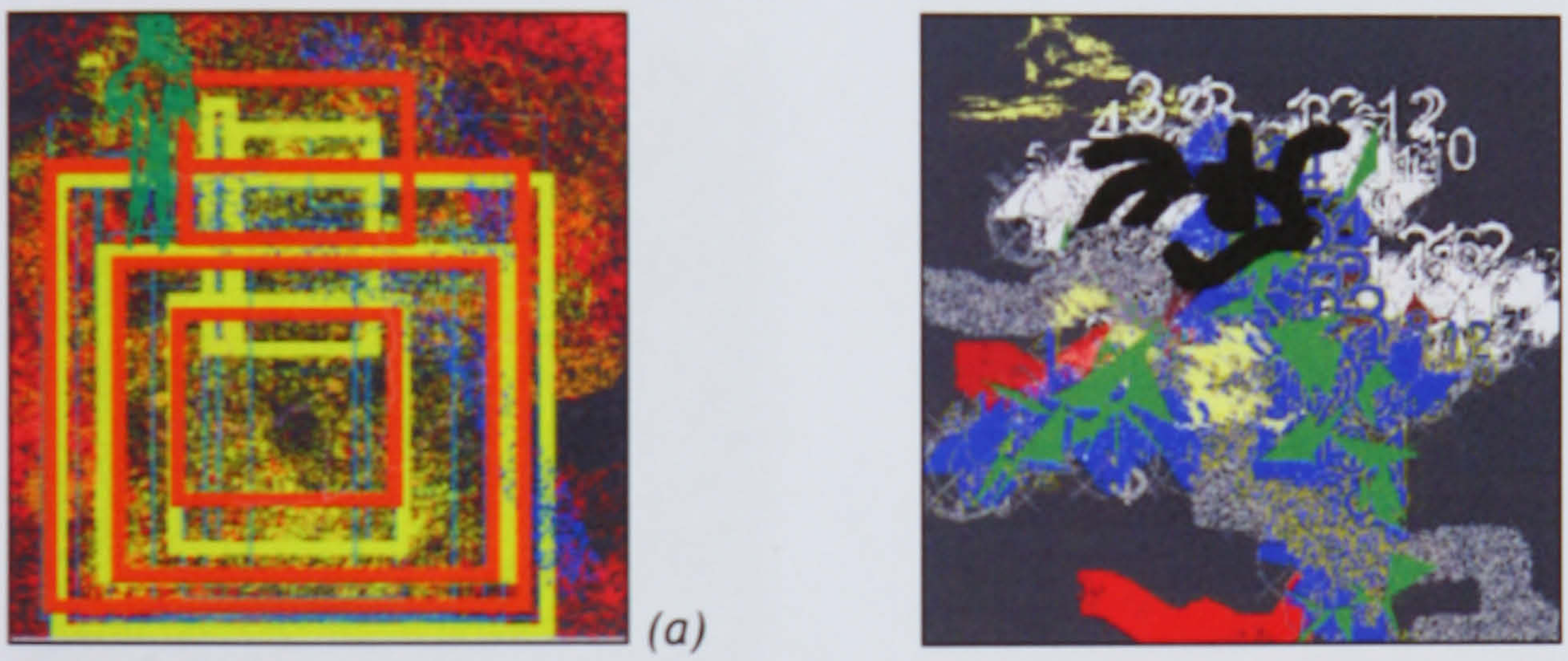
Figure 27. Visual elements as a form of expression in GP.



(a) *(b)*

In OS it is harder to state when a visual element expresses an emotion or a thought. This is due to the concurrent nature of drawing and the consequent difficulty in establishing relations among visual element that appear in a highly ephemeral way, during the course of the interaction. However, in the following (Fig. 28), it can be assumed that in *(a)* the green human body, standing precisely on one of the squares, is a response to the abstract drawing of concentric squares on the canvas. It can also be assumed that in *(b)* the eye is an expressive response to the unceasing drawing of numbers.

Figure 28. Visual elements as a form of expression in OS.

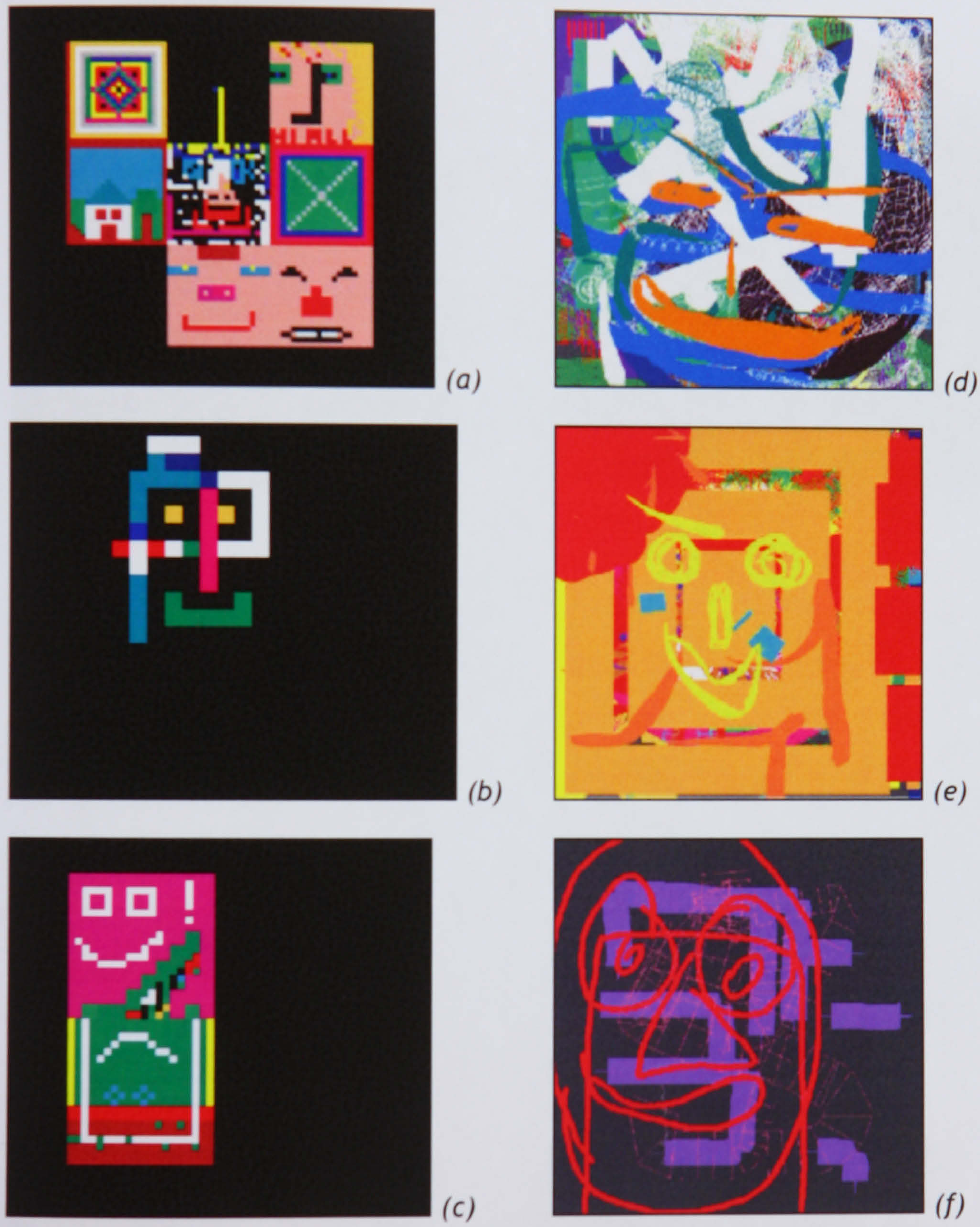


(a) *(b)*

Visual elements can also: c) allow the embodiment of participants through elements of auto-representation, such as facial expressions, simulated movements of limbs (in GP), or drawing actions (in OS). Such visual elements work both as an action mode and as a form of expression.

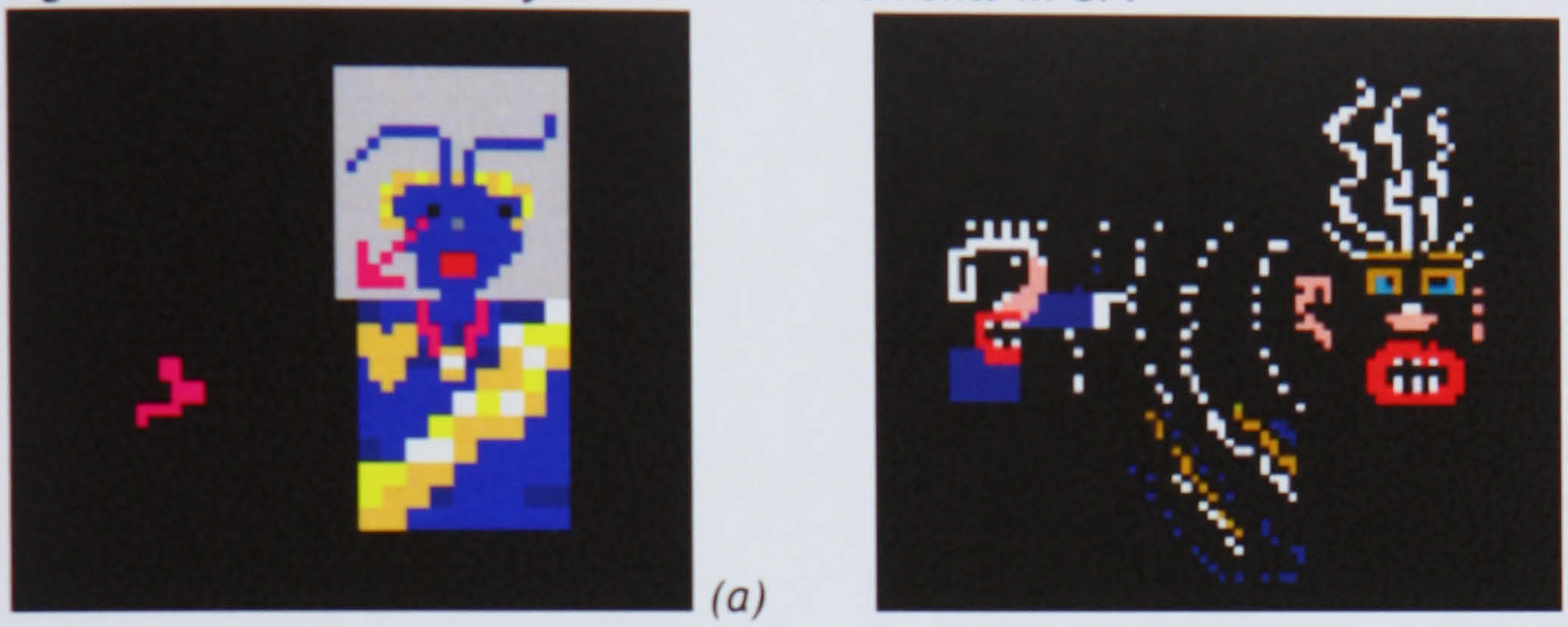
In the following (Fig. 29), there are some examples of facial expressions in GP and OS. In *(a)*, *(b)*, and *(c)* we can see how in GP such forms of auto-representation can be more or less naturalistic, while in OS, as we can see in *(d)*, *(e)*, and *(f)*, they are usually more abstract.

Figure 29. Embodiment by facial expression in GP and OS.



In the following (Fig. 30), visual elements are used to simulate senses and actions. In *(a)* the arrow is connected to the eye and to the other arrow on the left, trying to simulate the action of looking at each other. In *(b)* participants simulate the action of hearing, and the head on the right reacts to what is happening in the other areas of the canvas with the suggested movement of her eyes.

Figure 30. Embodiment by simulated movements in GP.



(a) *(b)*

In the following (Fig. 31), the drawing actions of participants embody the movement and physical presence within the space of interaction of participants themselves. It is important to recall that in OS drawing tools are reactive to the gestures of participants. They produce lines and marks that are different in thickness and features according to the speed of the drawing action. In this way we can perceive that in *(a)* the movement of participants was slow, heavy, and continuous, while in *(b)* it was rapid and fragmented.

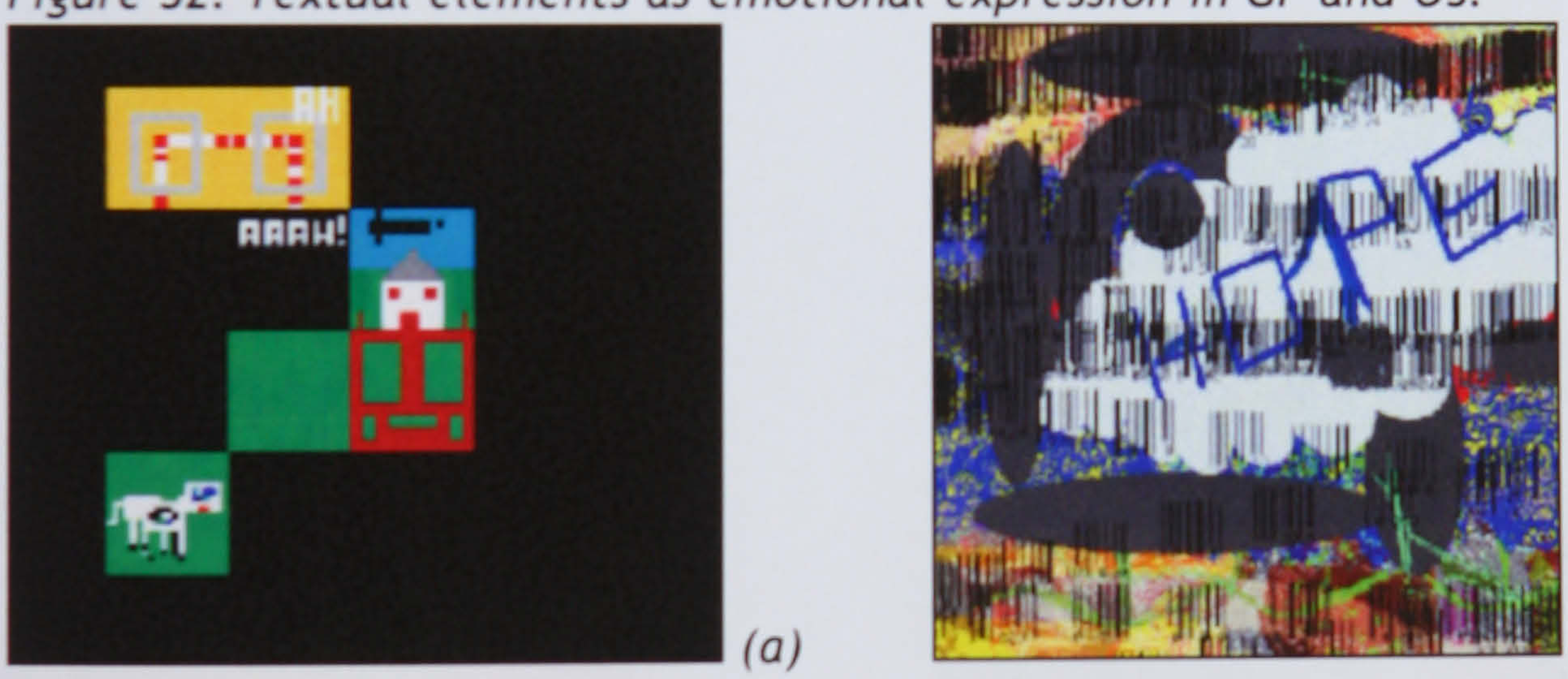
Figure 31. Embodiment by drawing actions in OS.

(a) *(b)*

6.3.1.1.4. Textual Elements

Textual elements represent a form of linguistic embodiment. Its most simple form is the writing of a name by a participant, in order to state his or her presence, but as a form of linguistic embodiment, textual elements can also: a) express emotions, as in the following (Fig. 32). Here *(a)* a GP participant expresses his or her emotion through the use of an exclamation ("Aaah!"), while in *(b)* an OS participant expresses his or her emotion through the use of an abstract word ("Hope").

Figure 32. Textual elements as emotional expression in GP and OS.



(a) *(b)*

Textual elements can also: b) express opinions and comments on the result of the interaction. In the following (Fig. 33), in *(a)* OS participants express their opinion about the final result, making fun of the outcome. In *(b)* we can see a comment on the results of the interaction where a GP participant reacts to the drawing of the Statue of Liberty with the offensive sentence "Fuck USA".

Figure 33. Opinions and comments in OS and GP.

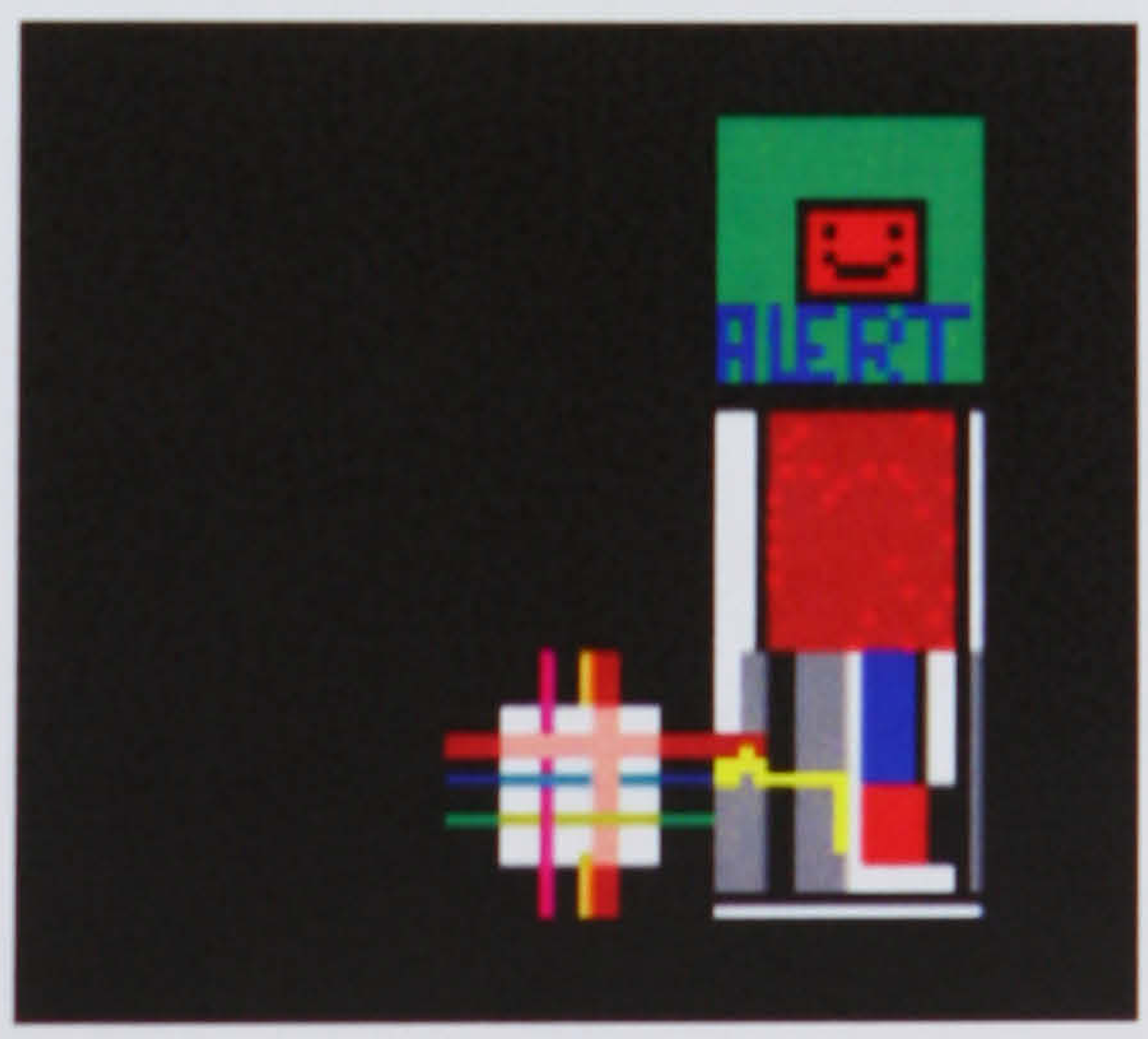
(a)

(b)

Textual elements can: c) act for a shift in the current emotional tone. In *(a)*, (Fig. 34), an OS participant asks for a change in the aggressive and dominating behaviour during the interaction through the use of the exclamation "No!". In *(b)*, a GP participant seems to alert other participants through the use of the word "Alert".

Figure 34. Claiming shifts in the current emotional tone in OS and GP.

(a)



(b)

Lastly textual elements can: d) allow verbal communications among participants. Such verbal communications can take the form of the name of a participant, usually a friend, in order to state his or her presence and position on the canvas. These can also take the form of greetings, invitations, questions, etc. See (Fig. 35) and(Fig. 36).

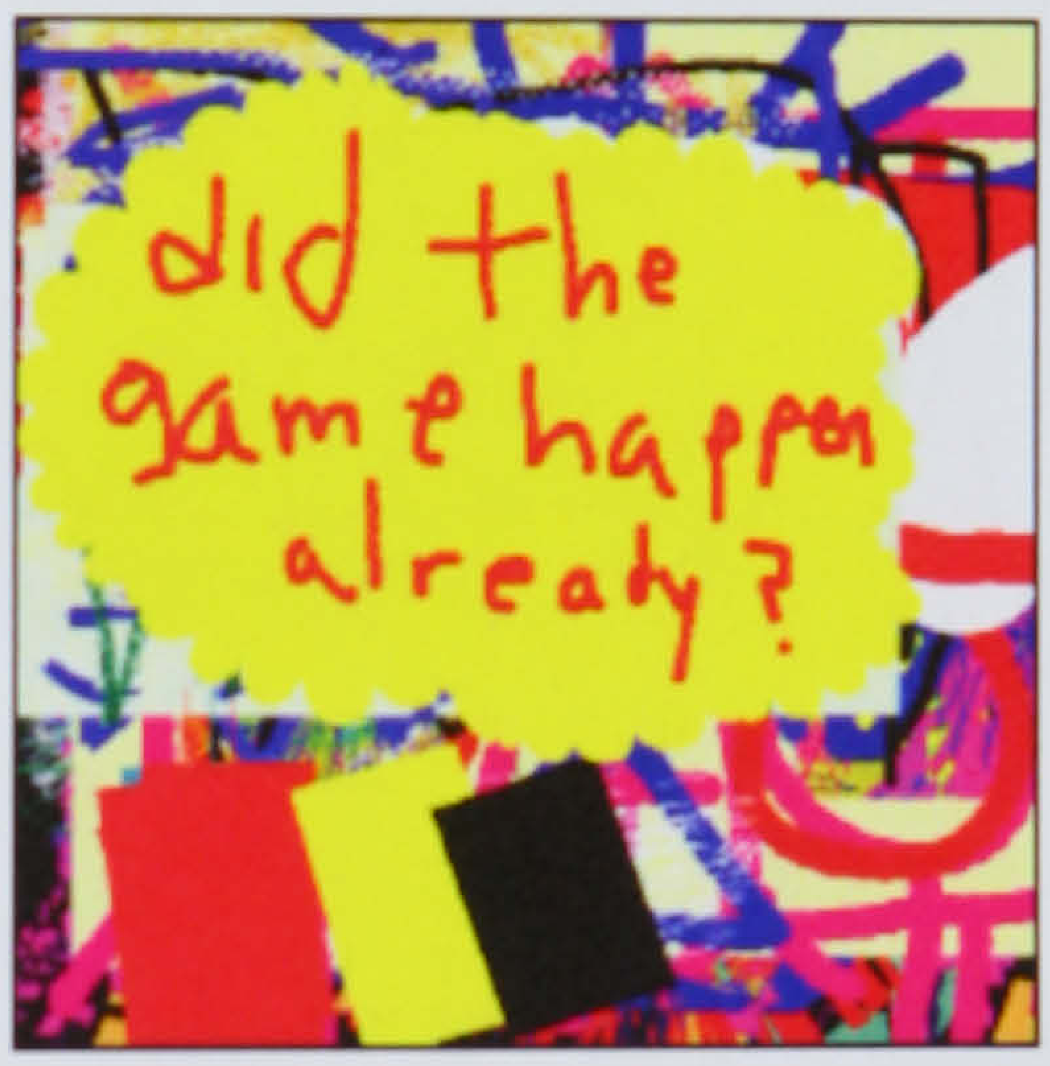
Figure 35. Verbal communications in GP.

(a)

(b)

Figure 36. Verbal communications in OS.

(a)



(b)

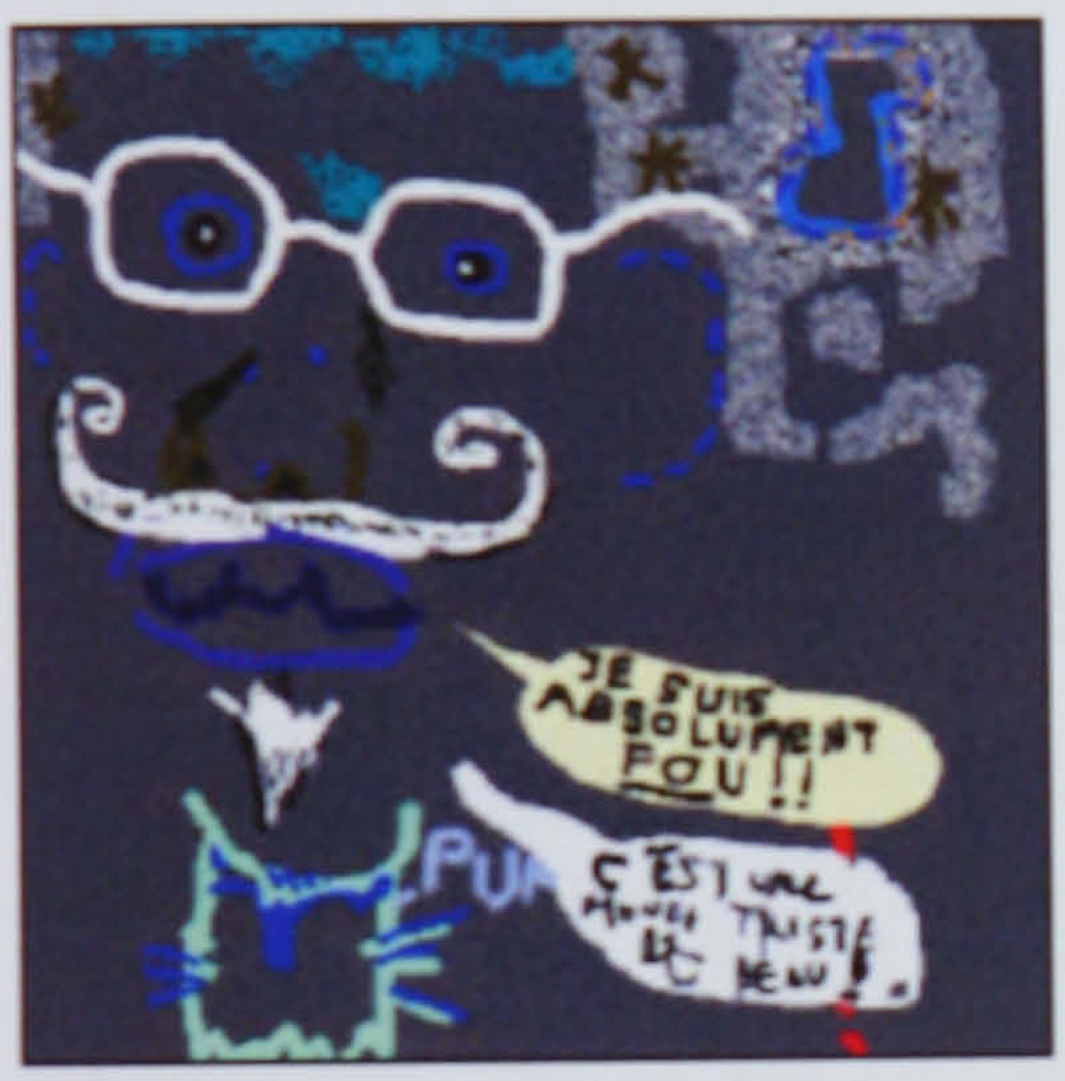
6.3.1.1.5. Time

Lines, marks, colours, and all the visual and verbal elements occurring during the interaction are in motion. They change, appearing and disappearing in time according to the actions of participants.

