

Science and Biology Education: strange, non-human loves, conversations & alliances with plants and other ways of narrating life

Leandro Belinaso¹
Daniela Ripoll²

¹Universidade Federal de Santa Catarina (UFSC), Florianópolis/SC – Brazil

²Universidade Luterana do Brasil (ULBRA), Canoas/RS – Brazil

ABSTRACT – Science and Biology Education: strange, non-human loves, conversations & alliances with plants and other ways of narrating life. Fauna, flora, environments and living beings, as well as the ecological, cultural and social relations between them and us humans, and, equally, everything that happens to them/us in given times and spaces, are articulated with what we call Science and/or Biology education in the scope of school and university education. Non-humans are deeply articulated with Literature, Visual Arts, Anthropology, Life Sciences, Scientific Dissemination and, especially, with the daily life of humans – but they seem to affect, still timidly, school classrooms and teacher education classrooms. In this sense, the text seeks to list possibilities of encounters between humans and non-humans at school and outside it.

Keywords: Science and Biology Education. Environmental Education. Animalities. Vegetable Alliances. Anthropocene.

RESUMO – Ensino de Ciências e Biologia: amores estranhos, não humanos, conversas & alianças com as plantas e outras formas de narrar a vida. Fauna, flora, ambientes e seres vivos, bem como as relações ecológicas, culturais e sociais entre eles e nós, humanos, e, igualmente, tudo aquilo que lhes/nos acontece em dados tempos e espaços, se articulam com o que chamamos de ensino de Ciências e/ou de Biologia no âmbito da educação escolar e universitária. Os não humanos articulam-se, de modo profundo, com a Literatura, as Artes Visuais, a Antropologia, as Ciências da Vida, a Divulgação Científica e, especialmente, com a vida cotidiana dos humanos – mas parecem afetar, ainda timidamente, as salas de aula escolares e as da formação docente. Nesta direção, o texto busca elencar possibilidades de encontros entre humanos e não-humanos na escola e fora dela.

Palavras-chave: Ensino de Ciências e Biologia. Educação Ambiental. Animalidades. Alianças Vegetais. Antropoceno.

In recent times, various extreme events – which function as disturbing encounters of the ways we understand the presence of non-humans among us – have been challenging humans. We feel on the skin, in the body, in our subjectivities, in our daily lives the effects of a pandemic caused, among countless factors, by the spread of a virus with a strange name, SARS-CoV-2. On the encounter between viruses and humans, the philosopher Paul Preciado (2020) shows, in a text full of provocations, that it evinces “[...] the utopia of the community and the immune fantasies of a society, externalizing their dreams of omnipotence (and the resounding failures) of their political sovereignty”. He also shows that a pandemic materializes, “[...] within the scope of the individual body, the obsessions that dominate the political management of the life and death of populations in a given period”¹.

Beyond the pandemic, we are haunted by many other phenomena (or, perhaps, we could call them “encounters”, “crises of coexistence”, etc.) triggered by a decisive anthropic participation, such as climate change. They are enunciated, both in the academic and cultural spheres, as responsible for the increased fires, floods, migrations, and the risk of extinction of many species of the planetary biodiversity. We are also witnessing a dizzying and catastrophic expansion of land grabbing, illegal mining, genocide, of rivers, animals, plants in environmentally and culturally sensitive areas of our country. And more: we have witnessed the intensification of hate speech, erected against cultural diversity, the rights of existence and voice of minorities, science, art, education. All these factors create tensions that produce physical and mental illnesses and lead to mass violence. It also creates strangeness about how we position and treat *others* – all *those others*, human or non-human, with whom we share this world. Santos and Dorneles (2022), biologists inspired by the works of Maria Esther Maciel, emphasize that the ways we bond with non-humans resonate in the relationships established between us humans. It is, therefore, a “[...] key to interpret the importance given to some animals and some human animals to the detriment of others” (Santos; Dorneles, 2022, p. 48, our translation). Thus, amid the images of Amazonian rivers “turning into clay” with the advance of mining, fallen trees, the progressive desertification of the southern fields and the fires in the Pantanal biome, we also see life (and its guarantee mechanisms) weaken, giving way to death and necropolitics in all spheres.

In this terrifying context, we have paradoxically seen thoughts, sensitivities, life practices and research in different areas – Biological Sciences, Visual Arts, Literature, Anthropology, Cultural Studies – that have provided differential perspectives as to non-humans. On the one hand, research points to the intelligences and deep sensitivity of non-humans, marking their resilience, their potencies, their strengths; on the other hand, it deepens ethical questions about what we have done with us as a species of the genus *Homo*, providing opportunities for the construction of more “listening” and sensitive ways of coexistence between us and non-humans, making visible the conflicts to be faced and believing in the potential joys of encounters.