Time is therefore perceived and experienced as a network of intentionalities, rather than as a linear measure of passing instants: "the collaborative effort [...] was[...]

engaging (60-90 minutes went by before I noticed it)" (Mike Williams, personal communication)[195]. Time engenders the emotional tone of the ongoing interaction, affecting the disposition of participants on different scales, from immediate to a more or less extensive duration. It enables a shared imaginary and narrative sequence to emerge from the non-linear flow of the activity and embodied actions of participants.

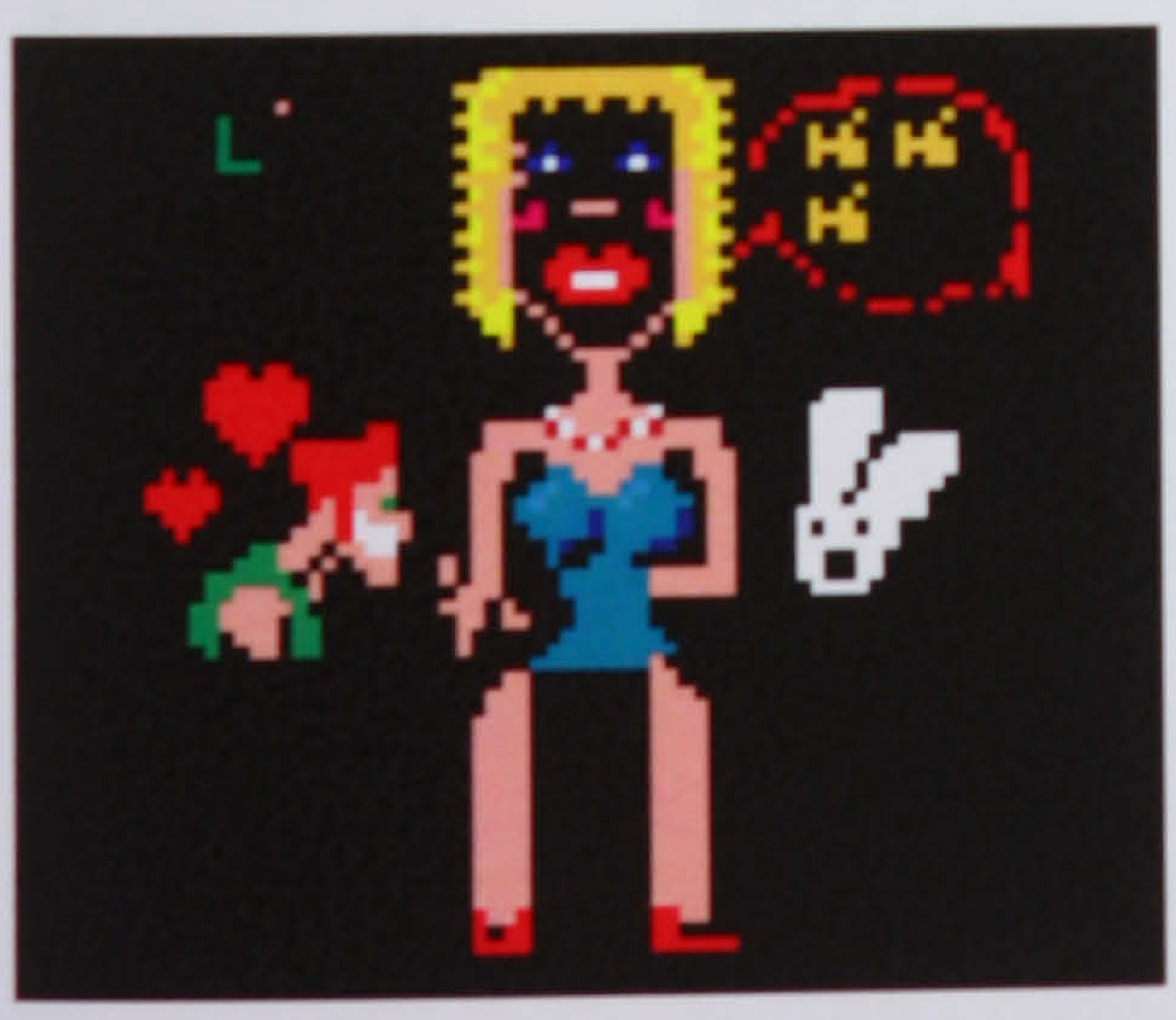
Figure 37. Shared imaginary in OS.



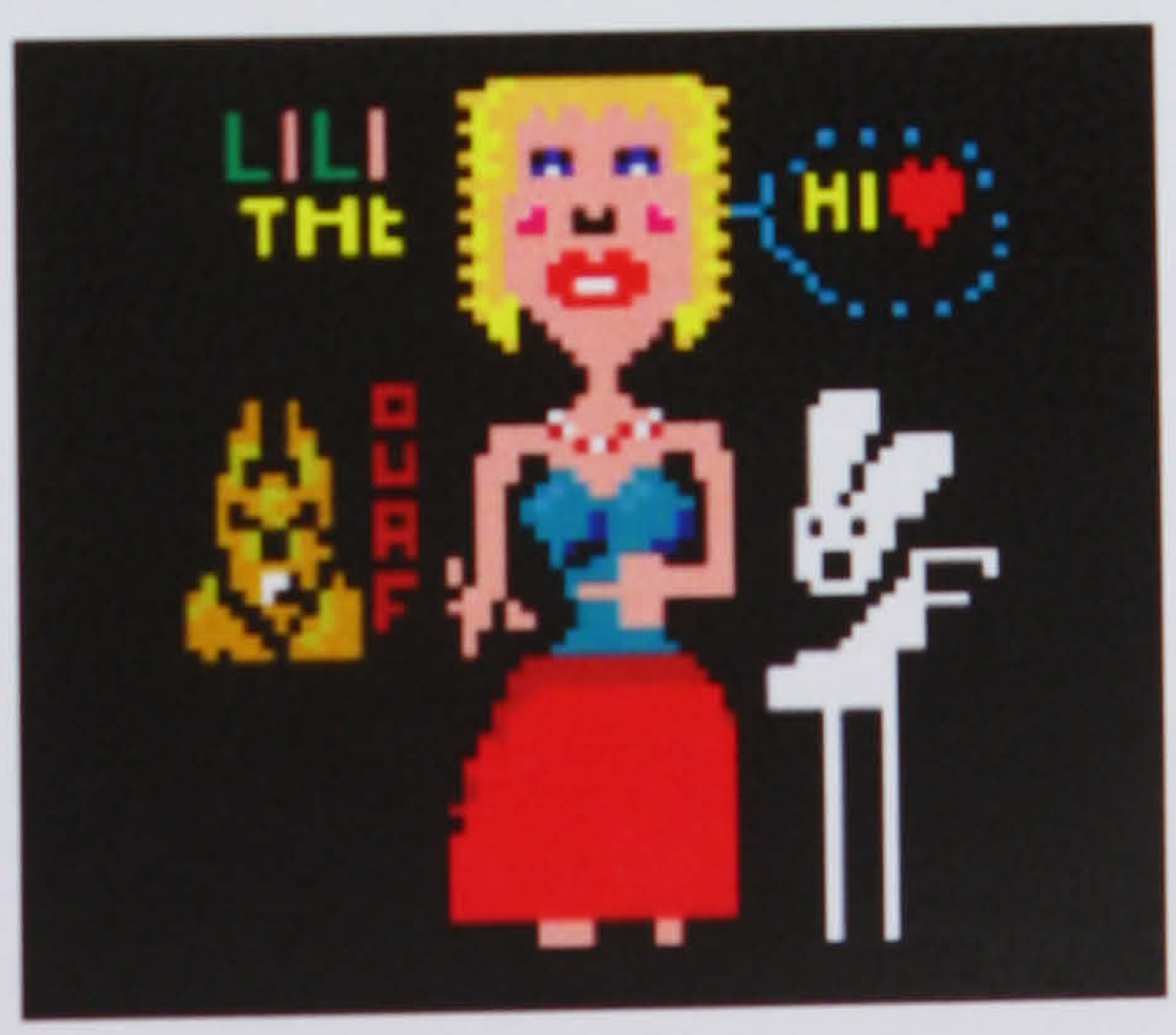
(a)

(b)

Figure 38. Narrative sequences in GP.



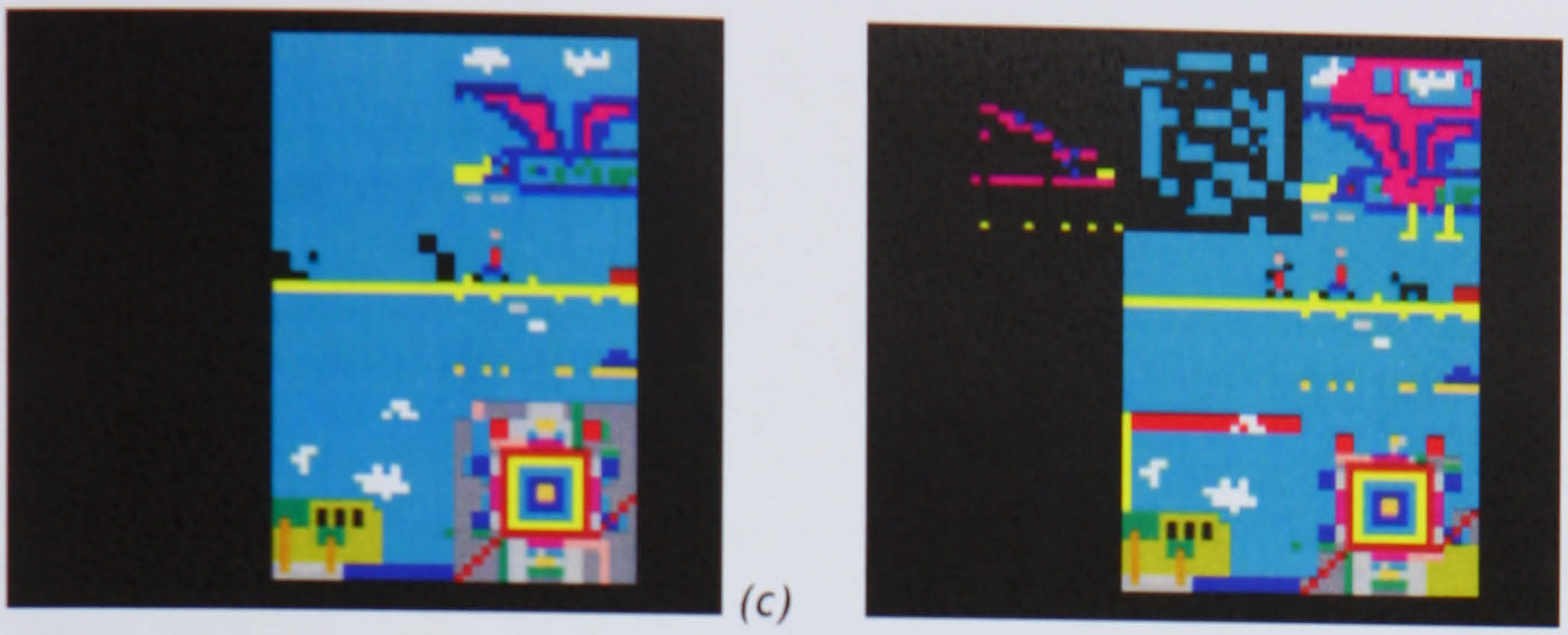
(a)



(b)

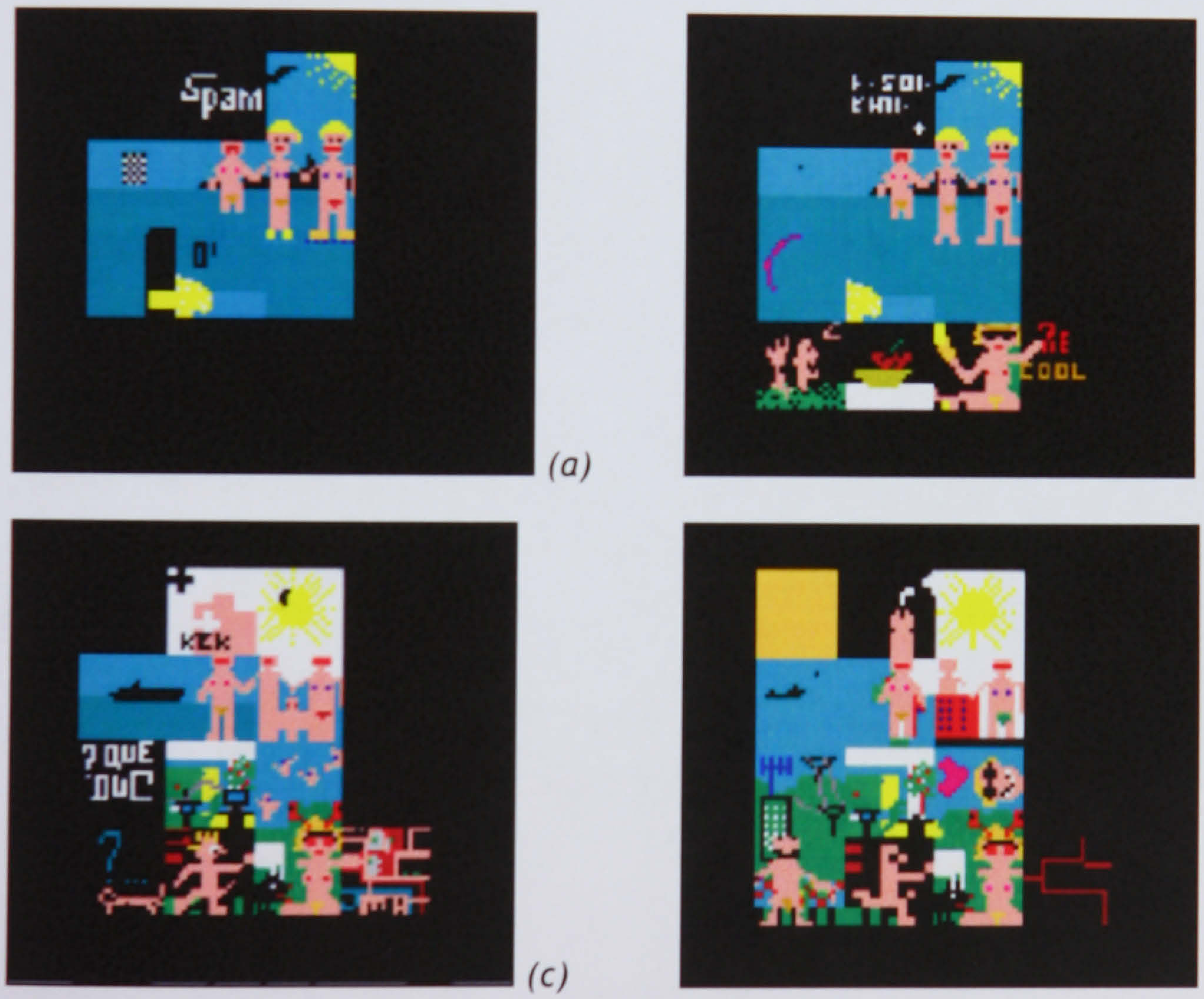
---

[195]Email dated 14 June 2002.



(c) (d)

Figure 39. Further narrative sequences in GP.



(a) (b)

(c) (d)

6.3.2. A Phenomenological Analysis of Verbal Activity

Even if statistically less relevant, the analysis of verbal activity gives some indications that confirm the observations made about the anomalous positions emergent on the Abaque of Régnier. This information can be taken into an account when attempting to understand the connection between verbal and visual activity.

Data analysed, according to Jakobson's functions (see 4.2.3.5.), are relative only to GP and OS. Data relative to SITO were abstracted from Lenara Verle's BA thesis "Novas Imagens Para Um Novo Meio: Um Estudo de Caso do Website de Arte Interativa SITO" (Verle, 1999), and are the result of this ethnographic study.

6.3.2.1. Emerging Functions

In GP, OS and SITO, different verbal functions prevail, and they are partially connected to the features of the communication medium that was used. However, some general observations can be inferred from the analysis of exchanged messages, and these observations seem to confirm an orientation regarding the relation between verbal chatting (or generally speaking, the verbal communication that occurs outside the canvas) and visual activity, that is common to all three art projects. It seems there is no direct correlation between verbal chatting and visual activity. Even in SITO, where verbal communication is an integral part of the dynamic continuum represented by the creative process within the community, verbal communication rarely directs or co-ordinates the drawing activity towards a specific endpoint.

6.3.2.1.1. Functions of Verbal Chatting in GP

Verbal chatting in GP takes place on private channels for multiple and simultaneous point-to-point conversations. These communication channels can be activated by clicking on the name of a participant inside the window that lists the nicknames of all those participating in a session, or by directly clicking on an individual drawing area.

According to the analysis, achieved using the Jakobson model, the emotive (57%) and conative functions (29%) prevail over the other functions. The predominant axis is therefore that of the "addresser-addressee". Verbal chatting in GP is directed towards: a) establishing or stressing a contact between participants; b) expressing feelings and emotions; or, c) giving instructions or co-ordinating the drawing activity (occasionally). Verbal chatting in GP appears fragmented, characterised by frequent conversational lapses, and a stream of consciousness style.

In the following (Fig. 40) and (Fig. 41), some excerpts illustrate examples in GP of emotive and conative clusters[196].

Figure 40. Example of an emotive cluster in GP.

Time	Participants	Message
13.50	marine@paris -> olivier@paris	c'est un sapin de noel rose ?
13.51	olivier@paris -> marine@paris	meuh non un cyclorobot voyons !|
14.08	marine@paris -> olivier@paris	j'aime bien mon chapeau, merci !
14.11	olivier@paris -> marine@paris	ha ca s'ameliore!
14.11	marine@paris -> olivier@paris	il a un peu mal au cœe

Figure 41. Example of a conative cluster in GP.

Time	Participants	Message
14.19	dante@milano -> pink@paris	pink?
14.19	dante@milano -> pink@paris	pink?
14.20	pink@paris -> dante@milano	we?

6.3.2.1.2. Functions of Verbal Chatting in GP

Verbal chatting in OS takes place in a single chat room that makes the conversation public among all participants. This chat room can be activated by clicking on a button on the interface that is put at the left of the drawing space.

According to the analysis, achieved using the Jakobson model, emotive (61%) and referential (17%) functions prevail. Therefore, the pole "addresser" and the pole "context" are predominant. In OS, verbal chatting is directed towards: a) expressing personal opinions about the system and the current activity; b) discussing the features of the system; c) giving explanations about the project and its functioning; and d) giving instructions or co-ordinating the drawing activity (rarely). In OS, verbal chatting is characterised by a clear sequence of long and shared conversational clusters, which are parallel to the drawing activity[197].

In the following (Fig. 42) and (Fig. 43), some excerpts illustrate parts of emotive and referential clusters in OS.

---

[196]By cluster I mean here the entire exchange between two participants during a session.

Figure 42. Example of an emotive messages exchange in OS.

Participant	Message
niki >	never communicated by graphics. it's almost like touching
margoPolo >	so everyone's experience is according to their computer update ... all unique images ...no two users alike ... archive is everyone's memory ... it reminds me a group of excited children talking at once

Figure 43. Example of a referential messages exchange in OS.

Participant	Message
Andrea >	ok... how does it work your work?
bumpkin >	there's a piece of sotware running on the server
bumpkin >	that listens for people to connect
bumpkin >	and then, when they have connected, it sends...

6.3.2.1.3. Functions of Verbal Communication in SITO

Verbal communication in SITO takes place through different communication channels, which range from the WWW, to IRC (ICQ or CUSeeMe), and e-mail. Verbal communication occurs among the members and supporters of the community at different times, not only as a form of impromptu chatting during the visual activity.

[197]According to Andy Deck, author of the art project and key informant, the connection between chatting and drawing is not stable, and it depends on people and their common languages.

According to Verle's analysis (Verle, 1999), verbal communication in SITO is directed mainly towards: a) expressing opinions about the community and its projects; and b) discussing the collaborative process (concepts, technical aspects, interaction rules, images creation and aesthetical issues, suggestions for further developments). Verbal communication in SITO is part of the dynamic continuum represented by the creative process within the community.

The following example is excerpted from Verle's study, and it expresses an opinion about the community and its projects from one of the SITO members:

> The site is incredible!! It's great to see conceptual, artistic, and technical thinking complementing each other, for a change!
>
> It is really a beautiful piece and inspiring as well :)
> I love the concept of the hygrid- What a truly unique way to inspire creation for the sake of creation... It's inspired me to find little visual toys to take pictures of and play with... I can hardly wait until they process my ID...(Verle, 1999, p. 121).

The following example, instead, refers to a discussion about the collaborative process among members of SITO. Specifically, it refers to a discussion about the process of creation of images:

> One thing I tend *not* to do is to look specifically for certain kinds of images. All my collages are guided by accidents and the material on-hand. Like you lot, I keep a folder of raw materials -- an analog to the shoeboxes full of clippings in the closet -- and it's got thousands of bits and pieces collected over the past year. Generally I'll start with one that strikes me for whatever reason and make that central -- it will guide the rest of the collage and thus the images that surround or weave with it (Verle, 1999, p. 138).

6.4. Summary of Results

1. *The Experience of Co-Creation*

   Co-creation is perceived as an intersubjective experience engendered by collaborative activities. It can be seen as a "place" or field of the joint intersubjective expression and collaborative production of single participants.

2. *Motivational Paths to Co-Creation*

   The main motivational paths to co-creation are emotionally driven, and based on the perception of creative environment as open and unpredictable.

3. *Features of Computational Environment*

   A computational environment enables co-creation by allowing 'emotional seeding'. Such 'emotional seeding' takes place due to the visual embodiment of the activities and emotional nature of participation.

   This embodiment of participants in the computational environment ensures that time, space, and physicality are experienced in intersubjective terms, rather than informational terms[198].

---

[198]Here we could agree with the claim of a relational concept of information as Fodor and Pylyshyn do in the field of cognitive science. They criticize Gibson's ecological theory, which postulates that the existence of objective information, although neither physical nor symbolic, is based on the thesis that perception is capable of extracting from the environment invariants, which possess both an objective content and a perceptual meaning.

7. Advancing Metadesign

Through a process of final and enveloping zooming out, that takes into account the intermediate results of previous chapters, this seventh chapter integrates and advances the conceptual framework and methodology of Metadesign. The concept of a design space based on three interdependent levels of design is introduced, and specific design principles for each level are identified.

The purpose of this chapter is to promote the notion of Metadesign as a "mode of design", i.e. a non-teleological idea of design, which the author names "sociotechnological know-how".

* * *

We have seen in chapter two, that Metadesign, according to the etymological hypothesis set in that chapter, has achieved, an extensive range of methods and techniques for meta-level design which denotes the prefix "meta-" as *behind.* Metadesign has also achieved positive developments in methods and techniques for designing together ("meta-" as *with*). However, as yet it shows a weak development in methods and techniques for the design of the "in-between", that is to say for the design of relational settings and affective bodies ("meta-" as *between/among*). Such a development has been fostered by Metadesign, but mainly at a theoretical level. Conversely, , as we have seen in the chapter three and six in particular, this development has found a path in the experimental design of co-creative environments in Net Art.

Metadesign unfolds as coherent design culture in the coexistence of these three facets or levels of design. Such levels of design relate back to the etymological field of oscillatory significance from which we originated, at the beginning of this work (see 2.1.1.). They challenge issues that are at the core of the contemporary philosophical and methodological debate about design (see 2.4.3.), and contribute to their development. These three levels of design (later called "folds") can be summarized as designing design (*behind*), designing together (*with*), and designing the "in-between" (*between/among*). They correspond, quite evidently, to the issues raised by Metadesign, and respectively to those we called anticipatory, participatory, and sociotechnical issues.

These three levels of design have not yet been integrated and articulated into a coherent approach. They emerge as constitutive of a culture of Metadesign by means of an analysis, the final aim of which is to promote their integration and development both at a conceptual and methodological level (see 2.4.2.). The transdisciplinary dialogue between Metadesign and the aesthetics and practice of Net Art, into which case studies are embedded, provides elements for a methodological development of the third level (the design of the "in-between"). However, it has also contributed substantially, during the development of this research, to the recognition and definition of the features of the new design space.

7.1. A Three-Fold Design Space

Metadesign deals with structures and processes at different resolutions and levels. Without being prescriptive, Metadesign, as a methodology, loops design time and use time, designer and user, producer and consumer. It defines a set of modes, later called "know-how", for designing structures and infrastructure (the *first fold*), collaborating (a *second fold*), and being related within a networked environment (the *third fold*).

7.1.1. *Behind*: Designing Design

This first fold relates to the concept of higher order design, and the possibility of a malleability and modifiability of structures and processes, as provided by computational media. Conceptually, it subsumes the idea of existing in a higher order level of design, and a source of transformation (see 2.1.2.). It can be seen as the structural ground for a new design approach, which focuses on general structures and processes, rather than on fixed objects and contents. Methodologically, it suggests methods and techniques for designing at a meta-level, and it is characterised by a non-prescriptive approach. It can be seen as the field where designers, better metadesigners, play an important role in establishing the conditions that allow users to become designers.

The first fold concerns the impossible task of fully anticipating at design time users' needs and tasks, situations and behaviours (see 2.4.3.1.). Focusing on the dynamic dimension of processes, Metadesign takes advantage of the malleability of software, and uses arbitrary information or computational artefacts, which can be structured at use time. The possibility of transforming and modifying components, contents, and contexts by interacting with the system, and even adjusting it, allows the user to respond to the deficit between what can be foreseen at design time and what emerges at use time.

This non-anticipatory feature, realized at the methodological level through end-user modifiability and programming, provokes a creative and unplanned opportunism, which focuses design on situated processes and emergent conditions, rather than on the anticipatory aspects of decision-making. Finally, this feature becomes a process of lifelong learning and shared creativity, that helps overcome the long standing teleological conviction that the outcome is more important than the process, and encourages a more convivial society (see 2.4.3.1.; but also 3.1., 3.2., and 6.4.).

To summarize[199], the First Fold of Metadesign ("designing design") means:

1. *Exploitation of computational media and networked environments as technical infrastructures.*
2. Design of general structures and processes (higher order design).
3. Methods and techniques to design at a meta-level (i.e. diagramming and seeding).
4. Setting of initial conditions to allow users to, in turn, become designers (i.e. underdesigning and underprescribing).
5. Malleability and modifiability of structures and processes (end-user modifiability and programming).
6. Situated processes and emergent conditions (open and evolvable systems).
7. *Lifelong learning and shared creativity (co-creation).*

---

[199]All the concepts, methods, and techniques mentioned here and in the following two sections have been fully presented and explained in the previous chapters, in particular in the section 2.4. Some of them are included in the final glossary.

7.1.2. *With*: Designing Together

The second fold is concerned with the way in which designers and users can collaborate to the design activity, both at design time and at use time. It indicates that design activity becomes both an initial planning stage, shared among the developers of the system and their users, and a lifelong condition of convivial and enactive behaviour[200] that is shared at different levels of social interaction (from groups to communities to society at large). Conceptually, this fold can be seen as the second step towards co-creation. Methodologically, it provides methods and techniques for letting users participate in the initial setting stage at design time, and it relies on the principles of the first fold, and related methods and techniques for enabling users to become lifelong learners and designers. It can be seen as the methodological basis on which designers and users play a fluid role in collaborative design activity, at different times and different levels of social interaction.

The second fold can be framed as a response to issues concerning the participation of the users in the design process, and as a further solution to the impossibility of complete anticipation of use at design time (see 2.4.3.2.). Compared to traditional participatory approaches to design, it represents an advance on the methodological level, transforming the issue of anticipation into an issue of participation, by supporting structural changes (*first fold*) and co-evolutionary processes (*third fold*). However, it is the combination of the three folds that distinguishes the conceptual framework of Metadesign from participatory design. For most participatory approaches, and design approaches focusing on the user in general, participation is

---

[200]Here enactive means "productive" as framed within cognitive science (see 2.4.3.).

basically a way of increasing the probability that a design corresponds to real needs and will be used as intended. Instead, in Metadesign participation is also an issue of embodiment, a way of being. People couple with the electronic or larger sociotechnical world they inhabit, and they act within it, due to forms of embodied interactionism[201]. From this perspective, co-creation can be conceived not only as fundamental in order to deal with the complexity of unforeseen problems and their solution, or with the blurring of user profiles, but also as closely connected to contemporary human condition.

To summarize, the Second Fold of Metadesign ("designing together") means:

1. *Sharing of design activities.*
2. Open and fluid levels of learning and working social aggregation (i.e. communities of practice, communities of interest, etc.).
3. Operational loop of design time and use time (non-binary logic).
4. Methods and techniques to involve users and developers in the initial setting stage at design time (participatory design).
5. Methods and techniques to put users in the lifelong condition to be in turn learners and designers (see first fold, but also think of critiquing mechanisms).
6. Users' participative status (embodied interactionism).
7. *General enhancement of enactive human condition (co-creation).*

---

[201]Usually by the means of a performative language of interaction and immersion through which users act with different levels of awareness and intentionality.

7.1.3. *Between*: Designing the In-Between

The third fold concerns the design of relational settings and affective bodies. It aims to both support existing social networks, and to design new relational spaces. It is based on the assumption that people interact with and somehow inhabit the computational space that is opened up by interface and constitutes a sort of objective reality (or ontological active setting). Such space is not simply determined by technology, but it is a relational system, which human beings experience and negotiate in relation to technology itself. From this perspective, technology is seen as "a trigger for structural change", or an intervention into the active relationship between human agency and organisational structures, which can alter roles and patterns of interaction. Within such a relational system, co-evolution takes place through reciprocal and recursive interactions, and co-creation is triggered by the sense, emotion, and interaction of affective bodies, embedded and active in the computational space.

Conceptually, this fold can be seen as the intersubjective ground (or fabric), on which relations and interactions come about, and processes are activated. Methodologically, it addresses how people can relate within a computational environment (among themselves and with the system at large), and how their relationships can empower co-evolutionary processes and co-creative behaviours.

On a methodological level, evidence from case studies demonstrates that in order to promote co-evolutionary processes and co-creative behaviours we need to think (and design) in terms of dynamic agencies emerging from the system, rather than in terms of pre-established user profiles, and pre-determined subjects and objects (as in the traditional idea of "user" or "outcome"). Furthermore, space and time cannot simply be conceived and designed as a matrix of synchronous and asynchronous combinations, but also in terms of intersubjective proximity and networks of intentionalities respectively. From this event-oriented perspective, as supported by the results of the case studies, each action or interaction is an act of creation, and represents a point of co-origin of subject and object. Therefore, it also denotes a co-origin of space and time. The system of experiential interrelations from which subject and object, space and time, originate within the system is provided by the embodiment of users' activity and emotional tone, and by their interactions.

As we have seen in the case studies, this kind of embodiment predominantly takes place through a pre-verbal and sensori-motor use of vectorial lines and colours, visual elements of auto-representation, and graphical and verbal elements with linguistic functions of different types. Moreover, in the case studies we have seen how the emergence of images and narrative sequences from chaotic states and collective mechanisms corresponds to the dynamic setting of "agencies" and to the spontaneous apparition of "planes" of interaction and creation, within an environment perceived as open and unpredictable.

This third fold can be seen as a response to the sociotechnical issues raised by Metadesign, and framed in 2.4.3.3. As we have seen, this fold relates to embodied interactionism, both conceptually and methodologically. However, embodiment is a status, a way of being, and if design is fundamentally a mediation process, an opportunity to enable greater participation in the design of non-material situations, then the challenge for a sociotechnical approach is to overcome its problem-centered nature. The design of sociotechnical systems is not just a matter of designing and adjusting technological artefacts in harmony with the people that will use that system, but a matter of how to design (or better metadesign) their interactions, among themselves and with the system. Philosophically, this means a subtle transfer from a teleological model of design to a creative mode of existence. This would provide a structural malleability (*first fold*) that can correspond to an "interactive openness", presented by ongoing collaborative (*second fold*) and embodied relationships and activities (*third fold*).

To summarize the Third Fold of Metadesign ("designing the in-between") means:

1. *Design of relational settings and affective bodies.*
2. Methods and techniques to empower co-evolutionary processes and co-creative behaviours (see methods and techniques of the previous folds, plus the following principles of embodied interactionism).
3. Embodiment of users' activity and emotional tone as experiential interrelations (affective bodies).
4. Methods and techniques to allow sensing, emotioning, and interacting activities (like emotional seeding[202] and agency patterning[203]).
5. Methods and techniques to allow reciprocal and recursive interactions (co-evolutionary processes).
6. Methods and techniques to set time as a network of intentionalities and space as an intersubjective proximity (relational settings).

---

[202]Emotional seeding, as we have seen in 6.3., is based mainly on an exploitation of pre-verbal and sensori-motor modalities.

[203]The spatio-temporal setting aimed to let dynamic agencies emerge from the system is here called "agency patterning". It defines size, resolution and level of the agency.

7. Creating a perceptible and practicable environment to deal with openness and, eventually, unpredictability ("interactive openness").
8. *Passage to a creative mode of existence vs. a teleological model of design (co-creation).*

7.2. Towards a Sociotechnological Know-How

The recognition and definition of a three-fold design space means a new approach to the very idea of interaction and design, and a new understanding of their scope.

The three-fold design space that this research has detailed, can be conceived as an "operational dimension", -or, according to Maturana, a dimension of interactions which becomes a historic dimension of reality, offering specific possibilities for social and non-social co-existence (Maturana, 1997). In order to apply this idea to the field of computational media, we can think of the three levels of design that identify and compose the design space here proposed, as part of a sociotechnical cycle or, more accurately, an upwards spiral.

For an example in existing technology, we could consider the Internet, and describe the three interdependent levels of our design space in the following way:

- Fold 1: Exploitation of computational malleability and modifiability (i.e. WWW).
- Fold 2: Shared design activities and reinterpretation for democratic purposes (i.e. online communities).

- Fold 3: Emergence of new social mindsets and expectations as result of new relational spaces.

It is the creation of new relational spaces and the emergence of new social mindsets and expectations that, in turn, will lead to the next wave of new technologies, and to the next sociotechnical cycle of folds one to three. Peer-to-peer computing (P2P), open source communities[204], and extreme programming (XP), for instance, could be considered in software design as new developments, mostly originating with user communities (i.e. P2P and open source), that reflect a shift of human motives and express the human desire to be in control of human destiny (Raymond, 1999; Pierce, 2002).

Interestingly, we could also apply the same idea to the sociotechnical cycle that was engendered by a technology like printing, and that led to the next wave of technology during the industrial revolution. Thus, a classic example would be:

- Fold 1: Exploitation of non-computational malleability and modifiability (i.e. democratisation of literacy)
- Fold 2: Shared publishing activities and common questioning of old values and beliefs (i.e. literature).
- Fold 3: Emergence of religious reformation, the Enlightenment, Science, etc.

This model not only enables us to predict sociotechnical changes on the horizon, but, most importantly, to promote Metadesign as "sociotechnological know-how". It

[204]See note 158.

advances Metadesign from a "model of design", conceived deterministically, to a "mode of existence", conceived as open and creative. If, methodologically, Metadesign represents a shift from an idea of design as top-down planning to an idea of emergence as bottom-up construction (a setting of conditions that will enable co-evolutionary and co-creative processes in the production of artefacts and meanings), then this final section aims to argue that to the operational dimension of Metadesign must correspond to a different idea of the design space.

To set initial conditions for human interaction, for their building, constructing, organizing, and relating activities, does not mean "to persuade" or "to induce" them more effectively to match designer's personal goals. Furthermore, a better understanding of emotions and intersubjective relationships is not a tool. Metadesign must aim to enhance spontaneous and autonomous ways of relating and interacting to liberate processes of "world-poiesis" that overcome the instrumental teleologism of traditional design, and, hopefully, enable a substantial participation and flexibility in the transformation of our environment.

According to Castells, as we have seen in chapter one, one of the features of the information technology paradigm is precisely that it is based on "flexibility", reconfigurability, reversibility, and fluidity. Another characteristic is the "convergence" of all technologies, no matter how specific, into a highly integrated system. Flexibility and convergence, based on the same logic of the information generation, increasingly extends an interdependence between the biological and the computational domain "both materially and methodologically" (Castells, 1996). We can already see integrated applications of computing power and biological materials, but this ongoing convergence also includes fields such as nanotechnology, artificial life, artificial intelligence, robotics and more.

Beyond this growing interdependence between the biological and the computational domain, Metadesign, and the three-fold design space that it entails, can support the adaptive and open-ended nature of the development of the information technology paradigm, and offer new possibilities for social and non-social co-existence.

The definition of the subject matter of Metadesign, in terms of a three-fold design space, represents a shift from a focus on human needs to one on human creative endeavour, from a focus on the user to one on creative action. The orientation expressed by this research, moving beyond a classical human-centred approach, can be seen as an attempt to focus on a transverse "mode" of relationship rather than on a closed "subject" such as the user, the community or a human "mode of consciousness". This orientation can also be seen as an effort to overcome rigid dualisms both in framing and solving problems, and in the forming of new social relationships by emergent artificiality and enhanced interconnectivity. From this perspective, the recognition and definition of a new design space means an attempt to shift from a "know-what" attitude to a "know-how" endeavour. t hopefully represents a shift from a culture of design as "planning" towards a culture of design as "seeding" (or emergence), where culture products, services, and systems are conceived as an integrated whole.

Addressing Metadesign as "sociotechnological know-how" does not mean that it could form a type of moral action. At best, as we have seen in 1.3., would become a social modelling informed by new ecological metaphors, inevitably conceived in terms of a recovery of new meta-narratives (Margolin, 1995). On the basis of the enactive perspective proposed by the three folds of Metadesign, it can be argued that an advance in design cannot be based on a priori metaphors or meta-narratives, in the same way that it cannot be based on a priori policies of technology, because this would impose ethical demands *on* design rather than extract new ethical principles *from* it (Mitcham, 1995).

The actual crucial point is, therefore, to learn a new "how" instead of establishing any "what", however appropriate. Any enactive capability that can be gained through Metadesign should be shared as an ethical "know-how" (Varela, 1999), rather than directed to "what" can be made transcendentally better for people. Such "know-how" should be conceived as a mode of consciousness (as caring can be understood), which is embodied in evolving practices of fluid and interdependent social communities, instead of deriving from social or cultural motivations (as argued by theories like social capital or gift culture[205]).

According to Varela, a shift from a" know-what" to a "know-how" attitude means a shift from rational judgment to mere, spontaneous response (as also suggested by Thacker in his paper on Metadesign, see 2.2.4.), i.e. from moral principles that are detached and prescriptive to an active and situated ethics (Varela, 2000). From this perspective, enactive capability and ethical action are conceived as a non-intentional project of being, based on a pragmatics of transformation that demands nothing less than a moment-to-moment awareness of the virtual nature of our selves.

[205]According to these theories motivations are based on specific benefits that flow from the trust, reciprocity, information, and cooperation associated with social networks (social capital), or on the prestige and social status that is determined not by what you control but what you give away (gift culture). See Putnam, 2000 and Raymond, 1999.

Hopefully, this can link knowledge and ethics in a new way, and foster unexpected sociotechnical systems:

> A society cannot last if it does not have a strong awareness of itself. Sometimes this awareness is elaborated producing History, looking at the future, in short making projects. Other times it is space to assume this role. It is the space in which we live together, to which collective memory belongs, the space then that allows us to identify ourselves. Thus, participating with the others to the whole that surrounds me, I become a thing among others, a subjective object. I co-exist in a whole where all is body: I co-exist with my fellow creatures which make me what I am, and also with a multiplicity of objects without which contemporary existence is no more conceivable (Maffesoli, pp. 144-145)[206].

[206]Originally: "Una società non può durare se non ha una forte consapevolezza di se stessa. A volte questa consapevolezza viene elaborata producendone la Storia, guardando verso l'avvenire, in breve facendo dei progetti. In altri casi è lo spazio che assume questo ruolo. Lo spazio vissuto in comune, lo spazio in cui si iscrive la memoria collettiva, lo spazio infine che consente l'identificazione. Così, partecipando con gli altri della totalità che mi circonda, divento una cosa tra le altre, un oggetto soggettivo. Co-esisto in un insieme in cui tutto fa corpo: co-esisto con i miei simili che mi costituiscono per quello che sono, e anche con una molteplicità di oggetti senza i quali l'esistenza contemp oranea non è più concepibile".

Conclusions

Aim of this work was to provide an understanding of Metadesign as an emerging design culture, and to integrate and advance its conceptual framework and principles through a transdisciplinary dialogue with the aesthetics and practice of Net Art. Co-creation is the main concept, mentioned in the subtitle, that underlies and draws this work on Metadesign as a central thread, and that this transdisciplinary dialogue contributes significantly to strengthen.

Thesis of this work is that the conceptual and methodological framework resulting from such a study can lead to define a new idea of design and a new design space. But rather than proposing a new "model of design", such a study promotes a new "mode of design". It promotes a shift from a culture of design as planning towards a culture of design as seeding or emergence, where setting the conditions for various design activities will enable co-evolutionary and co-creative processes in the production of artefacts and meanings.

It is belief of the author that such a "mode of design", identified as a set of principles which are organized in different and complementary levels of design, and embodied in the evolving practices of fluid and interdependent communities, might enable people to manage the construction of their environment and their relationships with the world in a creative and collaborative manner.

The problem of defining a new idea of design and a new design space arises with the spreading of information technologies and the changes they are producing in our material and existential conditions. It is a condition of increased scale and complexity in natural human interaction that is made tangible by technology, i.e. by the new status and properties of objects and materials and by the pervasive connectivity brought about the development of networked computing.

This is the problem with which current design theories deal, and to which both Metadesign and Net Art respond, by calling for an expansion of the creative process and respectively expressing a movement "beyond design" and "beyond art".

Within this context, Metadesign can be seen as a consistent conceptual and methodological instance of a design culture, which is emerging in the light of the changes occurring in our material and existential conditions, and from a wide range of theories and concepts.

Methodologically, Metadesign loops opposites like producer and consumer, designer and user, design time and use time. On the whole, it is concerned with promoting the malleability and modifiability of computational structures and processes, and with specifying methods and techniques based on principles and dynamics of participation to the design process which are non-prescriptive, and which can sustain convivial attitudes and creative behaviours. Its design space can be defined as a set of interdependent and complementary principles (or "modes") of designing structures and infrastructures capable to change (*first fold*, or "designing design"), collaborating (*second fold*, or "designing together"), and being related (*third fold*, or "designing the in-between") within a networked environment, where the intersubjective and contingent nature of relational settings and affective bodies is not only a methodological issue, but in the first place an epistemological and ontological one.

Theoretically, such a three-fold design space promotes a "mode of design", capable of overcoming a teleological notion of design, traditionally meant to respond to criteria of efficiency and control, and oriented to reductively represent and anticipate needs and values in a manner which fulfils them most efficiently. This research represents, therefore, an attempt to shift from a "know-what" attitude to a "know-how" endeavour, and it advocates the passage from a culture of design as "instrumental planning" to a culture of design as "creative emergence"[207].

The way in which this work has been developed is based on a fabric of hypothesis connected and confirmed by means of various research strategies. Each chapter produces specific and intermediate results, which are then composed and integrated in the final chapter. The logic is transdisciplinary, i.e. process-based and aiming at producing "crucial knowledge", rather than a totality of knowledge.

In this sense, it is important to highlight that case studies are not instances of Metadesign, but rather part of this overall methodology. They are instances of Net Art, and as such they substantiate our understanding of co-creation, as an intersubjective experience engendered by collaborative activities, and they provide those principles for the design of affective bodies and relational settings that are seen as a weak aspect in the practice of Metadesign.

Structurally, the work starts with identifying some main factors of change according to which design must rethink its boundaries and scope, and then it describes theories and practices of Metadesign that have occurred since the 1980s. Referring to the etymological roots and linguistic inheritance of the prefix "meta-", the work reconstructs the oscillatory trajectory along which the notion of Metadesign has developed, and it agglutinates around this trajectory a wide range of theories and concepts. Many are the philosophical and scientific implications of the transdisciplinary way in which the concepts under consideration respond to this wide range of theories, which go from modernism to post-modernism, from the revival of Leibniz and Spinoza in Deleuze's thinking to the theory of autopoietic systems in Maturana's biology, from machinic approaches to human agency to approaches more concerned with a democratic empowerment of all individuals within the society. All these theories neither are nor can be resolved within the thesis; however, in an effort to sustain an overall transdisciplinary methodology, crucial concepts and meaningful relationships recall each other and are connected along the structure of the work, crossing various theories and languages, in order to focus on a problem that is at once "between the disciplines, across the different disciplines, and beyond all disciplines" (Nicolescu, 1996): the definition of a new design space.

In a world where the major part of our everyday environments will be intrinsically linked with computing, network connections and artificial intelligence or artificial life forms, how we set the conditions for our recursive interactions, that is to say how we design our tools for communication and interaction, will substantially

---

[207]Of course this does not mean a delegitimation of instrumental planning (that would be ridiculous), but

influence the kind of life we live or we will be able to invent. Within this scenario, it is clear that a new culture of design is of vital importance. The rapid proliferation of distributed and networked computing, and its convergence with communication technology has generated an expansion of attention that moves beyond the basic usability issues to questions about the sociological, organizational, and cultural impact of computing. Established fields like socio-technical systems design or interaction design are therefore becoming crucial, but they need to be readdressed in the light of the definition of a new design space, seen as a conceptual framework from where an understanding and a new way of thinking about interaction and design themselves can be derived and translated in methodological principles. The boundaries of technology are to be stretched beyond the definition of networked computing as we know it today, in a way that will force us to re-negotiate our environment. We will live interfaced with an environment in which the borderline between what is artificial and what is natural, between the "self" and the "other", will be negotiable and changeable. Such a constant re-negotiation will be enacted by the conditions of our experience and relations with objects and beings. In a world of such complexity, what is challenging will be how to design, but in the terms of how to engender and seed, the relational systems through which to interface with our everyday environment and inhabit the world.

We are living in a world that tries to simplify contemporary complexity and to preserve objective certainties by making distinctions on the basis of differences and values assumed transcendentally, and by running towards spiritual and mythopoietic meta-narratives as expression of an aggressive unilateralism. In such a world, this

---

rather an advancement of our design culture.

work is a philosophical and methodological call for the creative capability of human beings, and for an immanent and shared ethics of engagement, the principles of which are extracted *from* the very design activity, rather than being ethical demands imposed *on* it. Finally, this research is a call for a mode of consciousness ("sociotechnological know-how"), embedded in the evolving design practices of fluid and interdependent communities, and capable of fostering change and unpredictability.

Abbreviations used

EDC - Envisionment and Discovery Collaboratory

YGR - Gene Youngblood, Kit Galloway, and Sherrie Rabinowitz

DK - Derrick de Kerckhove

PV - Paul Virilio

HM - Humberto Maturana

ET - Eugene Thacker

LM - Lev Manovich

SRL - Systems Realization Laboratory

SP - Celestino Soddu, Micheal Pontecorvo

YNL - Yevgeny N. Lazarev

L3D - Centre for Lifelong Learning and Design

LS - Lars Spuybroek

LAB - Lab[au]

GP - Générateur Poï étique

OS - Open Studio

SITO - SITO Synergy Gridcosm

Appendix I: Questionnaire n. 1

ID	QUESTION
	Agency
1	I felt influenced by other participants.
2	I felt that I interacted creatively with others.
3	I was following a goal.
4	I was emotionally coupled to other participants.
5	I imagined what other participants had the intention of doing.
6	My interaction with other participants was guided by the visualization of their activity.
7	My interaction with other participants was guided by my chatting with them.
8	I created something that was different than I would have created alone.
9	Previous knowledge of the people I was interacting with was relevant.
	Place
10	My activity was influenced by colours.
11	My activity was influenced by strokes and marks.
20	My activity was coupled to the activities of my neighbours.
21	My activity was coupled to the global activity.
22	My activity was influenced by the pictures of my neighbours.
23	My activity was influenced by the whole of all the pictures.
12	My relationships were affected mainly by the space of interaction.

13	My relationships were affected mainly by the time of interaction.
	Processes-material
14	The outcome of interaction was determined mainly by the computational features of the system.
15	The outcome of interaction was determined mainly by the active relationship among participants.
16	I felt there was a creativity that went beyond my interaction with the computer.
	Outcome
17	The outcome is predictable.
18	The experience is more important than the outcome.
19	I feel satisfied.

Appendix II: Questionnaire n. 2

ID	QUESTION
1	How would you define your relationship with other participants?
2	What factors affected your relationship with other participants?
3	What were your goals during the process of interaction?
4	What were your feelings during the process of interaction?
5	What are the differences, if any, between (*examined project*) and a game?
6	Why do you like to participate in (*examined project*) sessions?
7	What other net art projects do you like to participate in?

Appendix III: List of Respondents

Mrs AGUSTO, Giulia

Mr ANDERS, Peter

Mr ANDERSON, Bob

Mr ANTONUCCI, Luca

Mr ARMAGOST, Thomas

Mr AUBER, Olivier

Mr BERGESE, Andrea

Mr BHIHE, Cédric

Mrs BIRAL, Francesca

Mr BORG

Mrs BROWN, Jordan

Mr CERBERE, Yuumura

Mrs CHAPELLE, Josee

Mr CRANE, Ben

Mr DECK, Andy

Mrs DOLINSKY, Margaret

Mr DUBIN, Mark

Mr FOGLI, Matteo

Mr G., E.

Mrs GIACCARDI, Elisa

Mr GIAMELLO, Giorgio

Mrs GRIMALDI, Laura

Mr HARRELL, Roy

Mr HERMAN, Max

Mr HIROAKI, Ogata

Mr HOPKINS, John

Mrs KINTSCH, Anja

Mrs MAEGHT, Sam

Mrs MARTINI, Federica

Mr MAYER, Dan

Mrs MEYER, Aussie

Mr MOREAU, Antoine

Mrs OLIVARI, Julie

Mr OSBORN, Jeremy

Mr PUIRAVAU, Mickael

Mrs ROSA, Lucia

Mr RUSNOV, Nick

Mrs RUSSO SUPPINI, Alessandra

Mr SCHARFSTEIN, Ben-Ami

Mr STASTNY, Ed

Mr SUNSHINE, Mark

Mrs TADDEO, Gabriella

Mr TANZI, Dante

Mrs VAN HERK, Annemieke

Mr VAN SITO, Jon Lon

Mrs VERLE, Lenara

Mr VIGUIÉ, Jean-François

Mr WILLIAMS, Michael

Mr ZABLOCKI, Olivier

Mr ZUILL, David

Appendix IV: Large Format Illustrations

Illustration I. POIETIC GENERATOR: Mosaic of individual perceptions.

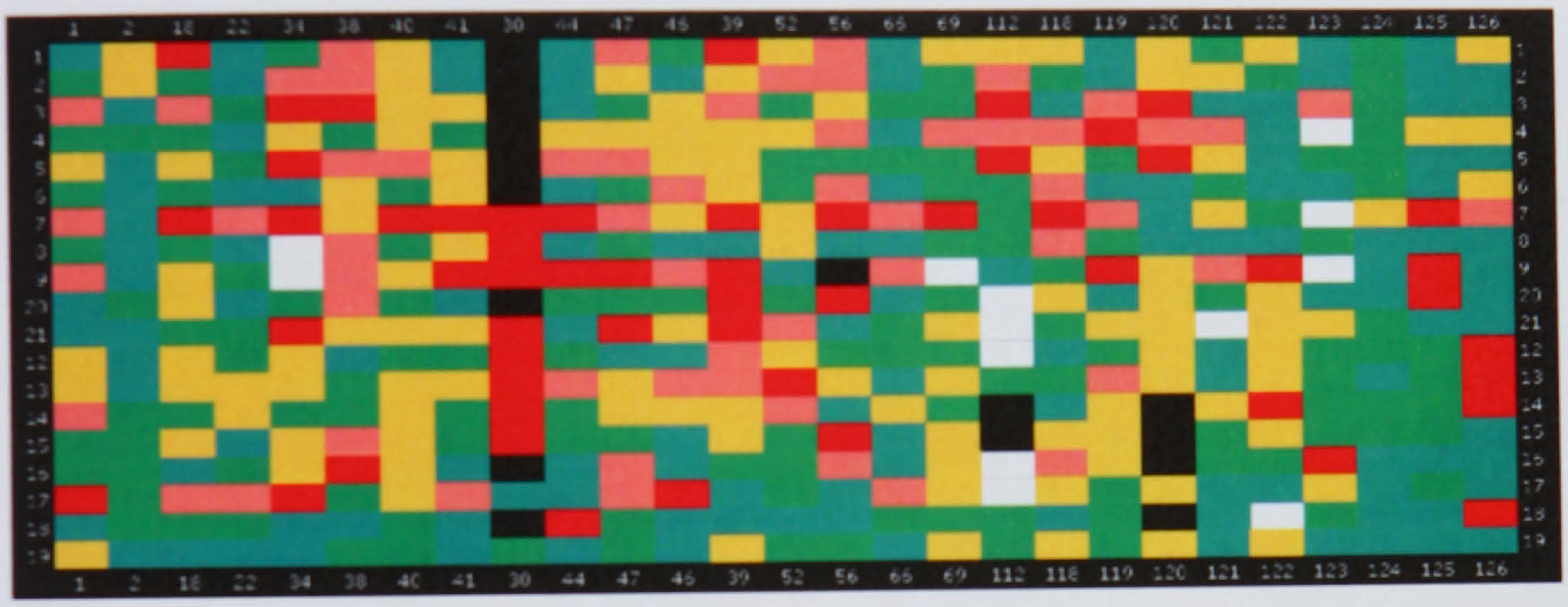


Illustration II. OPEN STUDIO: Mosaic of individual perceptions.

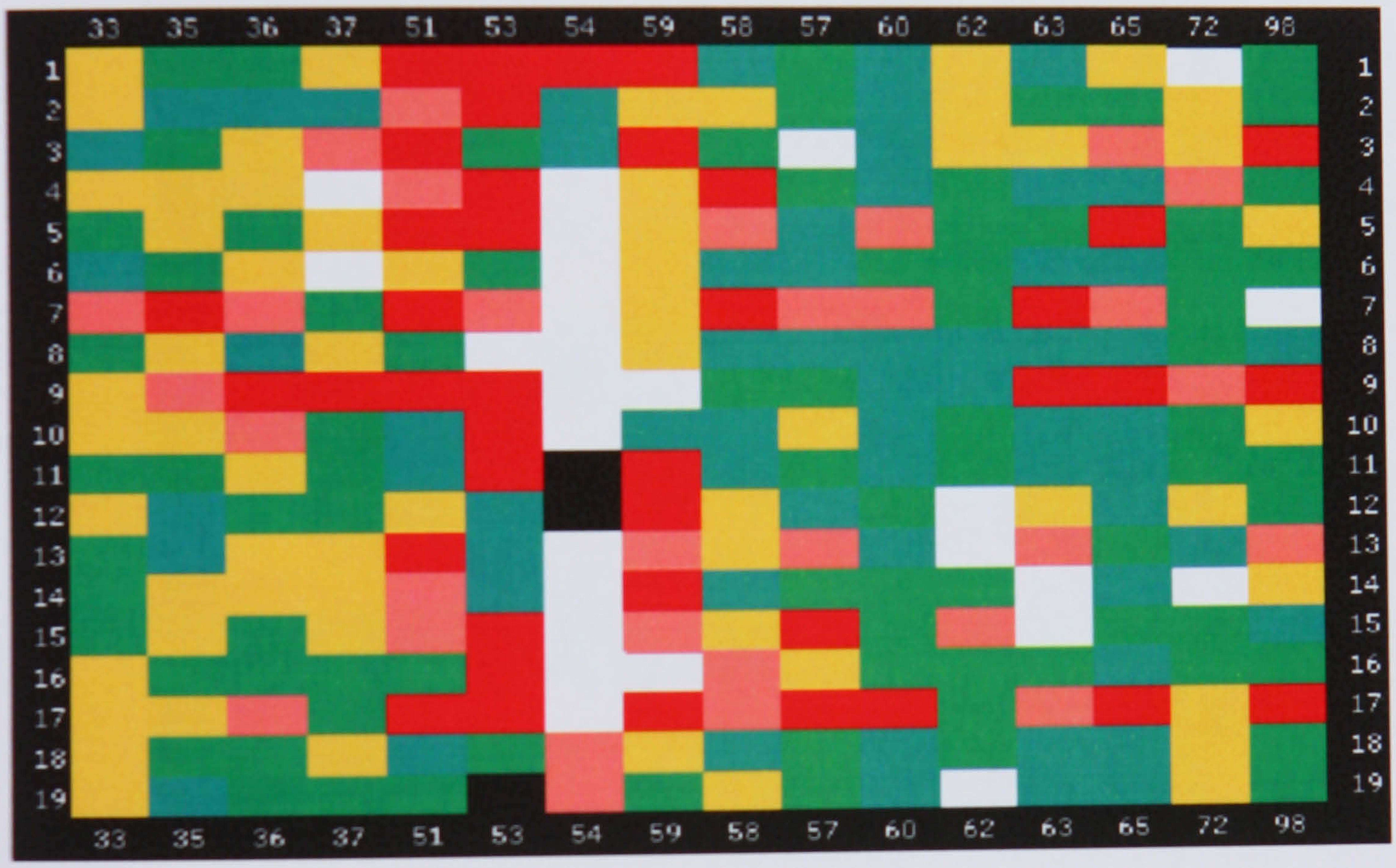


Illustration III. SITO: Mosaic of individual perceptions.

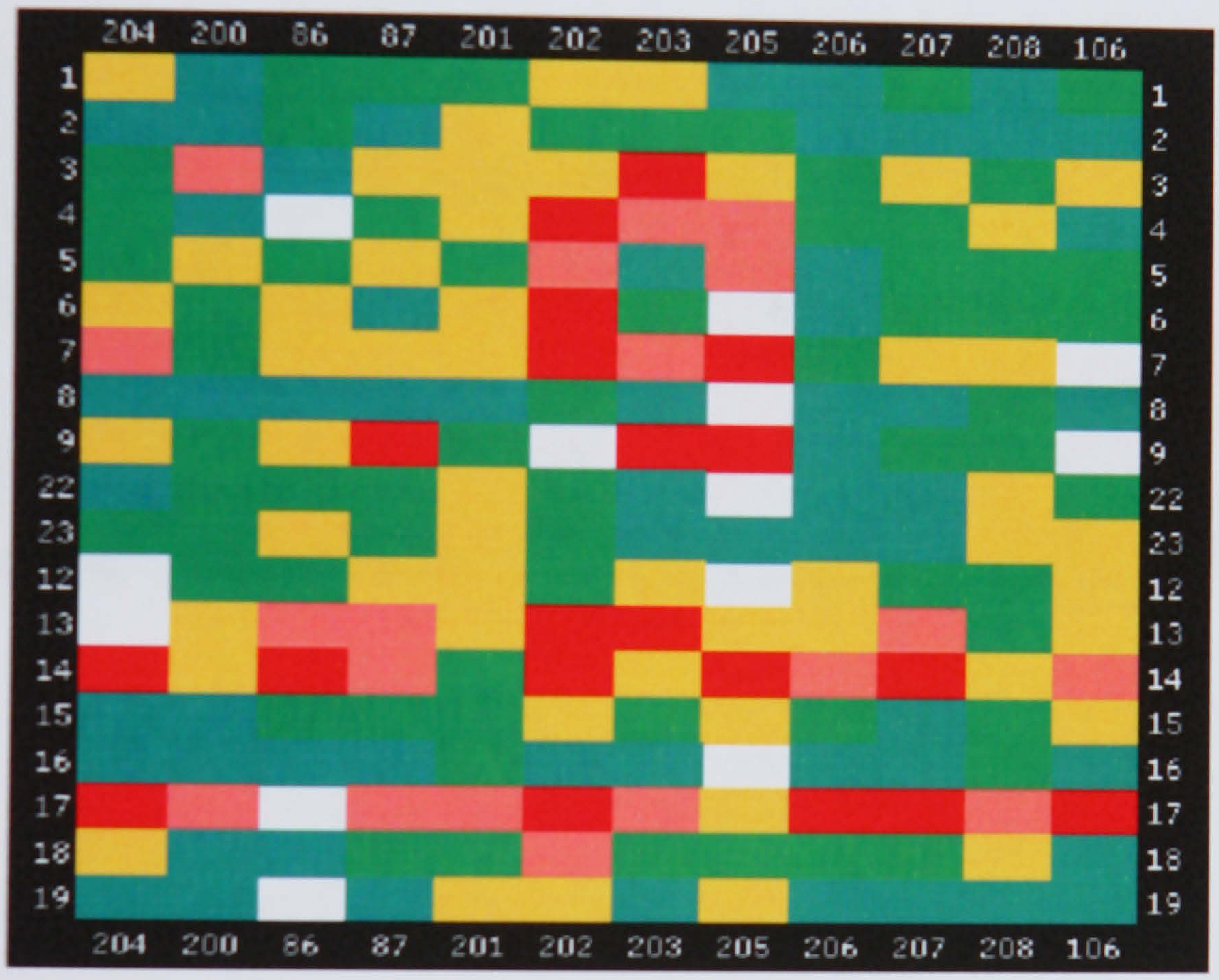


Illustration IV. POIETIC GENERATOR: Attitudes of participants.

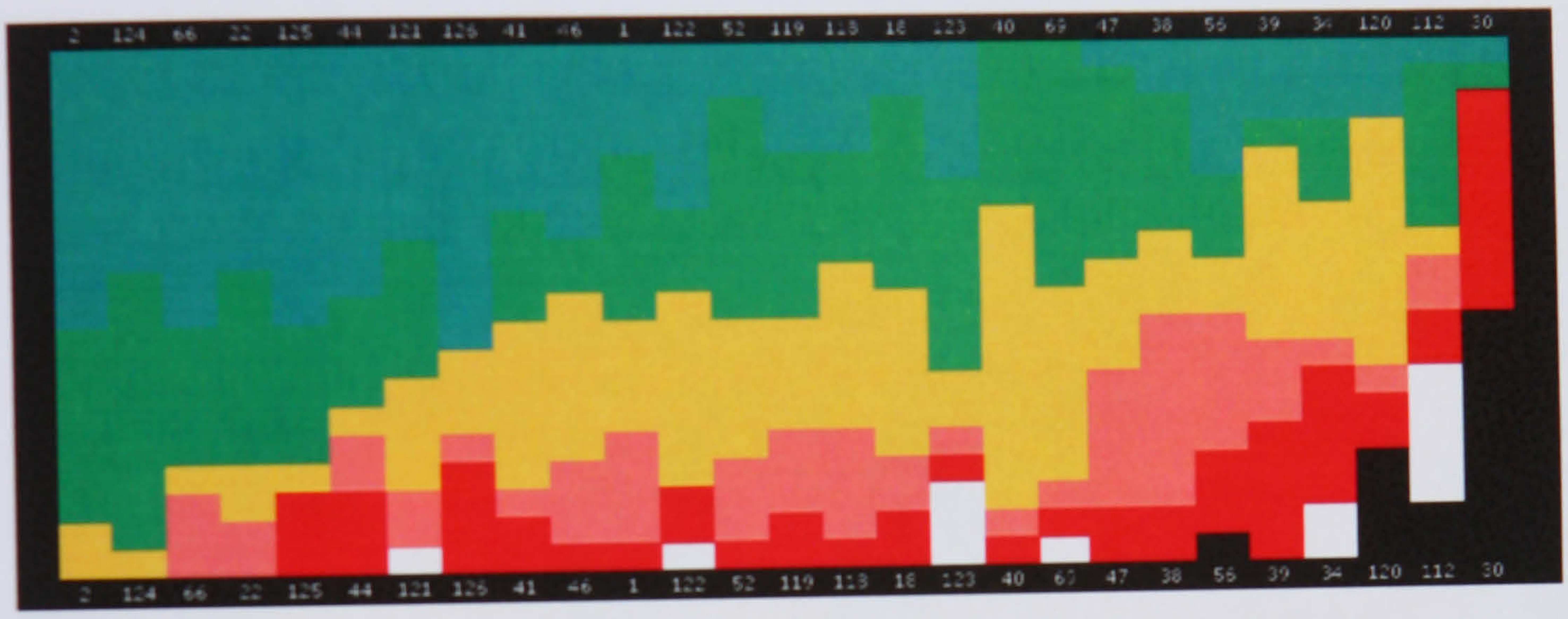


Illustration V. OPEN STUDIO: Attitudes of participants.

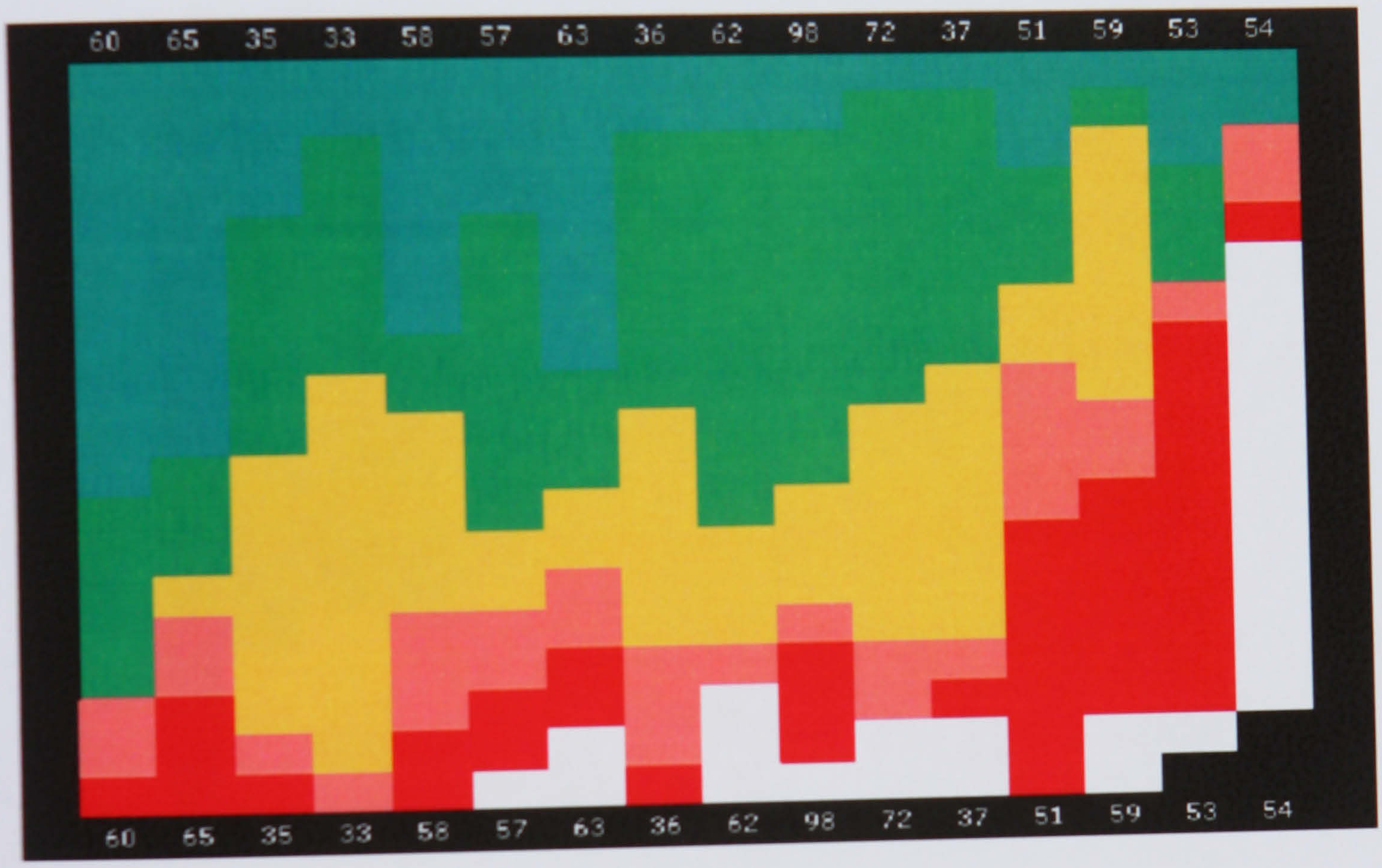


Illustration VI. SITO: Attitudes of participants.

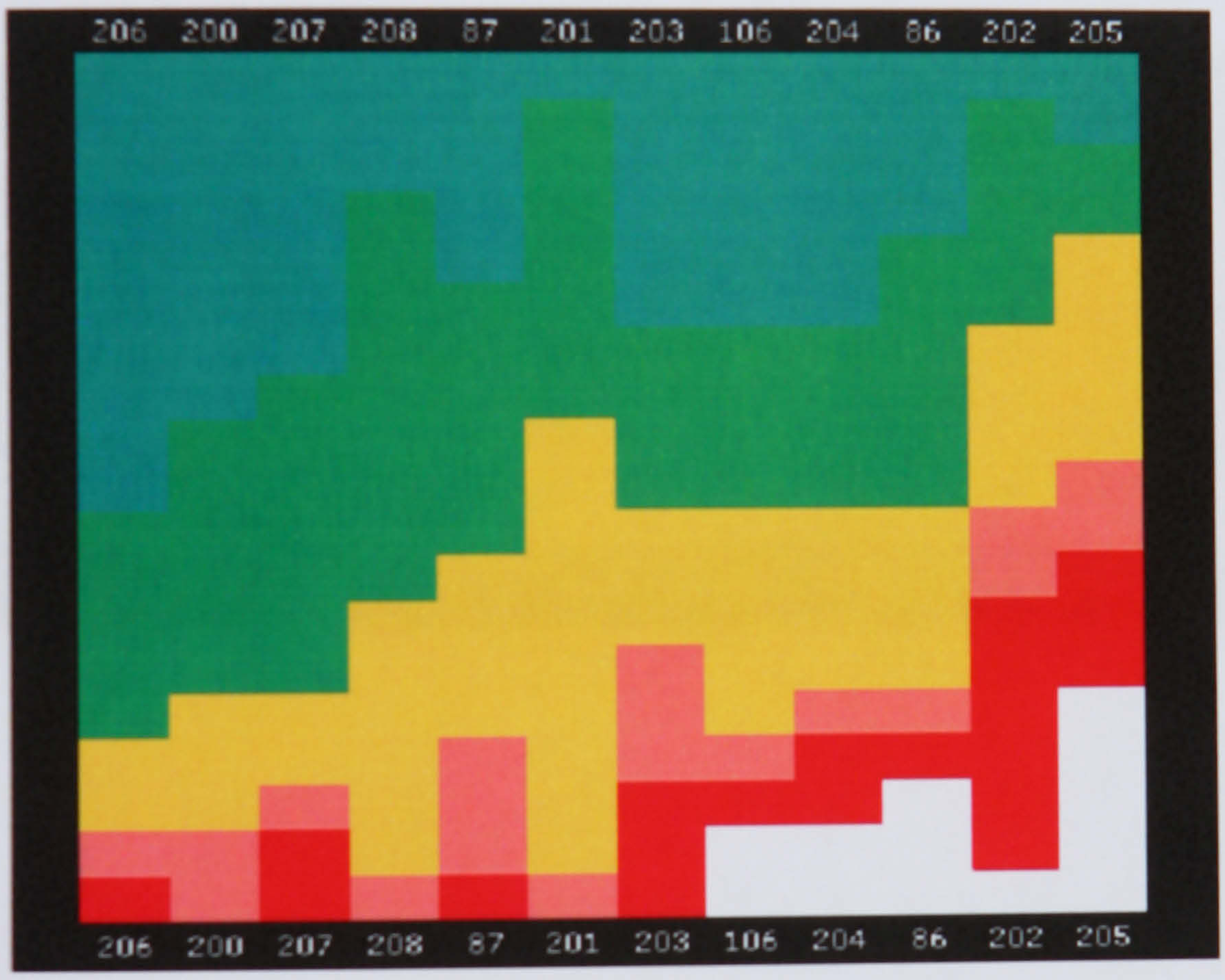


Illustration VII. POIETIC GENERATOR: Favourable (at the top) and unfavourable consensus (at the bottom).

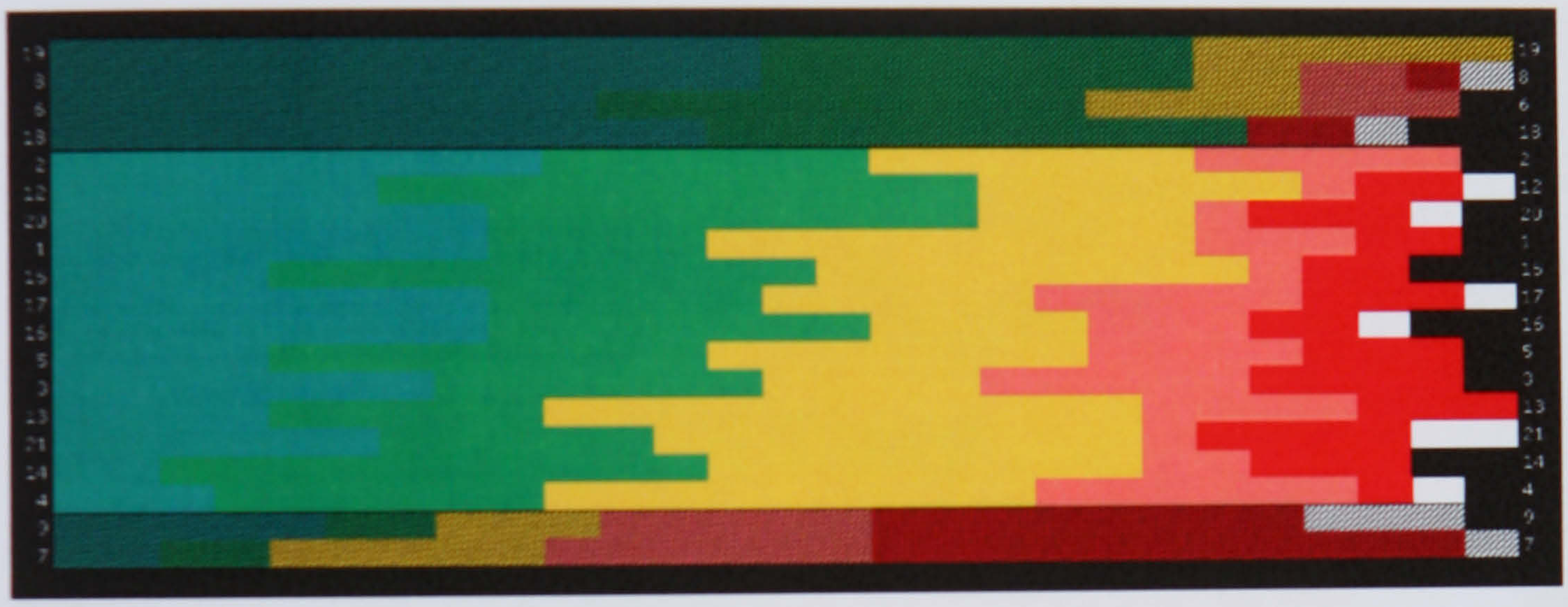


Illustration VIII. OPEN STUDIO: Favourable (at the top) and unfavourable consensus (at the bottom).

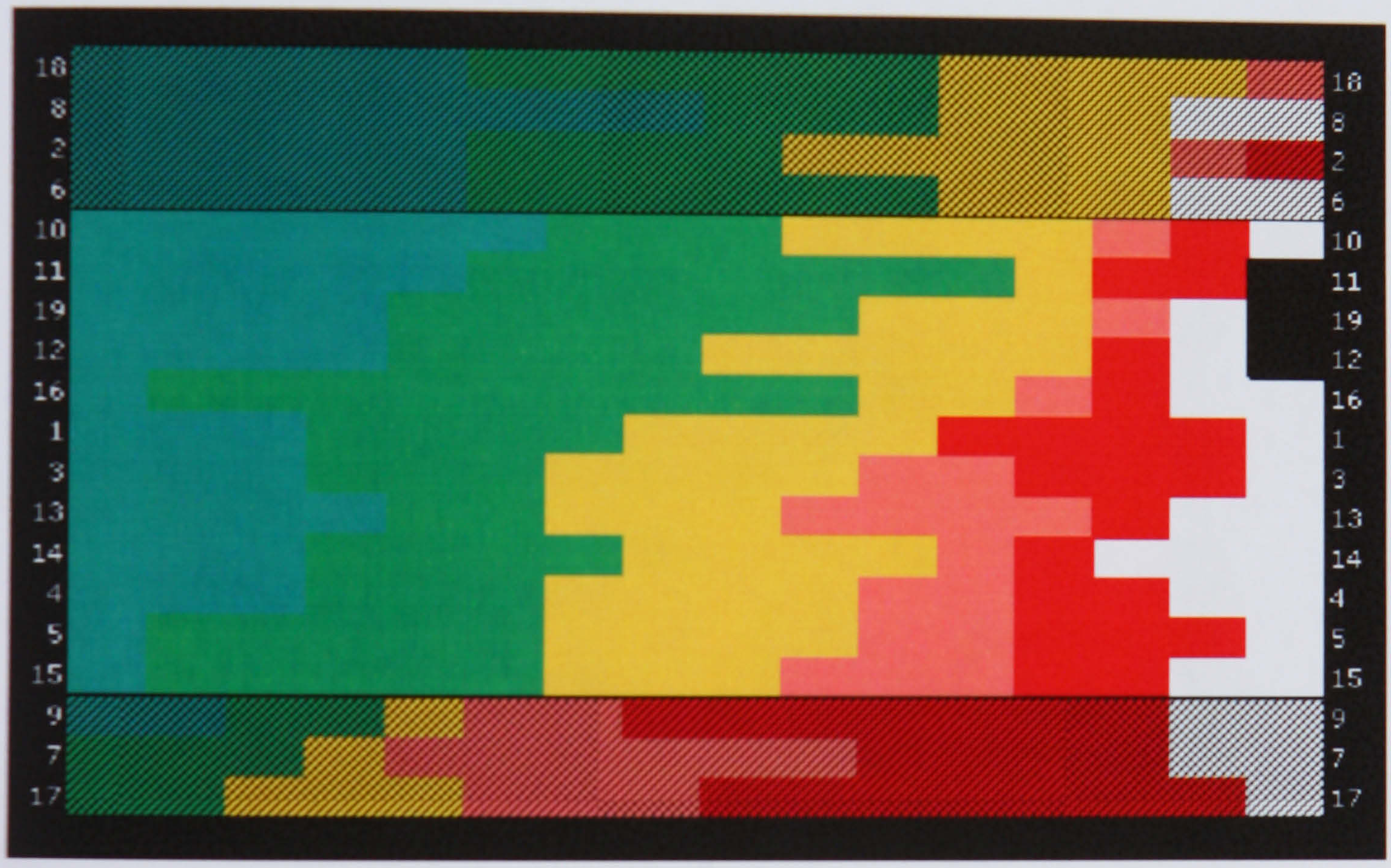


Illustration IX. SITO: Favourable (at the top) and unfavourable consensus (at the bottom).

Illustration X. POIETIC GENERATOR: Unfavourable consensus in relation to the theme "Place".

Illustration XI. OPEN STUDIO: Unfavourable consensus in relation to the theme "Place".

Illustration XII. SITO: Unfavourable consensus in relation to the theme "Place".

Illustration XIII. POIETIC GENERATOR: Anomalous positions.

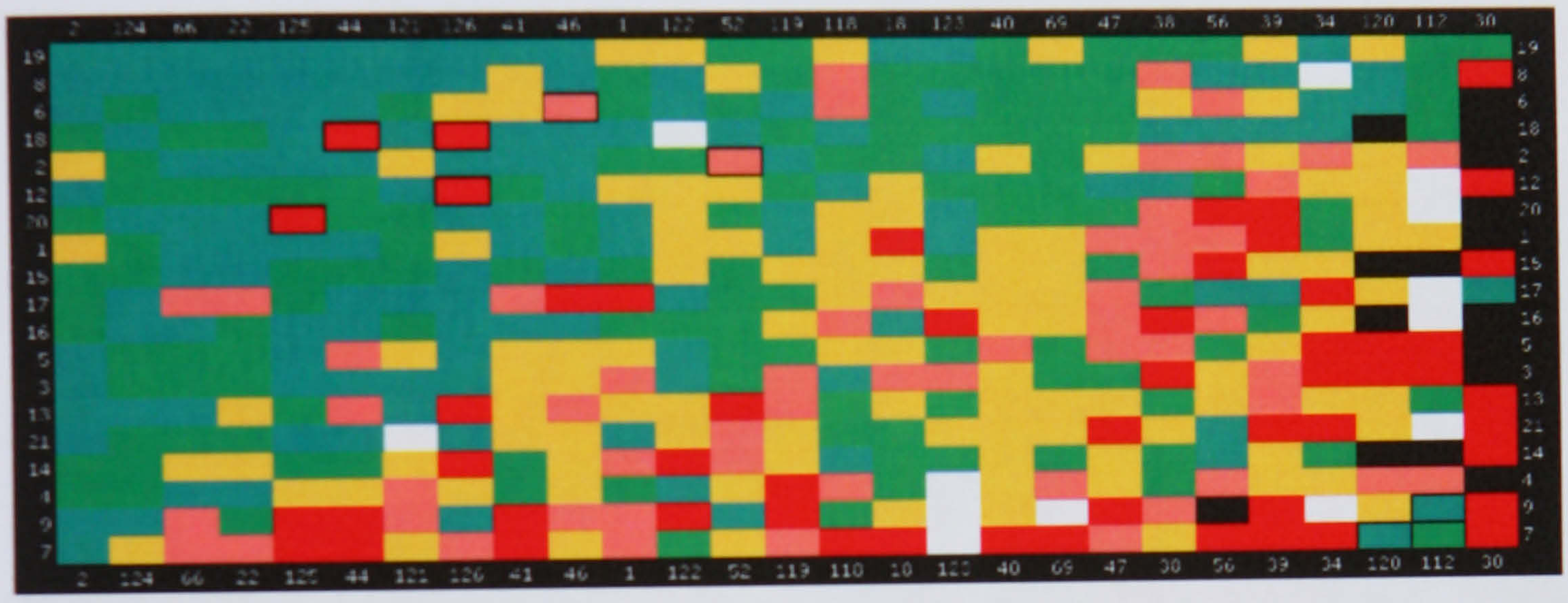


Illustration XIV. OPEN STUDIO: Anomalous positions.

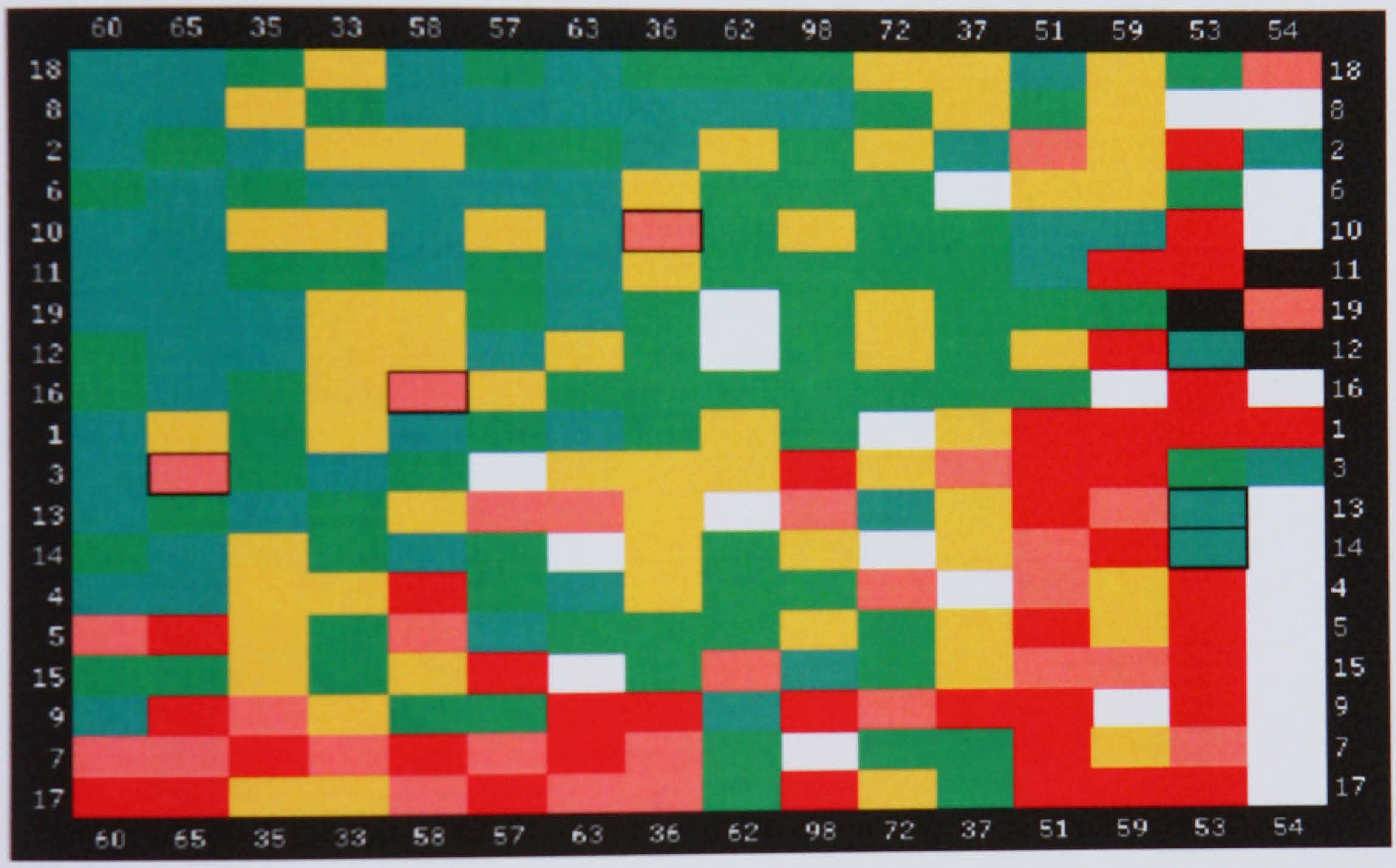


Illustration XV. SITO: Anomalous positions.

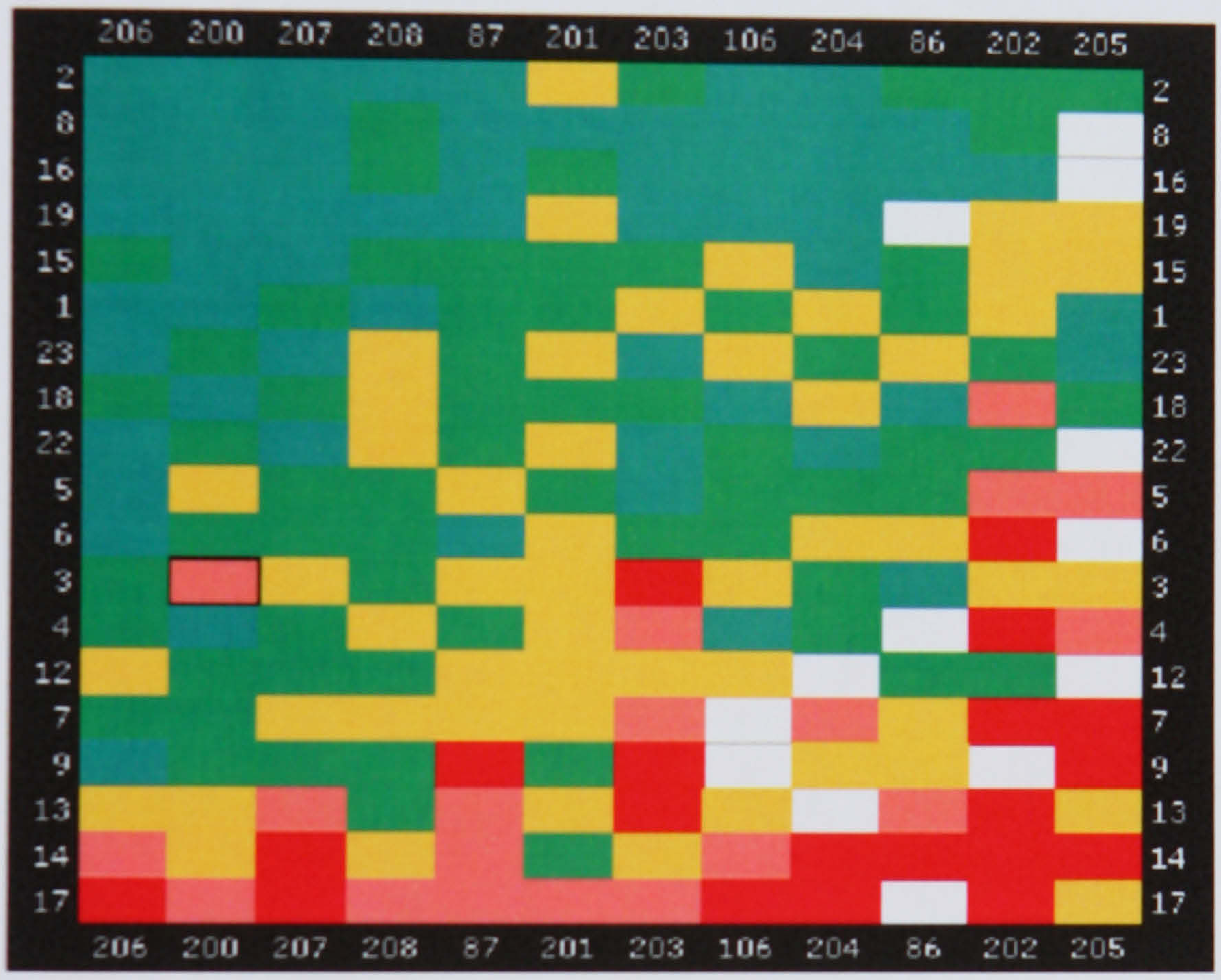


Illustration XVI. POIETIC GENERATOR: Emotional-existential path.

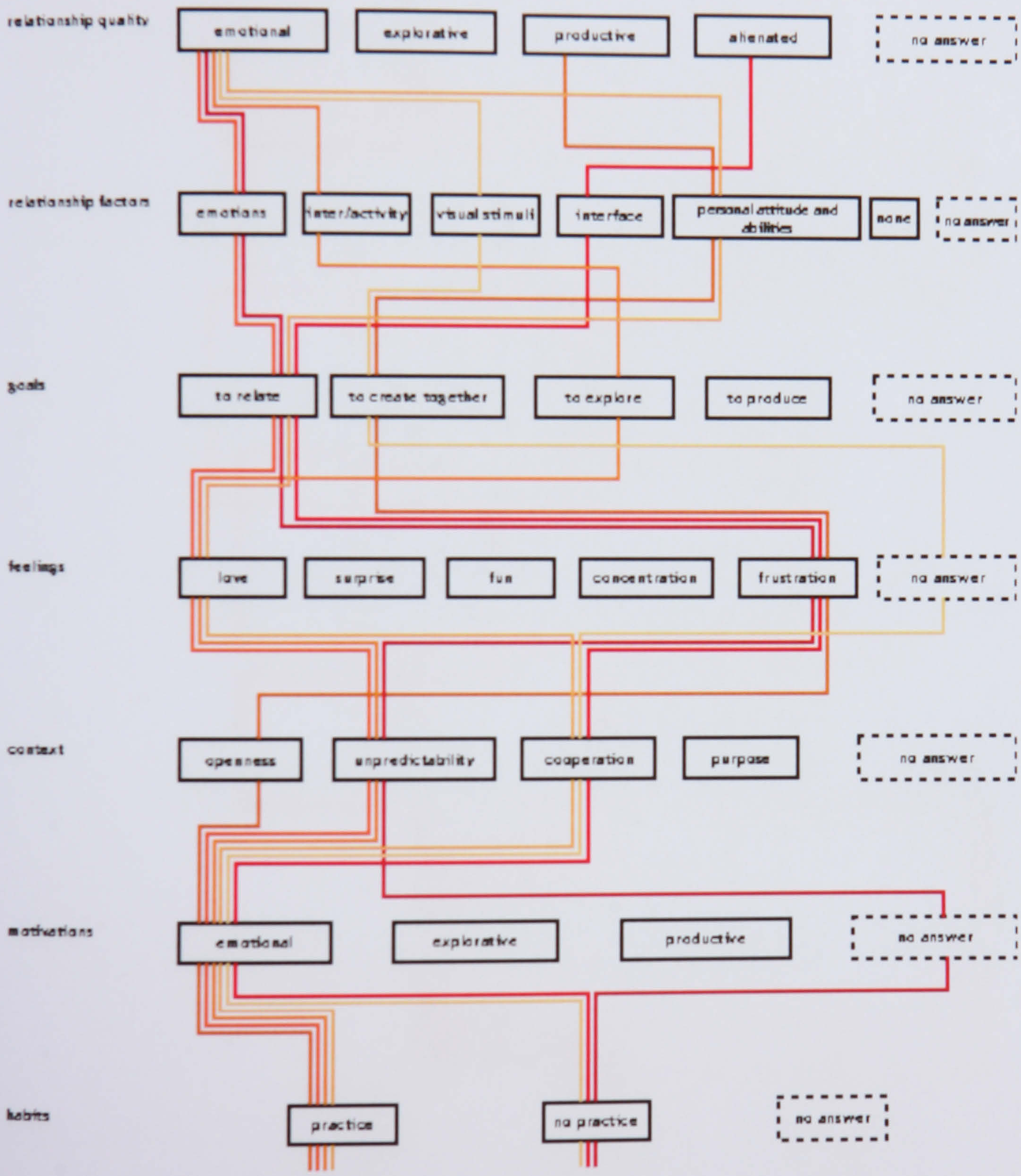


Illustration XVII. POIETIC GENERATOR: Explorative path.

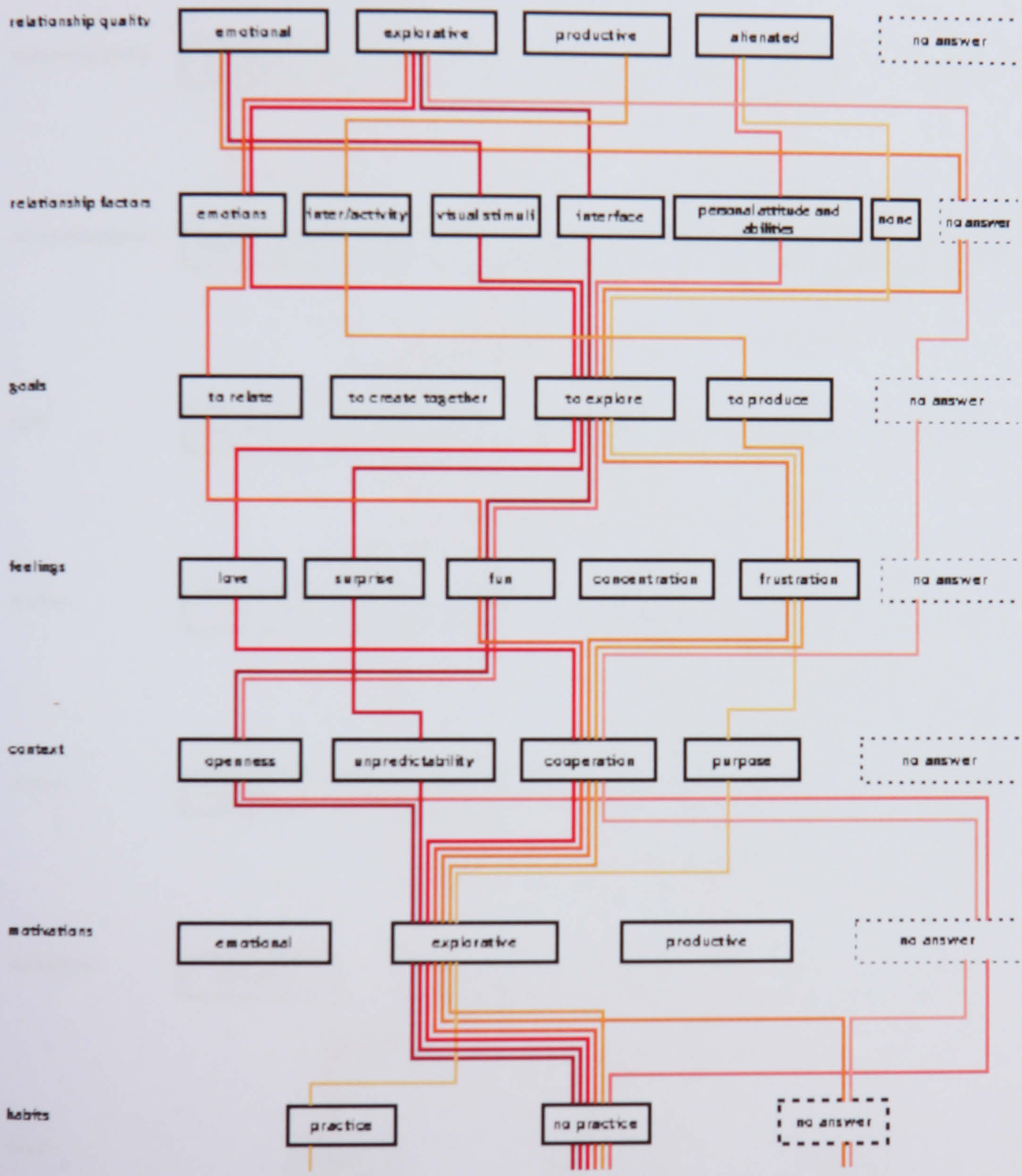


Illustration XVIII. POIETIC GENERATOR: Productive path.

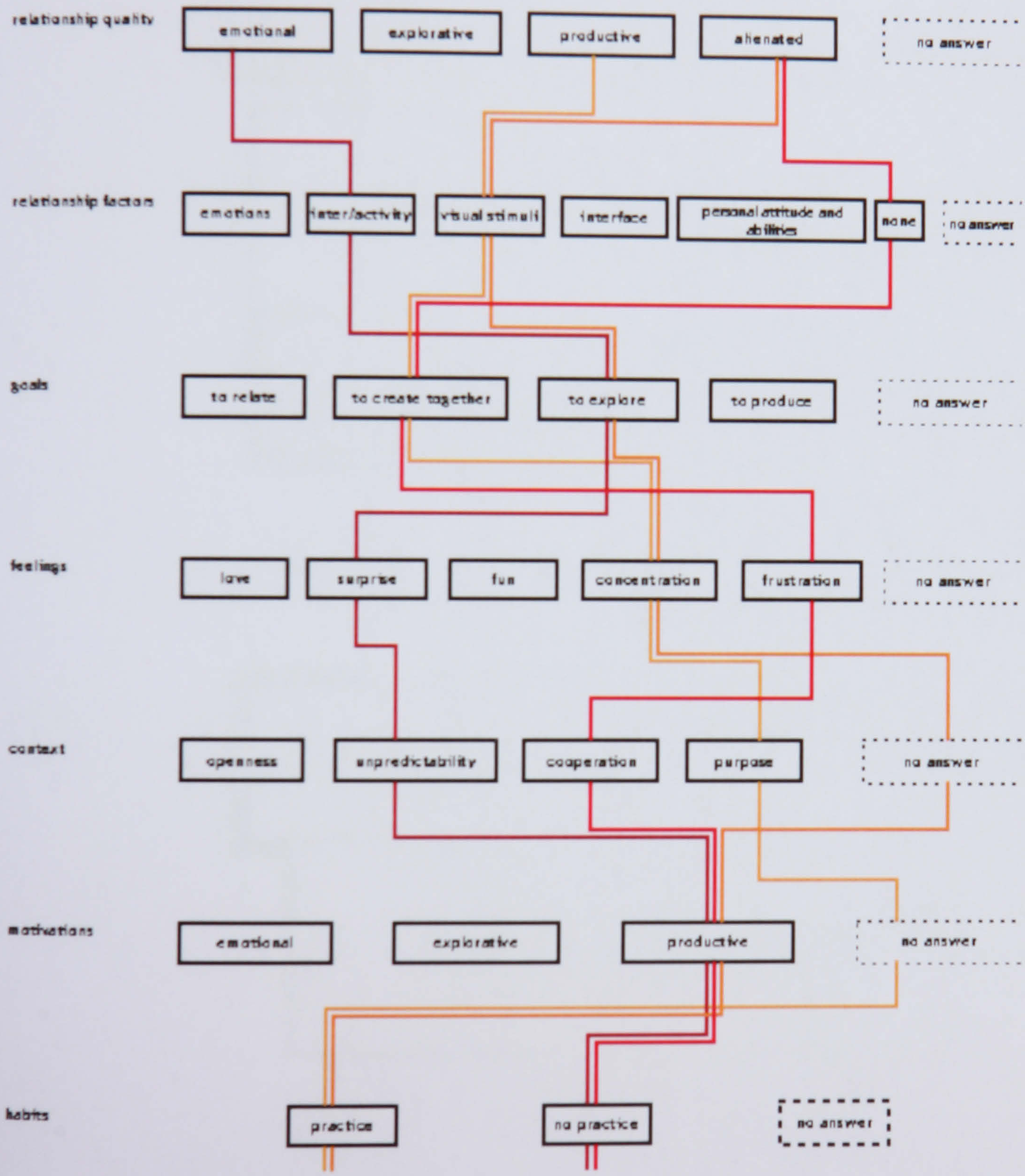


Illustration XIX. OPEN STUDIO: Emotional-existential path.

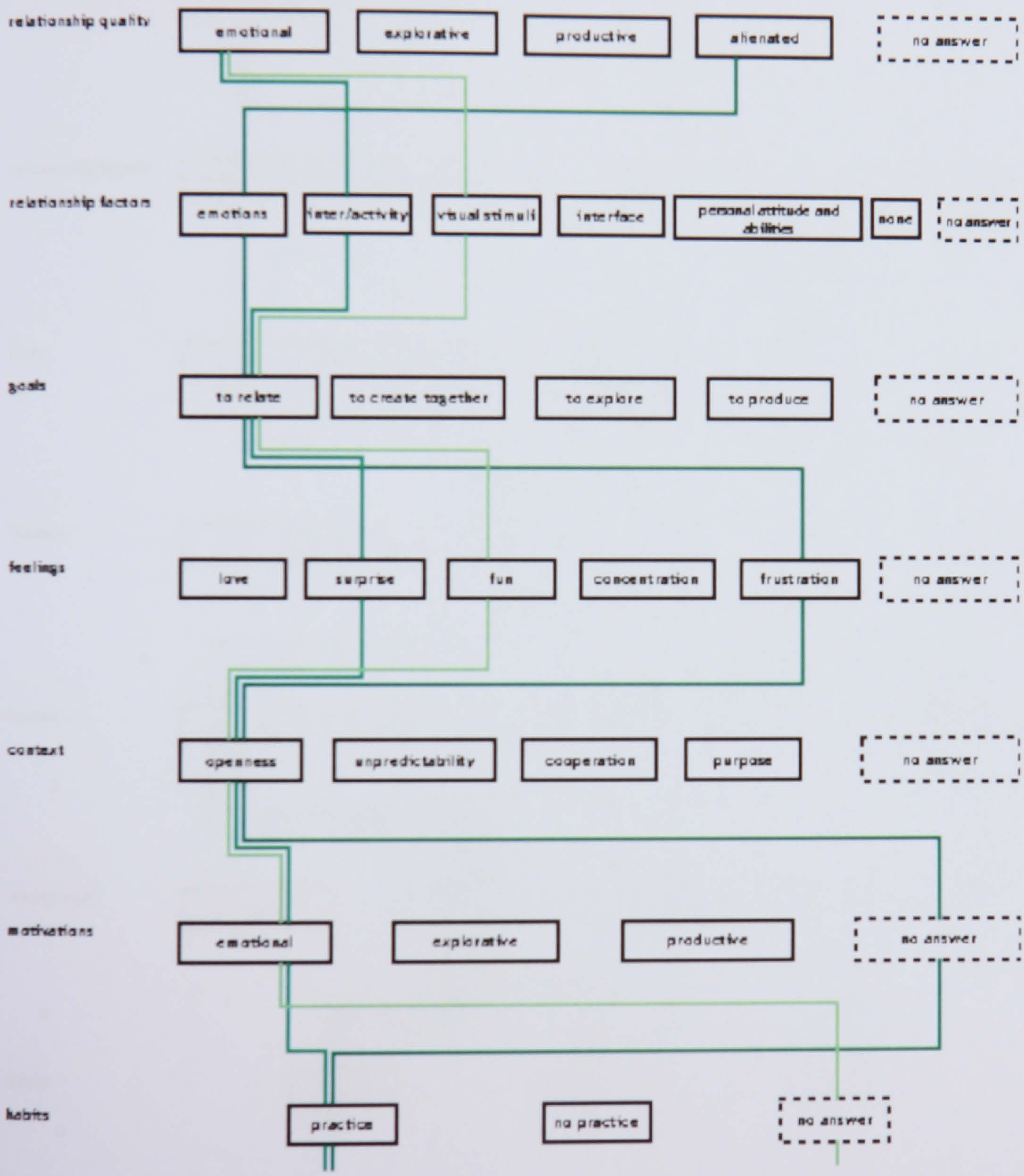


Illustration XX. SITO: Explorative path.

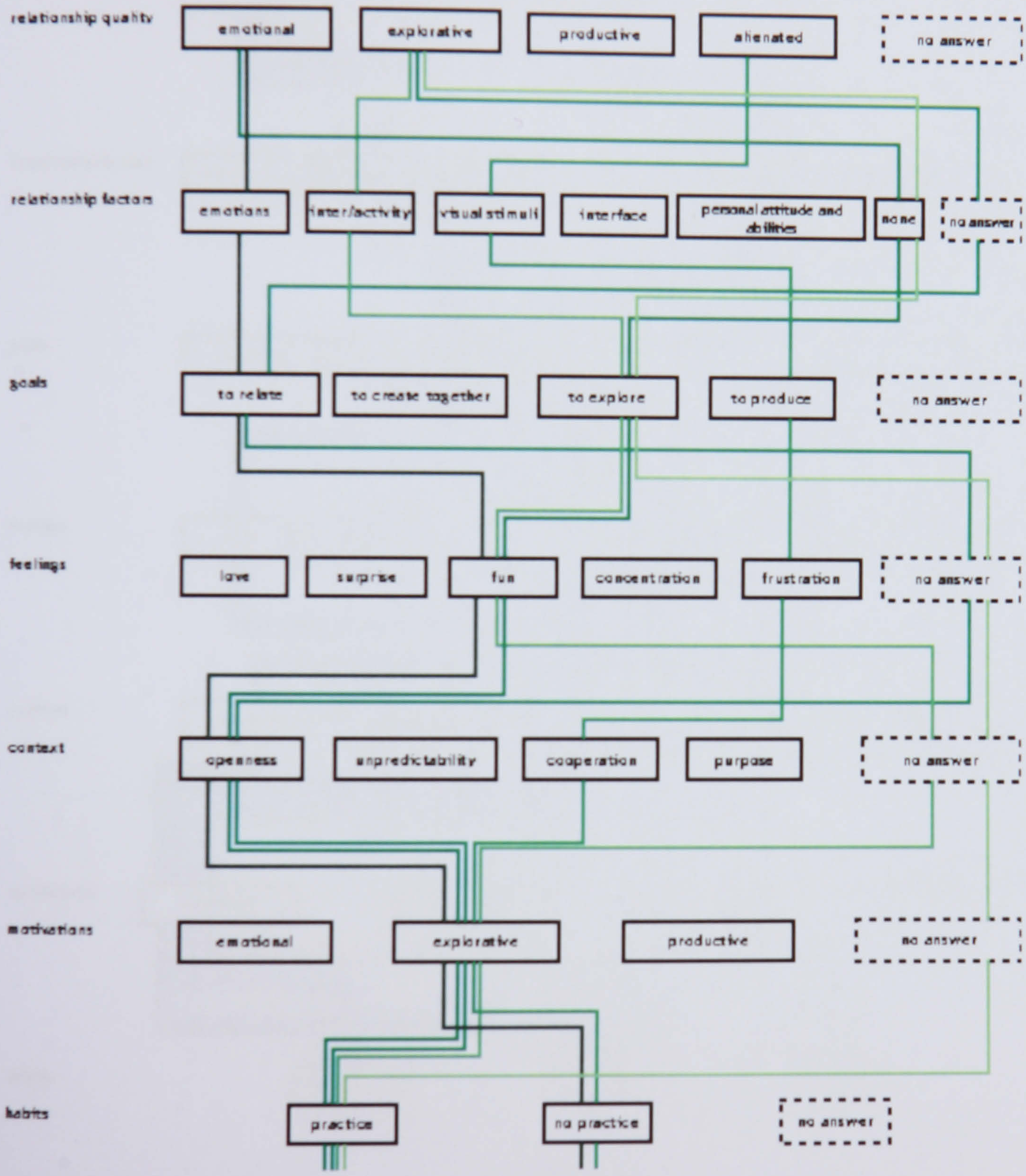


Illustration XXI. SITO: Emotional-existential path.

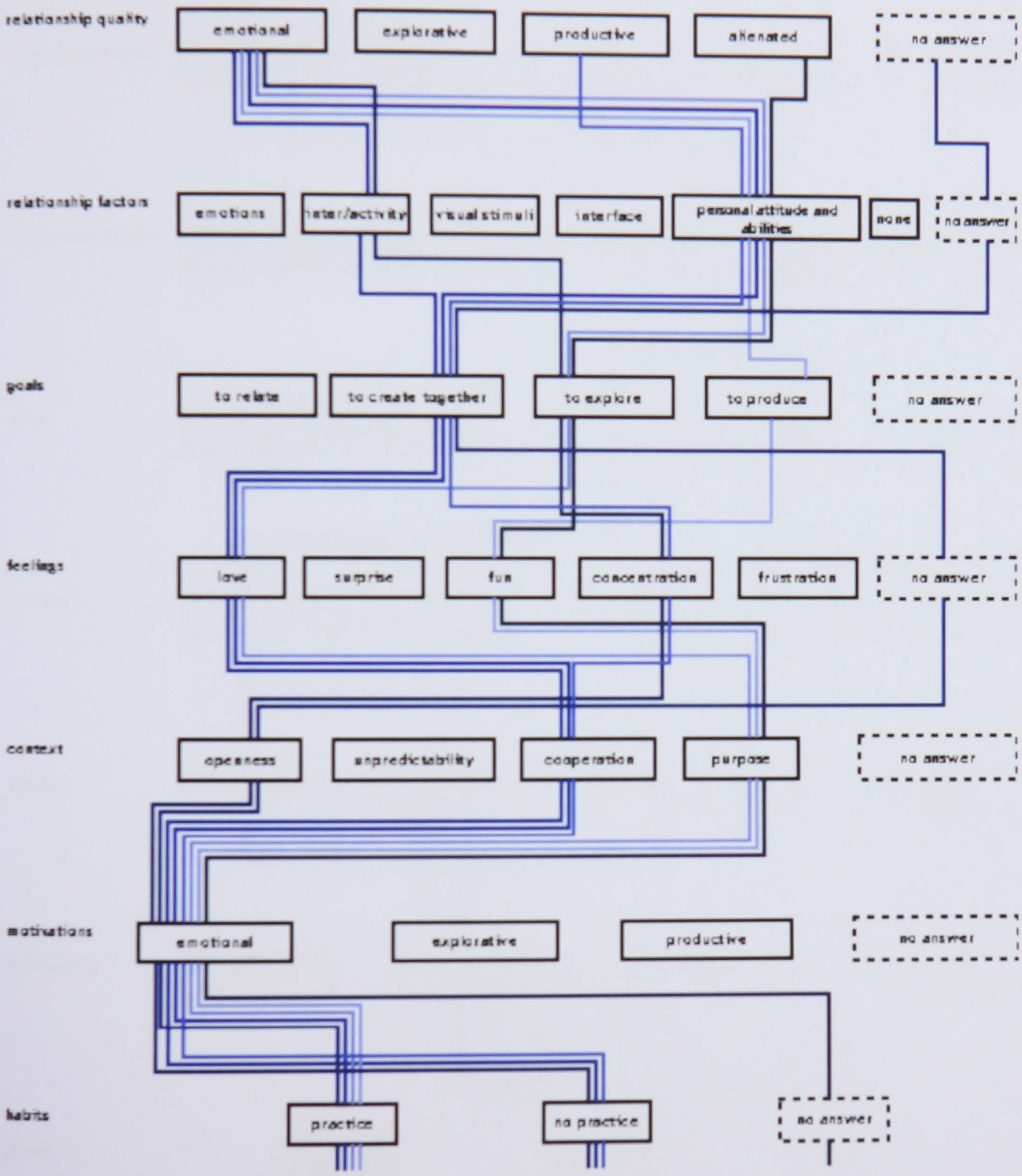


Illustration XXII. SITO: Explorative path.

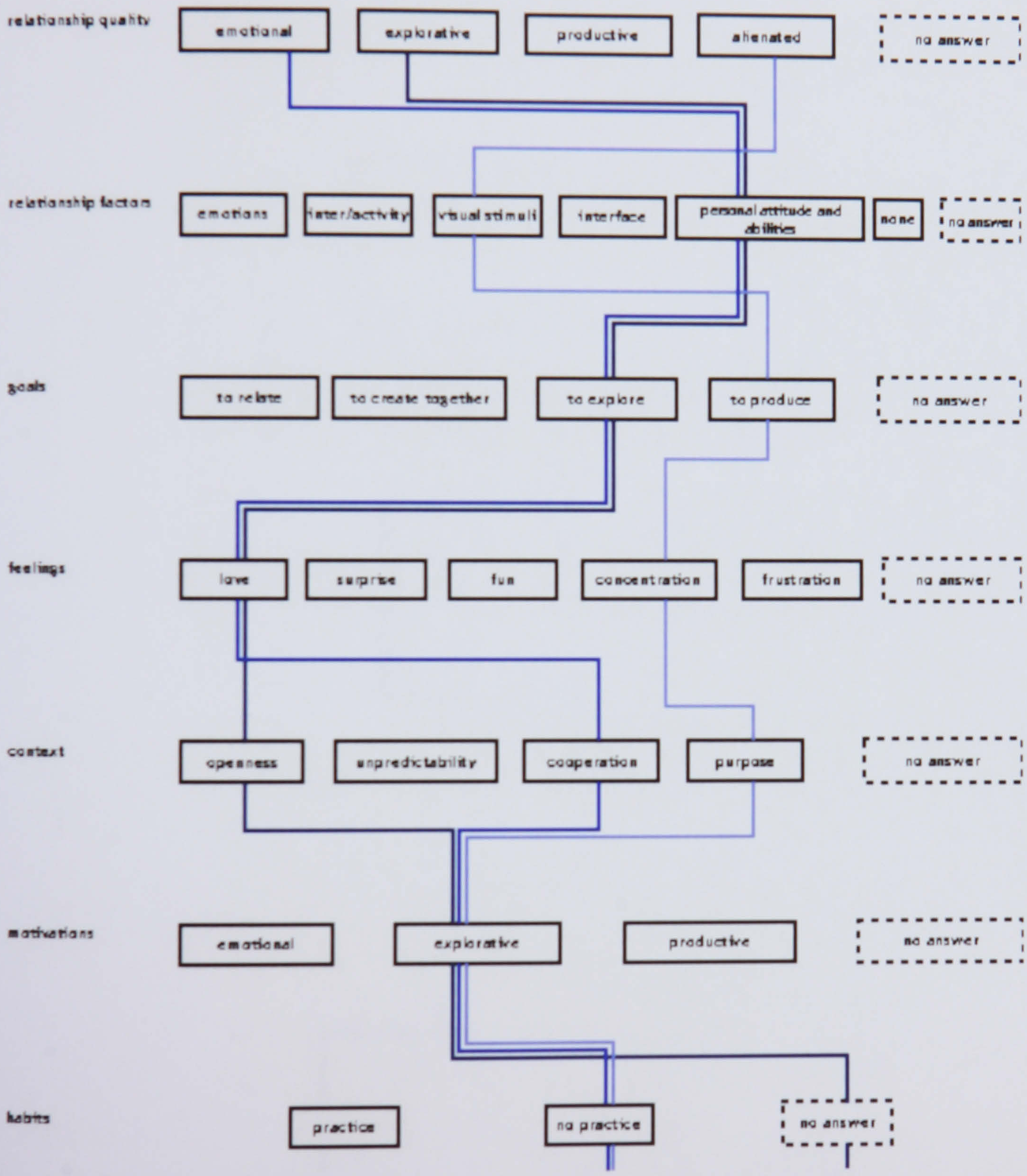


Illustration XXIII. SITO: Productive path.

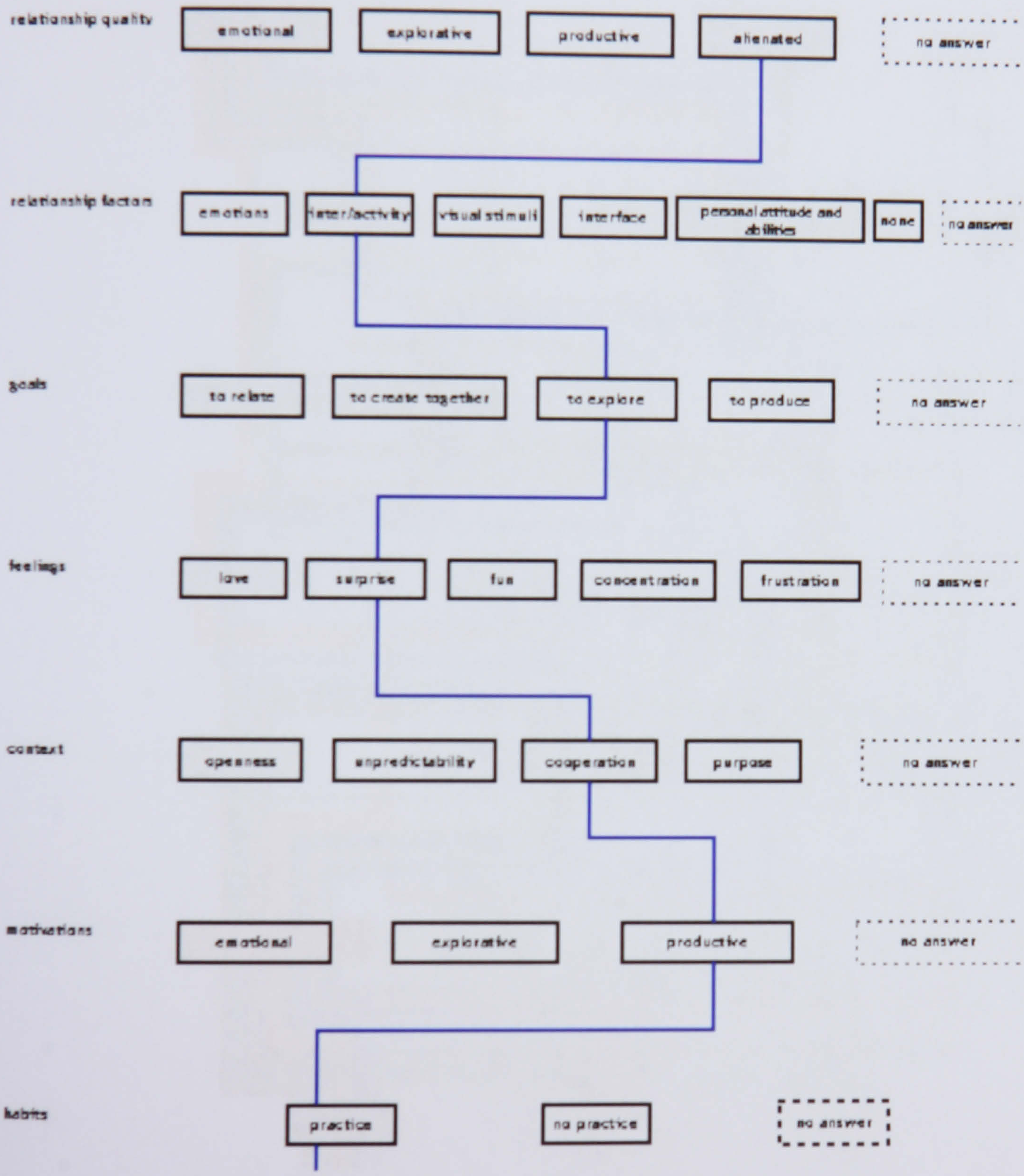


Illustration XXIV. General emotional-existential path.

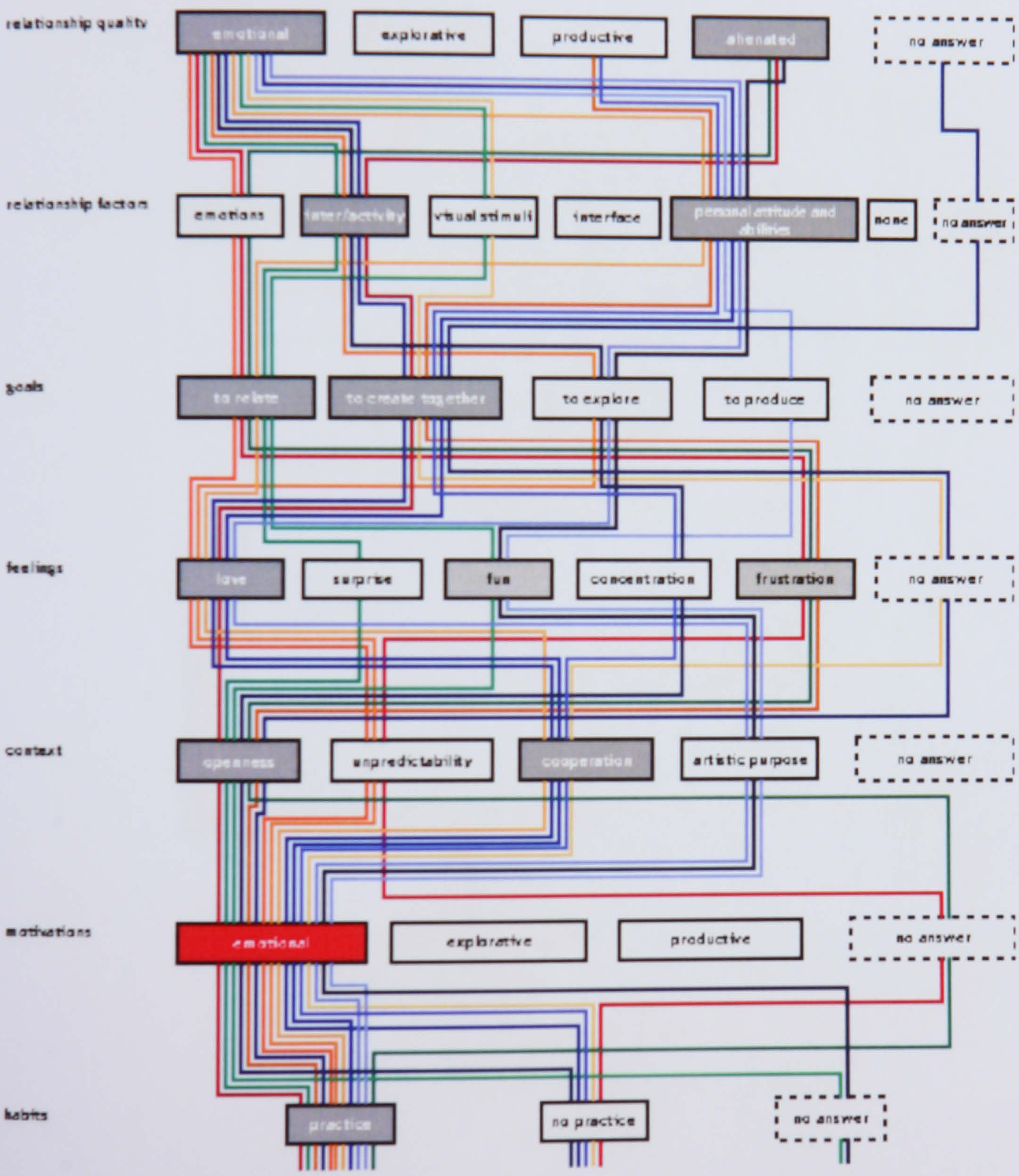


Illustration XXV. General explorative path.

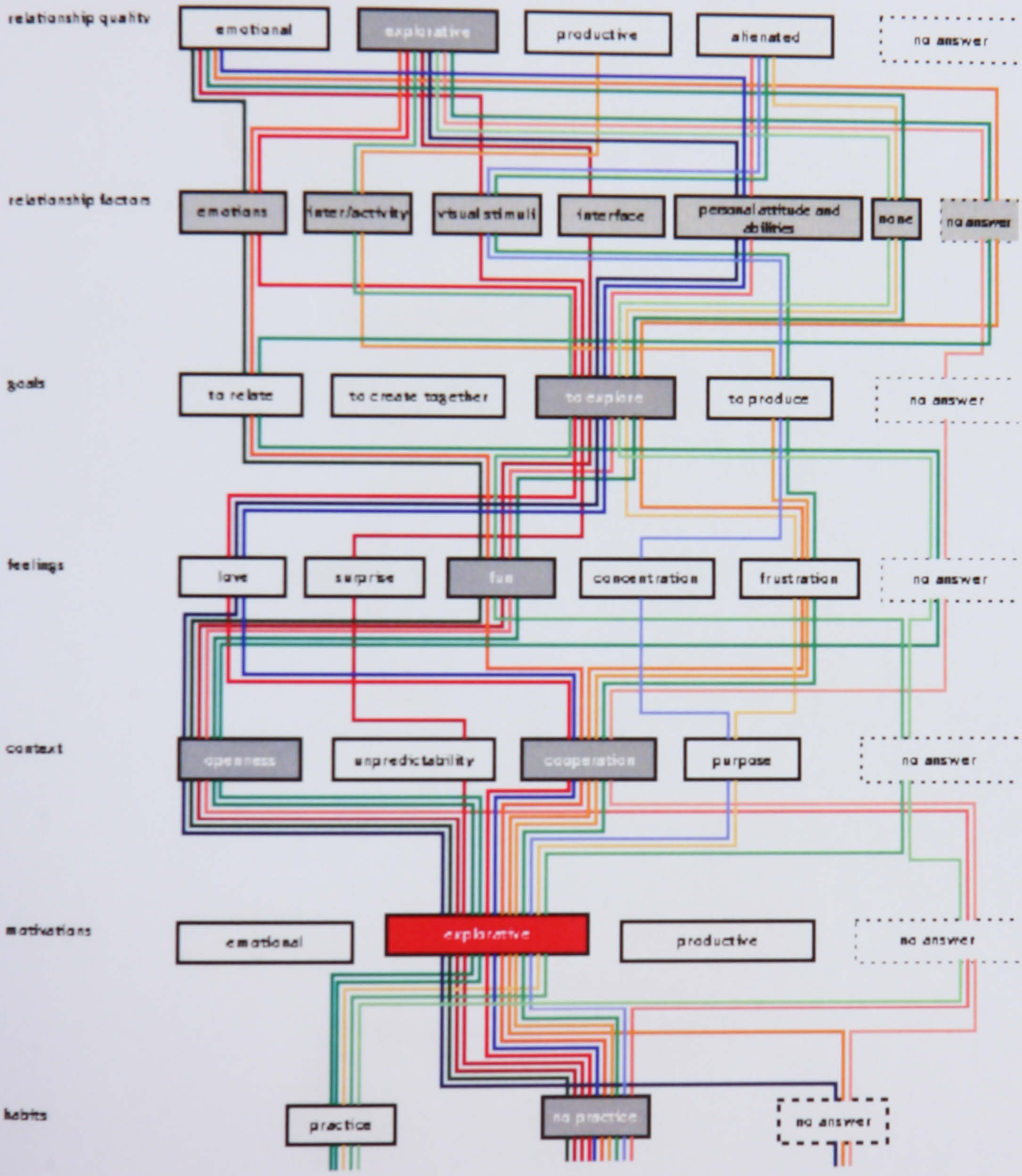


Illustration XXVI. General productive path.

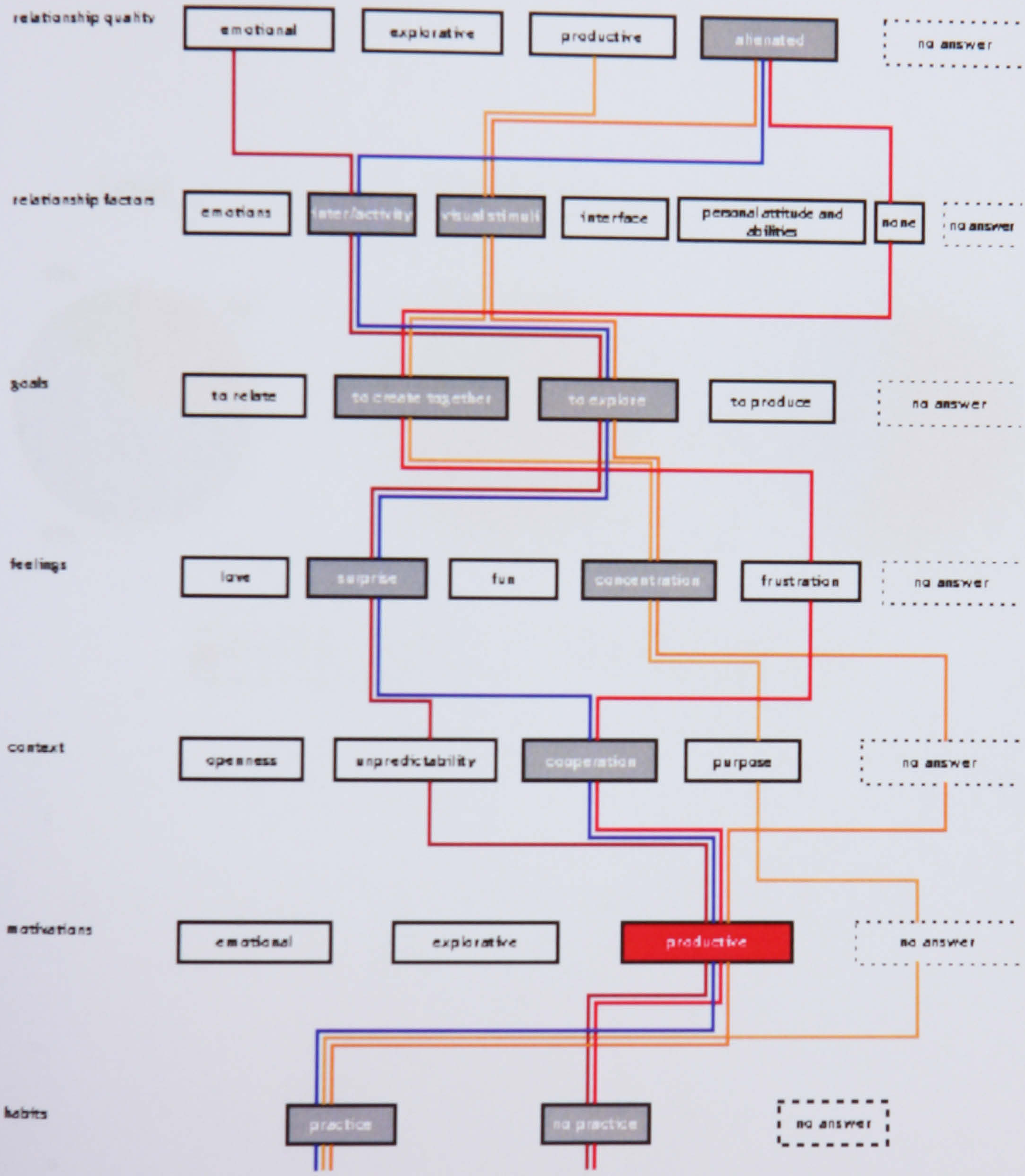
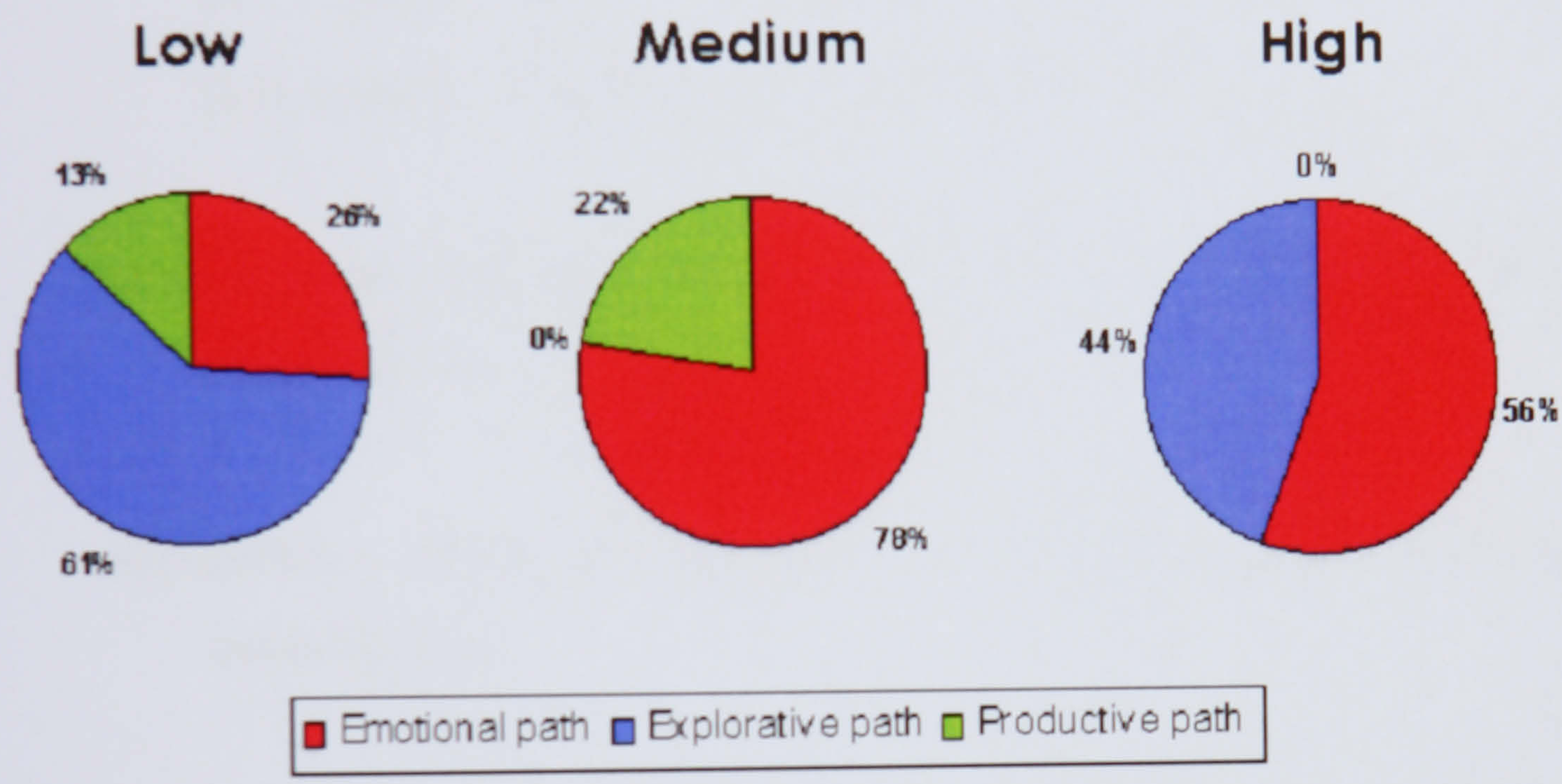


Illustration XXVII. Frequency of participations.



Bibliography

AGOSTON, T. C., UEDA, T., AND NISHIMURA, Y. (2000). "Pervasive Computing in a Networked World", in *INET2000: 10th Annual Internet Society Conference*, 18-21 July 2000, Yokohama, Japan. Available online: [http://www.isoc.org/inet2000/cdproceedings/3a/3a_1.htm].

AGRE, P. (1997). *Computation and Human Experience*. Cambridge, MA: Cambridge University Press.

ALEXANDER, C. (1964). *Notes on the Synthesis of Form*. Cambridge, MA: Harvard University Press.

ALEXANDER, C. (1979). *The Timeless Way of Building*. New York, NJ: Oxford University Press.

ALDERSEY-WILLIAMS, H., BOUND J., AND COLEMAN, R. (1999). "The Methods Lab. User Research for Design", in K. Hofmeester and E. de Charon de Saint Germain (eds.), *Presence: New Media for Older People*, pp. 121-157. Amsterdam: Netherlands Design Institute.

ALLEN, C. (1993). "Reciprocal Evolution as a Strategy for Integrating Basic Research, Design, and Studies of Work Practice", in Schuler, D. and Namioka, A. (eds.), *Participatory Design: Principles and Practices*, pp. 239-253. Hillsdale, NJ: Lawrence Erlbaum Associates.

ANZAI, T. (1994). "Renga Notes", Imagina94. Available online: [http://www.renga.com/archives/strings/note94/index.htm].

ARIAS, E. G., EDEN, H., FISCHER, G., GORMAN, A., AND SCHARFF, E. (1999). "Beyond Access: Informed Participation and Empowerment", in C. M. Hoadley and J. Roschelle, *Proceedings of the Computer Support for Collaborative Learning (CSCL) 1999 Conference*, pp. 20-32. Palo Alto, CA: Stanford University (Available from Mahwah, NJ: Lawrence Erlbaum Associates).

ARIAS, E., EDEN, H., FISCHER, G., GORMAN, A., AND SCHARFF, E. (2001). "Transcending the Individual Human Mind: Creating Shared Understanding through Collaborative Design", in J. Carroll (ed.), *Human Computer Interaction in the New Millennium*, pp. 347-372. Reading, MA: Addison-Wesley.

ARNHEIM, R. (1954). *Art and Visual Perception: A Psychology of the Creative Eye*. Berkeley: University of California Press.

ASCOTT, R. (1987). "The Telematic Moment", in M. Costa (ed.), *L'Estetica della Comunicazione*, pp.81-84. Salerno: Palladio Editrice.

ASCOTT, R. (1988). " On Networking", in *Leonardo*, vol. 21, no. 3, pp. 231-232.

ASCOTT, R. (1991). "Connectivity: Art and Interactive Telecommunications", in *Leonardo*, vol. 24, no. 2, pp. 115-118.

ASCOTT, R. (1993). "From Appearance to Apparition: Communications and Consciousness in the Cybersphere", in *Leonardo Electronic Almanac*, vol. 1, no. 2, October 1993. Available online: [http://mitpress2.mit.edu/e-journals/LEA/ARTICLES/ASCOTT.html].

ASCOTT, R. (1995a). "The Architecture of Cyberception", in M. Toy (ed.), *Architects in Cyberspace*, pp 38-41. London: Academy Editions.

ASCOTT, R. (1995b). "The A-Z of Interactive Arts", in *Leonardo Electronic Almanac*, Vol. 3, No. 11, November 1995.

ASCOTT, R. (2002). "Navigating Consciousness: Art and Transformative Technologies", in M. Costa, F. Forest, and A. Bureaud (eds.), *Artmedia VIII: From Aesthetics of Communication to Net Art*, 29 November-2 December 2002, Paris: ArtPress. Available online: [http://www.olats.org/projetpart/artmedia/2002eng/actes.html].

ASCOTT, R. (2003). *Telematic Embrace: Visionary Theories of Art, Technology, and Consciousness*. Edited and with an essay by Edward A. Shanken. Berkeley: University of California Press.

ASCOTT, R. (ed.) (1999). *Reframing Consciousness: Art, Mind and Technology*. Exeter: Intellect Books.

AUBER, O. (2002). "Esthétique de la Perspective Numérique", in M. Costa, F. Forest, and A. Bureaud (eds.), *Artmedia VIII: From Aesthetics of Communication to Net Art*, 29 November-2 December 2002, Paris. Available online: [http://www.olats.org/projetpart/artmedia/2002/t_oAuber.html].

AUBER, O. (2003a). "M-Point de Fuite! Esquisse d'une Filiation des Perspectives Spatiale, Temporelle, Numérique", online text. Available online: [http://poietic-generator.net/article.php3?id_article=46#nb3].

AUBER, O. (2003b). "Du Générateur Poï étique à la Perspective Numérique", online text. Available online: [http://km2.net/article.php3?id_article=96].

BAUMGARTEL, T. (2001). "Net Art: On the History of Artistic Work with Telecommunications Media", in P. Weibel and T. Druckrey (eds.) (2001), *Net_Condition: Art and Global Media*, pp. 152-161. Graz, Austria: Steirischer Herbst; Karlsruhe, Germany: ZKM/Center for ART and Media; Cambridge, MA: MIT Press.

BECKER, H., AND GEER, B. (1957). "Participant Observation and Interviewing: A Comparison", in *Human Organization*, vol. 16, no. 3, pp. 28-35.

BENTLEY, P. AND CORNE, D. (eds.) (2002). *Creative Evolutionary Systems*. San Francisco, CA: Morgan Kaufmann; San Diego, CA: Academic Press.

BENTLEY, P. J. (2000). "Exploring Component-Based Representations: The Secret of Creativity by Evolution?", in I. C. Parmee (ed.), *Evolutionary Design and Manufacture: Selected Papers from ACDM'00*. London; New York: Springer.

BENTLEY, P. J. (ed.) (1999). *Evolutionary Design by Computers*. San Francisco, CA: Morgan Kaufman Publishers Inc.

BERGSON, H. (1964). *Creative Evolution*. London: Macmillan. Translation of "Evolution Créatrice", authorized by Arthur Mitchell. First published 1911.

BIJKER, W. E. (1995). *Of Bicycles, Bakelites, and Bulbs: Toward a Theory of Sociotechnical Change*. Cambridge, MA: MIT Press.

BIKSON, T. K., AND EVELAND, J. - D. (1996). "Groupware Implementation: Reinvention in the Sociotechnical Frame", in *Computer Supported Cooperative Work '96*. Cambridge, MA: ACM Press.

BOLSTROM, R. P. AND HEINEN, J. S. (1977). "MIS Problems and Failures: A Socio-Technical Perspective, Part II: The Application of Socio-Technical Theory", in *MIS Quarterly*, vol. 1, no. 4, pp. 11-28.

BORDINI, S. (2000). "Arte Elettronica", in *Art Dossier*, no. 156. Firenze: Giunti.

BORILLO, M., AND GOULETTE, J.-P. (2002). *Cognition and Création: Explorations Cognitives des Processus de Conception*. Sprimont: Pierre Margada.

BOURDIEU, P., AND WACQUANT, L. J. D. (1993). *An Invitation to Reflexive Sociology.* Chicago: University of Chicago Press.

BOURRIAUD, N. (1998). *Pour une Esthetique Relationnelle*. Dijon: les Presses du Réel.

BRADFORD, R. (1994). *Roman Jakobson: Life, Language, Art*. New York: Routledge.

BRAND, S. (1995). *How Buildings Learn: What Happens After They're Built*. New York: Penguin Books.

BRANZI, A. (1999). *Introduzione al Design Italiano.* Milano: Baldini&Castaldi.

BRAS, B. A., AND MISTREE, F., (1991). "Designing Design Processes in Decision-Based Concurrent Engineering", in *SAE Transactions, Journal of Materials & Manufacturing*, no. 100, pp. 451-458.

BRUNER, J. (1996). *The Culture of Education*. Cambridge, MA: Harvard University Press.

BRUNER, J. D., GOODNOW, J. J., AND AUSTIN, G A. (1972). "Categories and Cognition", in J. P. Sprandley (ed.), *Culture and Cognition*, pp. 168-190. New York: Chandler.

BUCHANAN, R., AND MARGOLIN, V. (eds.) (1995a). *Discovering Design: Explorations in Design Studies*. Chicago: University of Chicago Press.

BUCHANAN, R., AND MARGOLIN, V. (eds.) (1995b). *The Idea of Design*. Cambridge, Mass: MIT Press.

BUREAUD, A. (2002). "Communication Art, Network Art, Net Art", in M. Costa, F. Forest, and A. Bureaud (eds.), in *ArtPress*, no. 282, spéciale Artmedia VIII, December 2002, p. 11. Paris: ArtPress édition.

CALLON, M. AND LATOUR, B. (1981). "Unscrewing the Big Leviathan: How Actors Macro-Structure Reality and How Sociologists Help Them to Do So", in K. Knorr-Cetina and A. Cicourel (eds.), *Advances in Social Theory and Methodology: Toward an Integration of Micro- and Macro-Sociologies*, pp. 277-303. Boston, London, and Henley: Routledge & Kegan Paul.

CARD, S.K., MORAN, T.P., AND NEWELL, A. (1983). *The Psychology of Human-Computer Interaction*. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

CARMAGNOLA, F. (1989). *La Visibilità: Per una Estetica dei Fenomeni Complessi*. Milano: Guerini e Associati.

CARMAGNOLA, F. (1998). *Parentesi Perdute: Crisi della Forma e Ricerca del Senso nell'Arte Contemporanea*. Milano: Guerini e Associati.

CARMEL, E., WHITAKER, R. D., AND GEORGE, J. F. (1993). "PD and Joint Application Design: A Translatantic Comparison", in *Communications of the ACM*, vol. 36, no. 6, pp. 40-48.

CASEY, E. S. (1997). *The Fate of Place: A Philosophical History*. Berkeley: University of California Press.

CASTELLS, M. (1996). *The Rise of the Network Society*. Oxford, UK; Malden, MA: Blackwell Publishers Inc.

CATHRO, W. (1997). "Metadata: An Overview", paper given at Matching Discovery and Recovery, seminar, August 1997. Available online: [http://www.nla.gov.au/nla/staffpaper/cathro3.html].

CAU, P. (1988). "La Produzione del Nuovo Ambiente", in *Alfa Bis: Metamorfosi delle Materie*, no. 106/10, Marzo 1988, pp. VII-VIII. Milano: Edizioni Caposile.

CESERANI, G. P. (1988). *Appuntamento a Babele: Studio sull'Uomo Comunicatore*. Milano: U. Hoepli.

CHALMERS, M. (1999). "Structuralist Informatics: Challenging Positivism in Information Systems", in *Proceedings Conference UK Academy for Information Systems*, pp. 13-22. McGraw-Hill.

CHAPMAN, J. (2002). *WWW.Animation*. New York: Watson-Guptill Publications.

CHAPUT, T. AND LYOTARD, J.-F. (1985). *Les Immateriaux*. Paris: Centre Georges Pompidou.

CLARK, A. (1997). *Being There: Putting Brain, Body and World Together Again*. Cambridge, MA: MIT Press.

COSTA, M. (1998). *Il Sublime Tecnologico: Piccolo Trattato di Estetica della Tecnologia*. Roma: Castelvecchi.

COSTA, M. (1999). *L'Estetica della Comunicazione: Come il Medium Ha Polverizzato il Messaggio, sull'Uso Estetico della Simultaneità a Distanza*. Roma: Castelvecchi.

COUCHOT, E. (1988). *Images: De l'Optique au Numerique*. Paris: Hermes.

CROSS, N. (1971). "Here Comes Everyman", in N. Cross (ed.), *Design Participation*, pp. 11-14. Manchester: Academy Editions.

CSIKSZENTMIHALYI, M. (1990). *Flow: The Psychology of Optimal Experience*. New York: HarperCollins Publishers.

DAVIS, D. (1973). *Art and the Future: A History-Prophecy of the Collaboration Between Science, Technology and Art*. London, Thames and Hudson.

DE FREITAS, L., MORIN, E., AND NICOLESCU, B. (1994). "Charter of Transdisciplinarity", adopted at the First World Congress of Trandisciplinarity, Convento da Arrábida, Portugal, 2-6 November 1994. Available online: [http://perso.club-internet.fr/nicol/ciret/english/charten.htm].

DE KERCKHOVE, D. (1995a). "Networked Art and Virtual Communities", in C. Faure et al. (eds.), *Arslab: I Sensi del Virtuale*. Milano: Fabbri Editore.

DE KERCKHOVE, D. (1995b). *The Skin of Culture Investigating: The New Electronic Reality*. Toronto: Somerville House Publishing.

DE KERCKHOVE, D. (1996). "Il Virtuale Ha Un'Estetica Che Lo Rende Più Umano", interview to Chiara Sottocorona. In *Telèma*, no. 6, Autunno 1996.

DE KERCKHOVE, D. (1997). *Connected Intelligence: The Arrival of the Web Society*. Toronto: Somerville House Publishing.

DE KERCKHOVE, D. (1999). "Nel Web l'Individuo e la Massa Non Si Oppongono Più, Convivono", interview to Raffaella Viglione. In *Telèma*, no. 17/18, Estate/Autunno 1999.

DE KERCKHOVE, D. (2000). "Forse Soltanto l'Arte Può Salvarci dal Rischio di una Mente Collettiva". In *Telèma*, no. 23, Inverno 2000/2001.

DE KERCKHOVE, D. (2001). *The Architecture of Intelligence*. Basel/Boston: Birkhäuser.

DECEMBER, J. AND GINSBURG, M. (1997). *HTML*. Milano: Apogeo.

DECK, A. (1998). "In Search of Meaningful Events: Curatorial Algorithms and Malleable Aesthetics", online text. Available online: [http://www.artcontext.com/crit/essays/cur_al/].

DECK, A. (1999). "Notes", presentation given at Net_Condition, 28 November 1999, ZKM, Karlsruhe, Germany.

DECK, A. AND NAPIER, M. (2001). "Graphic Jam", in P. Weibel and T. Druckrey (eds.), *Net_Condition: Art and Global Media*, pp. 88-89. Graz, Austria: Steirischer Herbst; Karlsruhe, Germany: ZKM/Center for ART and Media; Cambridge, MA: MIT Press.

DELEUZE, G. AND GUATTARI, F. (1994). *Difference and Repetition*. Translated by Paul Patton. New York: Columbia University Press.

DENZIN, N. K. AND LINCOLN, Y. S. (eds.) (1994). *Handbook of Qualitative Research*. Thousands Oaks, CA: Sage.

DEPAULA, R (2002). "Design for Empathy: A New Framework for the Design of Sustainable Special Educator Professional Development Environments". *Dissertation Proposal*. Boulder, CO: University of Colorado.

DEY, I. (1993). "Creating Categories", in *Qualitative Data Analysis*, pp. 94-112. London: Routledge.

DIETRICH, F. (1986). "Digital Media: Bridges Between Data Particles and Artifacts", in *The Visual Computer*, no. 2, pp. 135-151.

DIETRICH, F. (2000). "Data Particles - Meta Data - Data Space", in *Switch - New Media Journal*, vol.5, no. 3. Available online: [http://switch.sjsu.edu].

DOURISH, P. (2001). *Where the Action Is: The Foundations of Embodied Interaction*. Cambridge, MA: MIT Press.

DREYFUS, H. (1979). *What Computers Can't Do*. New York: Harper & Row.

DUCHEZ, M.-H. (1995). "Il Concetto di Materiale nella Tecnologia Musicale Contemporanea", in A. Di Scipio (ed.), *Teoria e Prassi della Musica nell'Era dell'Informatica*. Bari: Giuseppe Laterza Editore.

DYE, F.J. ET AL. (2000). "Constant Comparison Method: A Kaleidoscope of Data", in *The Qualitative Report*, vol. 4, no. 1/2, January 2000. Available online: [http://www.nova.edu/ssss/QR/QR4-1/dye.html].

ECKEHARD D., DOUGLAS S.A., KIRKPATRICK A.E., AND WESTERFIELD, M. (1997). "Participatory Design for Widely-Distributed Scientific Communities", in *Proceedings of the 3rd Conference on Human Factors & the Web: Designing for the Web: Practices & Reflections*, 12 June 1997, Denver, CO. Available online: [http://www.uswest.com/we-conference/proceedings/eck.html].

ECO, U. (1962). *Opera Aperta: Forma ed Indeterminazione nelle Poetiche Contemporanee*. Milano: Bompiani.

EDEN, H. (2002). "Getting in on the (Inter)Action: Exploring Affordances for Collaborative Learning in a Context of Informed Participation", in G. Stahl (ed.), *Proceedings of the Computer Supported Collaborative Learning Conference (CSCL '2002)*. Boulder, CO: University of Boulder Colorado.

EHN, P. (1993). "Scandinavian Design: On Participation and Skill", in Schuler, D. and Namioka, A. (eds.), *Participatory Design: Principles and Practices*. Hillsdale, NJ: Lawrence Erlbaum Associates.

EHN, P. (1999). "Everything that Rises Must Converge", in *Terms of Design: The 2nd Workshop of the Nordic Interactive Multimedia Research School (NIMRS)*, 28-30 May 1999, University of Art and Design, Helsinki, Finland. Available online: [http://www.nordic-interactive.org/nimres2/html/malmborg_ehn.html].

ENGELBART, D. C. (1995). "Toward Augmenting the Human Intellect and Boosting Our Collective IQ", in *Communications of the ACM*, vol. 38, no. 8, pp. 30-33.

ERICKSON, T. (2000). "Lingua Francas for Design: Sacred Places and Pattern Languages", in D. Boyarski and W. A. Kellogg (eds.), *Conference Proceedings of DIS 2000: Designing Interactive Systems, Processes, Practices, Methods and Techniques*, 17-19 August 2000, New York City, pp. 357-368. New York: ACM Press.

FEENBERG, A. (1995). *Alternative Modernity: The Technical Turn in Philosophy and Social Theory*. Berkeley, CA; London: University of California Press.

FEININGER, A. (1972). *Principles of Composition in Photography*. Garden City, NY: American Photographic Book Pub. Co.

FERRARI, M. AND MANZINI, E. (1985). "Interrogativi della Postmodernità", an interview to J.L. Lyotard, in *Modo*, no. 78.

FERRARO, A. AND MONTAGANO, G. (eds.) (1994). *La Scena Immateriale: Linguaggi Elettronici e Mondi Virtuali*. Genova: Costa & Nolan.

FINHOLT, T. AND SPROULL, L. (1990). "Electronic Groups at Work", in *Organization Science*, no. 1, pp. 41- 64.

FIORANI, E. (2001). *Il Mondo degli Oggetti*. Milano: Editori di Comunicazione-Lupetti.

FISCHER, G. (1994). "Putting the Owners of Problems in Charge with Domain-Oriented Design Environments", in D. Gilmore, R. Winder, and F. Detienne (eds.), *User-Centered Requirements for Software Engineering Environments*, pp. 297-306. Heidelberg: Springer-Verlag.

FISCHER, G. (1998). "Seeding, Evolutionary Growth and Reseeding: Constructing, Capturing and Evolving Knowledge in Domain-Oriented Design Environments", in *Automated Software Engineering*, Vol. 5, No. 4, October 1998, pp. 447-464. Dordrecht, Netherlands: Kluwer Academic Publishers. Available online: [http://www.cs.colorado.edu/~gerhard/papers/ase-093097.pdf].

FISCHER, G. (1999). "Social Creativity, Symmetry of Ignorance and Meta-Design", in L. Candy and E. Edmonds (eds.), *Proceedings of the Conference Creativity & Cognition 1999*, pp 116-123. Cambridge, MA: ACM Press.

FISCHER, G. (2002). "Beyond 'Couch Potatoes': From Consumers to Designers and Active Contributors", in *FirstMonday* (Peer-Reviewed Journal on the Internet). Available online: [http://firstmonday.org/issues/issue7_12/fischer/].

FISCHER, G. (2003). "Meta-Design: Beyond User-Centered and Participatory Design", in *Proceedings of HCI International 2003*, Crete, Greece (in press). Available online: [http://www.cs.colorado.edu/~gerhard/papers/hci2003-meta-design.pdf].

FISCHER, G. AND OSTWALD, J. (2003). "Knowledge Communication in Design Communities", in R. Bromme, F. Hesse and H. Spada (eds.), *Barriers and Biases in Computer-Mediated Knowledge Communication - And How They May Be Overcome*. Dordrecht, NL: Kluwer.

FISCHER, G. AND SCHARFF, E. (2000). "Meta-Design - Design for Designers", in D. Boyarski and W. Kellogg (eds.), *Proceedings of the 3rd International Conference on Designing Interactive Systems (DIS 2000)*, New York City, August 2000, pp 396-405. Cambridge, MA: ACM Press.

FISCHER, G., OSTWALD, J., MCCALL, R., REEVES, B., AND SHIPMAN, F. (2001). "Seeding, Evolutionary Growth, and Reseeding: Enriching Participatory Design with Informed Participation", in G. M. Olson, T. W. Malone, and J. B. Smith (eds.), *Coordination Theory and Collaboration Technology*, pp. 447-472. Mahwah, NJ: Lawrence Erlbaum Associates.

FISCHER, G., SCHARFF, E., AND YE, Y. (in press). "Fostering Social Creativity by Increasing Social Capital", in M. Huysman and V. Wulf (eds.), *Social Capital.* Available online: [http://www.cs.colorado.edu/~gerhard/papers/social-capital-2002.pdf].

FLANAGAN, J., HUANG, T., JONES, P. AND KASIF, S. (1997). *Human-Centered Systems: Information, Interactivity, and Intelligence.* University of Illinois, Urbana-Champaign: Beckman Institute.

FLUSSER, V. (1999). *The Shape of Things: A Philosophy of Design.* Translated by Anthony Mathews. London: Reaktion Books.

FODOR, J. AND PYLYSHYN, Z. (1981). "How Direct Is Visual Perception? Some Reflections on Gibson's Ecological Approach", in *Cognition*, no. 9, pp. 139-196.

FOGEL, A. (1993). *Developing Through Relationships: Origins of Communication, Self, and Culture.* London: Harvester WheatSheaf.

FOGEL, A., LYRA, M. C. D. P., AND VALSINER J. (eds.) (1996). *Dynamics and Indeterminism in Developmental and Social Process.* Mahwah, NJ: Lawrence Erlbaum.

FONDAZIONE FITZCARRALDO, DE VLIEG, M. A., AND FLOOD, M. (2001). *How Networking Works: IETM Study on the Effects of Networking.* Helsinki: Arts Council of Finland.

FRANK, P. AND ABENDROTH, M. (2003). "From DeSign to MetaDeSign", in *L'Art Même*, no. 18, February 2003.

GALAYEV, M. (ed.) (1994). "Prometheus: Art, Science and Technology in the Former Soviet Union", in *Leonardo*, vol. 27, no. 5.

GALLOWAY, K. AND RABINOWITZ, S. (1984). "The Challenge: We Must Create at the Same Scale We Can Destroy". Available online: [http://www.ecafe.com/84manifesto.html].

GIACCARDI, E. (1999). "Interactive Strategies of Network Art. Relationships and Agency", in *Proceedings of CADE '99: Third Conference on Computers in Art & Design Education*, University of Teesside, 7-9 April 1999, Teesside. Middlesbrough: University of Teesside.

GIACCARDI, E. (2001). "Transcultural Vision and Epistemological Shift: From Aesthetics to High Tech Society", in G. Marchianò e R. Milani (eds.), *Frontiers of Transculturality in Contemporary Aesthetics*, pp. 507-519. Torino: Trauben.

GIACCARDI, E. (2002). "Movements and Passages: The Lesson of Net Art", in *BIG TORINO 2002*, International Biennal of Young Art, April 19-May 19 2002, Turin.

GIANNÌ, E. (1993). *Estetologia del Colore: La Dynamica del Movimento nell'Arte*. Milano: Edizione Paoline.

GIDNEY, E. (1983). "The Artist's Use of Telecommunications: A Review", in *Leonardo*, vol. 16, no. 4, pp. 147-152.

GOETZ, J. P. AND LECOMPTE, M. D. (1981). "Ethnographic Research and the Problem of Data Reduction", in *Anthropology and Education Quarterly*, no. 12, pp. 51-70.

GREENBAUM, J. AND M. KYNG (eds.) (1991). *Design at Work: Cooperative Design Of Computer Systems*. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

HARRIS, B. AND DE KERCKHOVE, D. (1996). "Derrick de Kerckhove: McLuhan's Successor", in *Government Technologies: Visions* (special edition). Folsom, CA: Government Technologies. Available online: [http://www.interlog.com/-blake/derrick.htm].

HAYASHI, K. ET AL. (1999). "Activity Awareness: A Framework for Sharing Knowledge of People, Projects, and Places", in S. Bødker, M. Kyng, and K. Schmidt (eds.), *ECSCW'99: Proceedings of the Sixth European Conference on Computer Supported Cooperative Work*, 12-16 September 1999, Copenhagen, Denmark. Dordrecht: Kluwer Academic Publishers.

HEIDEGGER, M. (1976). "La Cosa", in M. Heidegger, *Saggi e Discorsi*. Milano: Mursia. English: Heidegger, M. (1968). *What is a thing?*. Translated by W. B. Barton, Jr., and Vera Deutsch, with an analysis by Eugene T. Gendlin. Chicago: H. Regnery Co.

HEIM, M. (1993). *The Metaphysics of Virtual Reality*. New York, NJ: Oxford University Press.

HENAGULPH, S. (2000). "The Three Pillars of Transdisciplinarity". Available online: [www.goodshare.org/pillars.htm].

HENDERSON, A. AND KYNG, M. (1991). "There's No Place Like Home: Continuing Design In Use", in J. Greenbaum and M. Kyng (eds.), *Design at Work: Cooperative Design Of Computer Systems*. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

HICKS, D., TOCHTERMANN, K., ROSE, T. AND EICH, S. (1999). "Using Meta-Data to Support Customization", in *Proceedings of the Third IEEE Meta-Data Conference*, 6-7 April 1999, Bethesda, Maryland, USA.

HOLENSTEIN, E. (1976). Roman Jakobson's Approach to Language Phenomenological Structuralism. Bloomington and London: Indiana University Press.

HOLLAN, J., HUTCHINS, E. AND KIRSH, D. (2002). "Distributed Cognition: Toward a New Foundation for Human-Computer Interaction Research", in J. M. Carroll (ed.), *Human Computer Interaction in the New Millenium*. New York, NJ: ACM Press.

HUTCHINS, E. (1995). *Cognition in the Wild*. Cambridge, MA: MIT Press.

ILLICH, I. (1971). *Deschooling Society*. New York: Harper and Row.

ILLICH, I. (1973). *Tools for Conviviality*. New York: Harper and Row.

ISHII, H. AND ULLMER, B. (1997). "Tangible Bits: Towards Seamless Interfaces Between People, Bits and Atoms", in *Proceedings of ACM CHI'97 Conference on Human Factors in Computing Systems*, pp. 234-241. New York: ACM Press.

JAKOBSON, R. (1960). "Closing Statement: Linguistics and Poetics", in T.A. Sebeok (ed.). *Style in Language*, pp. 350--377. New York, NJ: John Wiley & Sons, Inc.

JAROS, M. (2000a). "Geo-Aesthetics of Quasi-Objects", in R. Ascott (ed.), *Art, Technology, Consciousness: Mind@Large*, pp.176-80. Bristol: Intellect Books.

JAROS, M. (2000b). "Sustainable Passages", in *Strategies of Sustainable Product Policy*, pp. 111-120. Graz, Austria: IFF/IFZ.

JAROS, M. (2001a). "Ethological Knowledge Maps of Liminal Territories", in *Limen: Journal for Theory and Practice of Liminal Phenomena*, 1/2001. Available online: [http://limen.mi2.hr/limen1-2001/milan_jaros.html].

JAROS, M. (2001b). "Time, Technology and Representation: Towards Geo-Philosophy of Quasi-Objects?", in *Proceedings of Nature and Technology: Conference of the Society for Philosophy and Technology*, 9 July 2001, Aberdeen, UK.

JASPERS, K. (1971). *Philosophy of Existence*. Translated by Richard F. Grabau. Philadelphia: University of Pennsylvania Press.

JOHNSON, M. (1987). *The Body in the Mind: the Bodily Basis of Imagination, Reason, and Meaning*. Chicago: University of Chicago Press.

KANDINSLY, V. (1947). *Concerning the Spiritual in Art, and Painting in Particular*. New York: Wittenborn.

KENSING, F. AND BLOMBERG, J. (1998). "Participatory Design: Issues and Concerns", in *Computer Supported Cooperative Work*, no. 7, pp. 167-185.

KIDDER, L. AND JUDD, C. M. (1986). *Research Methods in Social Relations* (5th edition). New York: Holt, Rinehart & Winston.

KLING, R. (1999). "What is Social Informatics and Why Does it Matter?", in *D-Lib Magazine*, vol. 5, n. 1, January 1999. Available online: [www.dlib.org:80/dlib/january99/kling/01kling.html].

KUHN, T. S. (1962). *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press.

KUUTTI, K. (1996). "Activity Theory as a Potential Framework for Human-Computer Interaction Research", in B. A. Nardi (ed.), *Context and Consciousness: Activity Theory and Human-Computer Interaction*, pp. pp.17-44. Cambridge, MA: The MIT Press.

LAB[AU] (2001). "I-Tube: Building Connectivity", online text. Available online: [http://www.lab-au.com/files/doc/txt24.htm].

LAB[AU] (2002a). "Metadesign: De l'Analogie Aux Systèmes Programmatiques", in *Éc/arts*, no. 3. Available online: [http://www.lab-au.com/files/doc/ecarts3.htm].

LAB[AU] (2002b). "Connective Inter.face - Archite(x)tures", in *Spark Online*, version 31.0, April 2002. Available online: [http://www.spark-online.com/issue31/lab.html].

LAB[AU] (2003a)." MetaDeSign: The Setting of A Discipline", in *l'ARCA*, no. 177, February. Available online: [http://www.lab-au.com/files/doc/arca1-eng.htm].

LAB[AU] (2003b). "DeSIGN _ methodology | | MetaDeSIGN", in *Experimenta*, no. 45, July 2003.

LAKOFF, G. (1987). *Women, Fire, and Dangerous Things: What Categories Reveal About the Mind.* Chicago: University of Chicago Press.

LATOUR, B. (1993). *We Have Never Been Modern*. Cambridge, MA: Harvard University Press.

LATOUR, B. (1998). "Fatti, Artefatti, Fatticci", in M. Nacci (ed.), *Oggetti d'Uso Quotidiano: Rivoluzioni Tecnologiche nella Vita d'Oggi*, Venezia: Marsilio.

LAVE, J. AND WENGER, E. (1991). *Situated Learning: Legitimate Peripheral Participation*. Cambridge: University of Cambridge Press.

LAW, J. (1987). "Technology and Heterogeneous Engineering: The Case of Portuguese Expansion", in W.E. Bijker, T.P. Hughes, and T. Pinch (eds.), *The Social Construction of Technology Systems: New Directions in the Sociology and History of Technology*, pp. 111-134. Cambridge, MA: MIT Press.

LAYDER, D. (1993). *New Strategies in Social Research*. Cambridge: Polity Press.

LAZAREV, Y.N. (1994). "The Art of Metadesign", in *Leonardo*, vol. 27, no. 5, pp. 423-425.

LAZZARATO, M. (1996). *Videofilosofia: La Percezione del Tempo nel Postfordismo*. Roma: Manifestolibri.

LEA, M. AND GIORDANO, R. (1997). "Representations of the Group and Group Processes in CSCW Research: A Case of Premature Closure?", in G. C. Bowker, S.L. Star, W. Turner, and L. Gasser (eds.), *Social Science, Technical Systems, and Cooperative Work: Beyond the Great Divide*, pp. 3-25. Mahwah, NJ; London: Lawrence Erlbaum Associates, Publishers.

LEFEBVRE, H. (1991). *The Production of Space*. Cambridge, MA: Blackwell.

LEOPOLDSEDER, H., SCHÖPF, C. AND STOCKER, G. (1999). *Ars Electronica 79-99*. Linz: Ars Electronica Center-ORF.

LÉVY, P. (1998). *Becoming Virtual: Reality in the Digital Age.* Translated from the French by Robert Bononno. New York: Plenum Trade.

LINCOLN, Y. S. AND GUBA, E. G. (1985). *Naturalistic Inquiry.* Newbury Park, CA: Sage.

LIPPARD, L. R. (ed.) (1997). *Six Years: The Dematerialization of the Art Object from 1966 to 1972.* Berkeley: University of California Press.

LONGO, G. O. (1998). *Il Nuovo Golem: Come il Computer Cambia la Nostra Cultura.* Roma-Bari: Laterza.

LOVEJOY, M. (1997). *Postmodern Currents: Art and Artists in the Age of Electronic Media* (2nd edition). Upper Saddle River, NJ: Prentice Hall.

LUNDELL, K. (1999). "Playing with the Clichés of Art", in *Dagens Nyheter,* 11 March 1999. Translated by Ola Lindvall. Available online: [www.artcontext.org/shows/press/sweden.html].

LYOTARD, J.-F. (1979). *La Condition Postmoderne: Rapport sur le Savoir.* Paris: Minuit.

MACGREGOR WISE, J. (1997). *Exploring Technology and Social Space.* Thousand Oaks; London; New Dehli: Sage Publications.

MACKAY, W. E. (1990). *Users and Customizable Software: A Co-Adaptive Phenomenon*, Sloan School of Management: PhD Dissertation. Cambridge, MA: Massachusetts Institute of Technology.

MAEDA, J. (2000). *Maeda@Media*. New York: Rizzoli.

MAFFESOLI, M. (1994). "L'Oggetto Soggettivo: O il Mondo Cristallizzato", in A. Ferraro and G. Montagano (eds.), *La Scena Immateriale: Linguaggi Elettronici e Mondi Virtuali*. Genova: Costa & Nolan.

MANN, S. (1998). "Humanistic Computing: 'WearComp' as a New Framework and Application for Intelligent Signal Processing", in *Proceedings of the IEEE*, 86, pp. 2123-2151.

MANOVICH, L. (1999). "Avant-gard as Software", online text. Available online: [http://www.manovich.net/docs/avantgarde_as_software.doc].

MANZINI, E. (1987). *La Materia dell'Invenzione*. Arcadia: Milano.

MANZINI, E. (1988). "Geologia dell'Artificiale", in *Alfa Bis: Metamorfosi delle Materie*, n. 106/10, Marzo 1988, pp. I-II. Milano: Edizioni Caposile.

MANZINI, E. (1995). "Prometheus of the Everyday: The Ecology of the Artificial and the Designer's Responsibility", in R. Buchanan and V. Margolin (eds.), *Discovering Design: Explorations in Design Studies*. Chicago-London: The University of Chicago Press.

MANZINI, E. (1996). "Nuovi Materiali e Ricerca Progettuale", in A. Branzi (ed.), *Il Design Italiano 1964-1990*. Milano: Electa.

MARGOLIN, V. (1995). The Politics of Artificial, in *Leonardo*, vol. 28, no. 5. Available online: [http://mitpress2.mit.edu/e-journals/Leonardo/isast/articles/margolin.html].

MARGOLIN, V. (2002). *The Politics of Artificial: Essays on Design and Design Studies*. Chicago: University of Chicago Press.

MATURANA, H. R. (1997). "Metadesign", online text published by the Instituto de Terapia Cognitiva. Available online: [http://www.hum.auc.dk/-rasand/Artikler/metadesign.htm]. A version of this text has been published as Maturana, H. R. (1997). "Metadesign", in J. Brouwer and C. Hoekendijk (eds.), *Technomorphica*. Rotterdam, The Netherlands: V2_Organisatie.

MATURANA, H. R. (1998). "We Living Systems", in A. Broeckmann et al. (eds.), *The Art of the Accident: The Merging of Art, Architecture and Media Technology*. Rotterdam: V2_Organisatie; New York, NY: NAI Publishers.

MATURANA, H. R. AND VARELA, F. J. (1987). *The Tree of Knowledge: The Biological Roots of Human Understanding*. Translated by Robert Paolucci. Boston & London: Shambhala.

MAXWELL, K. (2002). "The Maturation of HCI: Moving Beyond Usability toward Holistic Interaction", in J. M. Carroll (ed.), Human Computer Interaction in the New Millenium. New York, NJ: ACM Press.

MAZLISH, B. (1993). *The Fourth Discontinuity: The Co-Evolution of Humans and Machines*. New Haven: Yale University Press.

MCFARLAND, D. AND BÖSSER, T. (1993). *Intelligent Behavior in Animals and Robots.* Cambridge, MA: The MIT Press.

MCLEOD, J. (2000). "Qualitative Research as Bricolage", paper presented to the panel *Qualitative Inquiry in Action: Researcher as Bricoleur,* Society for Psychotherapy Resaerch Annual Conference, Chicago, 22 June 2000. Available online: [http://shs.tay.ac.uk/shtjm/Qualitative Research as Bricolage.html].

MCLUHAN, M. (1964). *Understanding Media*. New York: McGraw-Hill.

MERLEAU-PONTY, M. (1965). *The Structure of Behaviour*. Translated by Alden L. Fisher. London: Methuen.

MESSERSCHMITT, D. G. (1999). *Networked Applications: A Guide to the New Computing Infrastructure*. San Francisco, CA: Morgan Kaufmann Inc.

MISTREE, F., SMITH, W. F., BRAS, B. A., ALLEN, J. K. AND MUSTER, D., (1990). "Decision-Based Design: A Contemporary Paradigm for Ship Design", in

Transactions, vol. 98, pp. 565-597. Jersey City, NJ: Society of Naval Architects and Marine Engineers.

MITCHAM, C. (1995), "Ethics into Design", in R. Buchanan and V. Margolin (eds.), *Discovering Design: Explorations in Design Studies*. Chicago-London: The University of Chicago Press.

MITCHELL, W. J. (1971). "Experiments with Participation-Oriented Computer Systems", in N. Cross (ed.), *Design Participation: Proceedings of the Design Research Society's Conference*, September 1971, pp. 73-78. Manchester: Academy Editions.

MORGAN, G. AND SMIRCICH, L. (1980). "The Case for Qualitative Research", in *Academy of Management Review*, no. 5, pp. 491-500.

MULDER, A. AND POST, M. (2000). "Interview to Lars Spuybroek", in *Book for the Electronic Arts*. Amsterdam: V2_Organisatie.

MUMFORD, E. (1987). "Sociotechnical Systems Design: Evolving Theory and Practice", in G. Bjerknes, P. Ehn and M. Kyng (eds.), *Computers and Democracy*. Brookfield, USA: Avebury.

MYERS, B., HUDSON, S. E. AND PAUSCH, R. (2002). "Past, Present, and Future of User Interface Software Tools", in J. M. Carroll (ed.), *Human Computer Interaction in the New Millenium*. New York, NJ: ACM Press.

NARDI, B.A. (1993). *A Small Matter of Programming*. Cambridge, MA: The MIT Press.

NEWELL, A., AND SIMON, H.A. (1976). "Computer Science as Empirical Inquiry: Symbols and Search", in *Communications of the ACM*, vol. 19, no. 3, pp.113-126.

NICOLESCU, B. (1996a). "Levels of Complexity and Levels of Reality: Nature as Trans-Nature", in B. Pullman (ed.), *Proceedings of the Plenary Session of the Pontificial Academy of Sciences on The Emergence of Complexity in Mathematics, Physics, Chemistry and Biology*, 27-31 October 1992, Casina Pio IV, Vatican. Vatican City: Pontificia Academia Scientiarum Editions (distributed by Princeton University Press). Available online: [http://www.pul.it/irafs/CD IRAFS'02/texts/Nicolescu.pdf].

NICOLESCU, B. (1996b). *La Transdisciplinarité: Manifeste*. Le Rocher, Paris.

NICOLESCU, B. (2000). "Transdisciplinarity and Complexity: Levels of Reality as Source of Indeterminacy", in F. Tito Arecchi, *Determinismo e Complessità*, pp. 127-142. Roma: Armando Editore.

NORMAN, D. A AND DRAPER, S. W (eds.) (1986). *User-Centered System Design, New Perspectives on Human-Computer Interaction*. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

NORMAN, D. A. (1988). *The Psychology of Everyday Things*. New York: Basic Books.

NORMAN, D. A. (1993). *Things that Make Us Smart*. Reading, MA: Addison-Wesley.

NORMAN, D. A. (1998). *The Invisible Computer: Why Good Products Can Fail, the Personal Computer Is So Complex, and Information Appliances Are the Solution*. Cambridge, MA: MIT Press.

NUNES, M. (1997). "What Space is Cyberspace? The Internet and Virtuality", in D. Holmes (ed.), *Virtual Politics: Identity and Community in Cyberspace*. London; Thousand Oaks, CA: Sage Publications.

NUTTALL, J. (1971). "How To Use Technology", in N. Cross (ed.), *Design Participation: Proceedings of the Design Research Society's Conference*, September 1971, pp. 19-20. Manchester: Academy Editions.

OLSON, H. (1995). "Qualitative 'versus' Quantitative Research: The Wrong Question", in *Connectedness: Information, Systems, People, Organizations - CAIS/ACSI 95 Annual Conference of the Canadian Association for Information Science*, 7-10 June 1995, School of Library and Information Studies, University of Alberta, Edmonton. Available online: [http://www.ualberta.ca/dept/slis/cais/olson.htm].

ORAVEC, J. A. (1996). *Virtual Individuals, Virtual Groups: Human Dimensions of Groupware and Computer Networking*. Cambridge, UK: Cambridge University Press.

OSTWALD, J. (2001). "DynaSites". Available online: [http://www.cs.colorado.edu/-ostwald/dynasites.html].

PAREYSON, L. (1974). *Estetica: Teoria della Formatività*. Firenze: Sansoni.

PARMESANI, L. (1997). *L'Arte del Secolo: Movimenti, Teorie, Scuole e Tendenze 1900-2000*. Milano: Skira/Gio Marconi.

PASINI, F. (1994). "La Nuova Età del Soggetto", in F. Pasini and G. Verzotti (eds.), *SoggettoSoggetto: Una Nuova Relazione nell'Arte di Oggi*, 24 Giugno - 28 Agosto 1994, Castello di Rivoli Museo d'Arte Contemporanea. Milano: Edizioni Charta.

PASSERON, R. (1989). *Pour une Philosophie de la Création*. Paris: Klincksieck.

PATTON, M. Q. (1987). *How to Use Qualitative Methods in Evaluation*. Newbury Park, CA: Sage.

PATTON, M. Q. (1990). *Qualitative Evaluation and Research Methods* (2nd edition). Newbury Park, CA: Sage.

PIERCE. D. (2002). "Extreme Programming", in *The Computer Bulletin*, May 2002, p. 28.

PIGNOTTI, L. (1993). *I Sensi delle Arti: Sinestesie e Interazioni Estetiche*. Bari: Edizioni Dedalo.

PONTECORVO, M. S. (2000). "Emergent Design", in *Proceedings of Generative Art Conference 2000*. Milano: AleaDesign.

PONTECORVO, M. S. AND ELZENGA, R. N. (1999). "Arties: Meta-Design as Evolving Colonies of Artistic Agents", in *Proceedings of Generative Art Conference 1999.* Milano: Politecnico di Milano.

POPPER, F. (1988). "De la Participation à l'Interactivité Dans les Arts Plastiques", in *Vers une Culture de l'Interactivité? - Actes du Colloque*, 19-20 May 1988, Cité des Sciences et de l'Industrie La Villette, Paris.

POPPER, F. (1993). *L'Art à l'âge électronique*. Paris: Éditions Hazan. English: Popper, F. (1993). *Art of the Electronic Age.* London: Thames and Hudson

PREECE, J., ROGERS, Y., AND SHARP, H. (2002). *Interaction Design: Beyond Human-Computer Interaction*. New York, NJ: John Wiley & Sons, Inc.

PUTNAM, R. D. (2000). *Bowling Alone: The Collapse and Revival of American Community.* New York: Simon & Schuster.

QUÉAU, P. (1986). *Eloge de la Simulation: De la Vie des Langages à la Synthèse des Images*. Seyssel: Éditions Champ Vallon.

QUÉAU, P. (1994). "Alterazioni", in A. Ferraro and G. Montagano G. (eds.), *La Scena Immateriale: Linguaggi Elettronici e Mondi Virtuali*. Genova: Costa & Nolan.

RAYMOND, E. S. (1999). *The Cathedral and the Bazaar: Musings on Linux and Open Source by an Accidental Revolutionary*. Cambridge, MA: O'Reilly Publications.

RÉGNIER, F. (1984). *L'Enterprise Annonce la Couleur: Gerer les Divergences Leviers d'Efficacite Creatrice*. Paris: Les Editions d'Organisation.

RÉGNIER, F. (1989). *Annoncer la Couleur: Pour une Approche Nuancée du Consensus*. Nancy: Institut de Metrologie Qualitative (IMQ).

REPENNING, A., IOANNIDOU, A., AND ZOLA, J. (2000). "AgentSheets: End-User Programmable Simulations," in *Journal of Artificial Societies and Social Simulation*, vol. 3, no. 3.

RESNICK, L. B., LEVINE, J. M. AND TEASLEY, S.D. (eds.) (1991). *Perspectives On Socially Shared Cognition*. Washington, DC: American Psychological Association.

RESNICK, M., MARTIN, F., BERG, R., BOROVOY, R., COLETTA, V., KRAMER, K., AND SILVERMAN, B. (1998). "Digital Manipulatives: New Toys to Think with", in *CHI'98: Human Factors in Computing Systems*, pp. 281-287. New York, NJ: ACM Press.

RITTEL, H. (1984). "Second-Generation Design Methods", in N. Cross (ed.), *Developments in Design Methodology*, pp. 317-327. New York: John Wiley & Sons.

RITTEL, H. AND WEBBER, M. M. (1984). "Planning Problems are Wicked Problems", in N. Cross (ed.), *Developments in Design Methodology*, pp.135-144. New York: John Wiley & Sons.

ROCCI, L. (1983). *Vocabolario Greco-Italiano*. Roma: Società Editrice Dante Alighieri.

ROGOFF, B. AND LAVE, J. (1984). *Everyday Cognition*. Cambridge, MA: Harvard University Press.

ROLLIN, P.-O. (2002). "LAB[au]: Metadesign et Hypermédia", in *L'Art Même*, no. 14, Janvier 2002. Available online: [http://www.lab-au.com/files/doc/lartmeme.htm].

ROPOHL, G. (1999). "Philosophy of Socio-Technical Systems", in *Philosophy and Technology*, vol. 4, no. 3, Spring 1999.

ROSS, D. (1999). "Art and the Age of the Digital" (transcription of a lecture at the San Jose State University, 2 March 1999), in *Switch*, vol.5, no.1. Available online: [http://switch.sjsu.edu/web/v5n1/ross/].

Rössler, Otto E. (1998). *Endophysics: The World As an Interface*. Singapore; River Edge, NJ: World Scientific.

ROY, J. M., PETITOT, J., PACHOUD, B. AND VARELA, F. J. (1998). *Naturalizing Phenomenology: Current Issues in Contemporary Phenomenology and Cognitive Science*. Stanford: Stanford University Press.

RUSH, M. (1999). *New Media in Late 20th-Century Art*. London-New York: Thames & Hudson.

SALOMAN, G. (Ed.) (1993). *Distributed Cognitions: Psychological and Educational Considerations*. Cambridge, UK: Cambridge University Press.

SAUVAGEOT, A. AND LÉGLISE, M. (1999). *Culture Visuelle et Art Collectif sur le Web*, Rapport de Recherche, Ministère de la Culture et de la Communication. Available online: [http://www.culture.fr/culture/mrt/bibliotheque/sauvageot/sauvageot.htm].

SCHÖN, D. A. (1983). *The Reflective Practitioner: How Professionals Think in Action*. New York: Basic Books.

SCHÖN, D. A. (1987). *Educating the Reflective Practitioner*. San Francisco: Jossey-Bass.

SCHULER, D. AND NAMIOKA, A. (1993). *Participatory Design: Principles and Practices*. Hillsdale. NJ: Lawrence Erlbaum Associates.

SHEAR, J. (ed.) (1997). *Explaining Consciousness: The Hard Problem*. Cambridge, MA: MIT Press.

SHIMIZU, H. (2001). "Ba: Principle of Art", in *Ba and Co-Creation*, no. 9, August 2001, pp. 41-44.

SHULGIN, A., BOOKCHIM, N., AND BLANK & JARON (2001). "Introduction to Net.Art (1994-1999)", in P. Weibel and T. Druckrey (eds.), *Net_Condition: Art and Global Media*. Graz, Austria: Steirischer Herbst; Karlsruhe, Germany: ZKM/Center for ART and Media; Cambridge, MA: MIT Press.

SIMON, H. A. (1996). *The Sciences and the Artificial*, 3rd edition (originally published in 1969). Cambridge, MA: MIT Press.

SIMONSEN, J. AND KENSING, F. (1997). "Using Ethnography in Contextual Design", in *Communications of the ACM*, vol. 40, no. 7, July 1997, pp. 82-88.

SMITH, B. (1996). *On the Origin of Objects*. Cambridge, MA: MIT Press.

SNOW, C. P. (1993). *The Two Cultures*. Cambridge, UK: Cambridge University Press.

SODDU, C. (1989). *Città Aleatorie*. Milano: Masson Editore.

SODDU, C. (1993). "The Design of Morphogenesis", in *Demetra*, no. 5, December 1993. Available online: [http://soddu2.dst.polimi.it/demetra2.htm].

SODDU, C. (1999). "Generative Art", in *Proceedings of Generative Art Conference 1998*. Roma: Dedalo.

SODDU, C. (1999). "Recognizability of the Idea: The Evolution Process of Argenia", in *Proceedings of AISB99*, April 1999, Edinburgh. Available online: [http://soddu2.dst.polimi.it/edinburgh%5Csoddu_edinb.htm].

SODDU, C. (2000a). "Argenia, Art's Idea as Generative Code", in *2000 Genetic and Evolutionary Computation Conference Proceedings*, University of Central Florida Editor, Las Vegas, Nevada.

SODDU, C. (2000b). "From Forming to Transforming", in *Proceedings of Generative Art Conference 2000*. Milano: AleaDesign.

SODDU, C. (2000c). "New Naturality: A Generative Approach to Art and Design", in *Artificial Life 7 Workshop Proceedings*. Portland, Ontario: Carlo C. Maley and Etlis Boudreau Editors.

SODDU, C. AND COLABELLA, E. (1997). "Argenic Design", paper given at the *International Conference on Contextual Design/Design in Contexts*, The European Academy of Design, Stockholm. Available online: [http://soddu2.dst.polimi.it/stockh_i.htm].

SORGAARD, P. (1987) "A Cooperative Work Perspective on Use and Developments of Artifacts", Aarhus University, Computer Science Department, Working Paper, DAIMI PB-234, p.3.

SPUYBROEK, L. AND RUBY, A. (1998). "Where Space Gets Lost", in A. Broeckmann et al. (eds.), *The Art of the Accident: The Merging of Art, Architecture and Media Technology*. Rotterdam: V2_Organisatie; New York, NY: NAI Publishers.

SPUYBROEK, L. AND SIK, C. I. (2002). "Diagramming: Lars Spuybroek Interviewed by Cho Im Sik", in R. S. Vasudevan, J. Bagchi, R. Sundaram, M. Narula, G. Lovink and S. Sengupta, *Sarai Reader 02: The Cities of Everyday Life*, pp. 243-248. Delhi: Sarai - The New Media Initiative; Amsterdam: Society for Old and New Media (SONM).

STALDER, F. (1997). "Actor-Network-Theory and Communication Networks: Toward Convergence", online text. Available online: [http://www.fis.utoronto.ca/stalder/html/network_theory.html].

STAR, S. AND GRIESEMER, J. (1989). "Institutional Ecology: Translations and Boundary Objects", in *Social Studies of Sciences*, vol. 19. London: Sage.

STEIN, L. (1999). "Challenging the Computational Metaphor: Implications for How We Think", in *Cybernetics and Systems*, vol. 39, n. 6, pp. 473-507.

STERNE, J. (1999). "Thinking the Internet: Cultural Studies Versus the Millennium", in S. Jones (ed.), *Doing Internet Research: Critical Issues and Methods for Examining the Net*. Thousand Oaks, CA: Sage.

STEWART, I. (1997). *Does God Play Dice? The New Mathematics of Chaos*. London: Penguin Books.

STIFF, P. (1993). "Graphic Design, Metadesign, and Information Design", in *Information Design Journal*, vol. 7, no. 1.

STRINGER, P. (1971). "A Rationale for Participation" in N. Cross (ed.), *Design Participation: Proceedings of the Design Research Society's Conference*, September 1971, pp. 26-29. Manchester: Academy Editions.

SUCHMAN, L. (1987). *Plans and Situated Actions*. Cambridge, UK: Cambridge University Press.

SUDWEEKS, F. AND SIMOFF, S. J. (1999). "Complementary Explorative Data Analysis: The Reconciliation of Quantitative and Qualitative Principles", in S. Jones (ed.), *Doing Internet Research: Critical Issues and Methods for Examining the Net*. Thousand Oaks, CA: Sage.

SUNSHINE, M. (2002). *Gridcosm Primer*. Available online: [http://www.armoredbaby.com/sito/default.htm].

TARKA, M. (2002). "Trouble in the Media: Hybrid Practice, Hybrid Discourses", in *Online Archives: Perspectives in Networked Knowledge Spaces*, 25-26 October 2002, workshop held in Schloss Birlinghoven, Sankt Augustin. Available online: [http://netzspannung.org/workshops/online-archives/?lang=en].

TAYLOR, J. (1994). *Performance by Design*. Englewood, NJ: Prentice-Hall.

THACKARA, J. (2000). "The Design Challenge of Pervasive Computing", in *CHI2000: Conference on Human Factors in Computing Systems*, 1-6 April 2000, The Hague, Netherlands. Available online: [http://www.doorsofperception.com/In+the+Bubble/details/13/].

THACKARA, J. (2001). "Smart Questions", in *Doors of Perceptions*, July 2001. Available online: [http://www.doorsofperception.com/projects/in_the_bubble/smartmatter.html].

THACKER, E. (2002). "Bioethics and Bio-ethics", workshop paper for *Towards Human Technologies Conference*, 15-17 July 2002, University of Queensland, Australia. Available online: [http://www.uq.edu.au/gsm/Confpapers/thacker1.doc].

THACKER, E. (in press). *Biomedia*. Minneapolis: University of Minnesota Press.

THOMPSON, E. (1995). *Colour Vision. A Study in Cognitive Science and the Philosophy of Perception*. New York; London: Routledge.

THOMPSON, E. (1999). "Human Consciousness: From Intersubjectivity to Interbeing" (A Proposal to the Fetzer Institute). Available online: [http://www.consciousness.arizona.edu/pcs/pcsfetz1.html].

THOMPSON, E. (2000). "Beyond the First Person: Intersubjectivity and Phenomenological Methods". Paper given at Towards a Science of Consciousness IV, 10-15 April 2000, Tucson, AZ.

THOMPSON, E. (ed.). (2001). *Between Ourselves: Second-Person Issues in the Study of Consciousness*. Charlottesville, Va.: Imprint Academic.

TOFFLER, A. (1980). *The Third Wave* (1st edition). New York: Morrow.

TORNATZKY, L. AND FLEISCHER, M. (1992). *The Process of Technological Innovation*. Lexington, MA: Lexington Books.

TREVOR, T. AND COX, G. (2002). "Generator" (statement for the exhibition), 14-19 November 2002, Liverpool. Available online: [http://www.generative.net/generator/].

TROCHIM, W. (1989). "Outcome Pattern Matching and Program Theory", in *Evaluation and Program Planning*, 12, pp. 355-366.

TURKLE, S. (1995). *Life on Screen: Identity in the Age of the Internet*. New York, NJ: Simon & Schuster.

UENO, T. (1996). "The Work of Art in the Age of Cyber Technology", in *Nettime archive*. Available online: [http://amsterdam.nettime.org/].

UNCLE AUSSIE, "The Art of Zoom". Available online: [http://www.sito.org/cgi-bin/pagify/synergy/gridcosm/oommaiy.html].

VARELA, F. J. AND SHEAR, J. (1999). "First-Person Methodologies: What, Why, How?", in F. J. Varela and J. Shear (eds.), *The View from Within: First-Person Approaches to the Study of Consciousness*, pp. 1-14. Thorverton, UK; Bowling Green, OH: Imprint Academic.

VARELA, F., THOMPSON, E., AND ROSCH E. (1991). *The Embodied Mind: Cognitive Science and Human Experience*. Cambridge, MA: The MIT Press.

VARELA, J. F. (1999). "Present-Time Consciousness", in F. J. Varela and J. Shear (eds.), *The View From Within: First-Person Approaches to the Study of Consciousness*, pp. 111-140. Thorverton, UK: Imprint Academic.

VARELA, J. F. (1999). *Ethical Know-How: Action, Wisdom, and Cognition*. Stanford, CA: Stanford University Press.

VARELA, J. F. (2000). "Steps to a Science of Interbeing", in G. Watson, S. Batchelor, and G. Claxton (eds.), *The Psychology of Awakening: Buddhism, Science, and Day-to-Day Lives*. York Beach, Maine: Samuel Weiser, Inc.

VERLE, L. (1999). *Novas Imagens Para Um Novo Meio: Um Estudo de Caso do Website de Arte Interativa SITO*. MA Thesis, Pontificia Universidade Catolica do Rio Grande do Sul, Brasil.

VERLE, L. (2003). "Artists and Articipants: Sito Collabspace and Artchives". Available online:

[www.newschool.edu/mediastudies/conference/virtual_reality/lenara_verle.htm].

VIRILIO, P. (1995). *The Art of the Motor*. Minneapolis: University of Minnesota Press.

VITTADINI, N. (1993). "Comunicare con i New Media", in G. Bettetini and F. Colombo (eds.), *Le Nuove Tecnologie della Comunicazione*. Milano: Bompiani.

WEIBEL, P. AND DRUCKREY, T. (eds.) (2001). *Net_Condition: Art and Global Media*. Graz, Austria: Steirischer Herbst; Karlsruhe, Germany: ZKM/Center for ART and Media; Cambridge, MA: MIT Press.

WEISER, M. (1991). "The Computer for the Twenty-First Century", in *Scientific American*, September 1991, pp. 94-10.

WEISER, M. AND BROWN, J. S. (1995). "Designing Calm Technology". Unpublished MS, Xerox PARC, December 1995. Available online: [http://www.ubiq.com/hypertext/weiser/calmtech/calmtech.htm].

WESTBROOK, L. (1994). "Qualitative Research Methods: A Review of Major Stages, Data Analysis Techniques, and Quality Controls", in *Library and Information Science Research*, no. 16, pp. 241-254.

WILDEMUTH, B. M. (1993). "Post-Positivist Research: Two Examples of Methodological Pluralism", in *Library Quarterly*, no. 63, pp. 450-468.

WILSON, S. (2002). *Information Arts: Intersections of Art, Science, and Technology.* Cambridge, MA: The MIT Press.

WINOGRAD, T. (1997). "From Computing Machinery to Interaction Design", in P. Denning and R. Metcalfe (eds.), *Beyond Calculation: the Next Fifty Years of Computing*, pp. 149-162. Amsterdam: Springer-Verlag.

WINOGRAD, T. (ed.) (1996). *Bringing Design to Software*. Reading, MA: Addison-Wesley.

WINOGRAD, T. AND FLORES. F. (1986). *Understanding Computers and Cognition: A New Foundation for Design*. Norwood, NJ: Ablex Publishing Corporation.

WOOD, J. (1997a). "Some Proprioceptive Observations of 'Being-With'", in *Proceedings of Problem of Action and Observation Conference*, Amsterdam, April 1997. Available online: [http://futures.gold.ac.uk/IDEAbase/observation.html].

WOOD, J. (1997b). "Design After Dualism", in *Proceedings of International Product Design Conference*, Brunel University, Uxbridge, June 1997. Available online: [http://futures.gold.ac.uk/IDEAbase/dualism.html].

WOOD, J. (1999). "The Interactive Product: Digital Systems of Participation & Connection". Available online: [http://futures.gold.ac.uk/IDEAbase/partic.html].

WOOD, J. (2000). "Towards an Ethics of Flow: Design as an Anticipatory System", in D. M. Dubois (ed.), *Proceedings of the First International Conference CASYS'97 on Computing Anticipatory Systems*, 11-15 August 1997, Liège, Belgium. Woodbury, NY: AIP.

WOOD, J. (ed.) (1998). *The Virtual Embodied: Presence/Practice/Technology.* London; New York: Routledge.

WRENSCH, T. AND EISENBERG, M. (1998). "The Programmable Hinge: Toward Computationally Enhanced Crafts", in *Proceedings 11th Annual Symposium on User Interfaces and Software Technology.* New York, NJ: ACM Press, pp. 89-96.

YIN, R. K. (1994). *Case Study Research: Design and Methods* (2nd edition). Sage: Thousand Oaks, CA.

YONEYAMA, M. (1996). "L'Esperienza Pura in Nishida Kitaro e i Dualismi Occidentali", in *Il Paesaggio dell'Estetica: Teoria e Percorsi, Atti del III convegno nazionale della Associazione Italiana per gli Studi di Estetica*, Università di Siena, Maggio 1996.

YONEYAMA, M. (2001). "Creative Chora and the Aesthetics of Place", in G. Marchianò and R. Milani (eds.), *Frontiers of Transculturality in Contemporary Aesthetics.* Torino: Trauben.

YOUNGBLOOD, G. (1984). "Virtual Space. The Electronic Environments of Mobile Image", in *Ars Electronica Symposium 1984.* Available online: [http://kultur.aec.at/20Jahre/].

YOUNGBLOOD, G. (1986). "Metadesign. Toward a postmodernism of reconstruction", in *Ars Electronica Symposium 1986.* Available online: [http://kultur.aec.at/20Jahre/].

ZEVI, B. (1993). *Saper Vedere l'Architettura: Saggio sull'Interpretazione Spaziale dell'Architettura.* Torino: Giulio Einaudi Editore.