The effects of our actions as a species are taken as decisive to introduce the Earth into a new (aspiring) geological age named as the Anthropocene so as to emphasize such decisive participation of our species in the transformations of the planet. To underline the view that any and all forms of life may come to be valued as a *commodity*, have a financial value and a priced utility, biologist Donna Haraway (2016) presents the term Capitalocene. The American scholar of culture also points to other denominations of this new “geological age”. The title Plantationocene highlights the historical modes of agricultural production, *plantations*, immense monocultures and their structural connections with racism. The notion of Chthulucene alludes to a monster, from a science fiction tale by H.P. Lovecraft, that comes out of the underground to appropriate everything and everyone. The researcher reconfigures the meaning of Chthuluceno by highlighting the need to take into account, in our daily actions and life and research practices, everything and everyone. Living in and by the Chthulucene has to do with cultivating joyful affections, with creation of more and more expansive connections of our ability to act collectively. Still unfolding the terms under debate, Malcom Ferdinand (2022) proposes the word Negrocene to be able to deal, at the same time, with both environmental fracture and racial and colonial fracture.

Animals, plants, fungi, lichens, viruses, bacteria, all living beings known or yet to be known, as well as the ecological, cultural and social relations between them and us humans, and, equally, everything that happens to them/us in given times and spaces, are articulated with what we call Sciences and/or Biology Education in the scope of school and university education. They also interrelate with scientific dissemination and with everyday life – when we think, especially, of artifacts, instances and practices that are not usually and formally taken as educational, but present themselves to us, as stated by Giroux (2003), as true “teaching machines” to be, to be present and to belong to the living world. Literary books, poetry, television programs, cinematic films, audio episodes on digital platforms, science journals, science blogs, posts on social networks, printed and digital newspapers, artistic exhibitions in museums, on the streets, on the internet: there is a whole cultural myriad producing diverse knowledge about beings and environments in accelerated and vertiginous anthropic transformation. Our own bodies are also sometimes shown as landscapes modified by the desired or undesired beings that inhabit us.

However, all these questions that come to us from different fields of knowledge production – from Literature, Visual Arts, Anthropology, Life Sciences – through an attentive and sensitive listening of non-humans, seem (still!) to timidly affect school classrooms and teacher education classrooms. Thus, we organized this thematic section so that we could look into how such discussions have permeated pedagogical practices and research in Science and Biology Education – and, above all, so that we could understand how school education has incorporated these new knowledge about non-humans articulated to literary, anthropological, historical, artistic, ethical and political aspects.

We have seen being unfolded, throughout the 14 selected texts, some questions and provocations formulated at the time of the public call for the submission of articles: *what do such knowledge bring in terms of new ways of understanding, narrating and, therefore, constituting the world? What kinds of experiments have been carried out in different pedagogical practices that enable us to understand life, the various forms of life, environments and their transformations in other ways? What possible ethical-political-ecological positions can or should we, humans, occupy?*

This thematic section opens with an interview that we conducted through email with the researcher and fiction writer Maria Esther Maciel, which can be read on the page of the journal *Educação & Realidade*². In it, the scope of the proposed debate is greatly expanded, since the author, when talking about zooliterature, expands the possibilities for authors to create strategies, through writing, to narrate animal lives from their “own points of view” (that is, those created through narratives), as well as, at the limit, undertake their “own” (auto)biographies. Thus, as in the other texts that follow, it is a matter of narrating other stories, possibilities, ways of thinking and acting.

Two articles, at the beginning of the thematic section, advocate writing as a force that intensifies life. Ways of writing imply – these texts seem to mean – ways of existing. To expand and vary life, there is a reliance on entanglement, coexistence, the thawing of insipid and fixed existences that Biology education sometimes insists on representing and inscribing through monochromatic normative textualities.

In *Abomináveis Amores entre Estranhos*, Thiago Ranniery and Nathália Terra Barbosa advocate Biology education as the art “of cultivating tangled stories”. Along a delicious and consistent textual journey, readers come across different intercessors, such as, for example, specific fictional books by Marguerite Duras and Octavia Butler. The article moves around a thought-provoking question: “[...] what happens to the stories told by biology education if taken from love for and among creatures that generate *a priori* no ethical appeal?”.

In the desire to *queerize* Biology education, the essay relies on “an entangled affective materiality” to interrupt the normative axes of heterosexuality catapulted in the classrooms by a linear and progressive perspective of biological events, by an idea of bodily wholeness and strength, by the integrity and fixed maintenance of the binomial nature and culture, by the difference seen as a mirrored alterity. The authors remind us that they do not write to save societies or to inform and denounce something that can be easily captured by the moralizing networks of pedagogical language. One writes erotically to perform the disturbing presence of a stranger in us. “*Queer* is a matter of intimacy, of becoming intimate with other beings, living and non-living”. Teaching biology is confused with the cultivation of stories that nurture strange intimacies. They are “[...] stories of love, that is, of bodily vulnerability to a passionate erotic connection, whose infestation leaves marks on us, in spite of us”.

In *Modos de habitar o Mundo: uma Educação em Ciências com/sem meio à/pela Vida*, Tiago Amaral Sales, Fernanda Monteiro Rigue and Alice Copetti Dalmaso also offer us a manifesto in defense of the intense creation of varied, multiple and hybrid lives in biology teaching. To inhabit a development process, a text, is to live in relationship, in entanglement with other human and non-human beings, in hybridization. It is allowing, say the authors, that a territory becomes part of us, that a landscape becomes a body. The teaching of science and biology usually delivers ready-made narratives and stories about the living world, leaving little room for a corporeal, adventurous, sensitive and inventive experience of other and different ways of existing. In the manifesto essay there is a defense of the mobilization and activation of scriptural forces that unfold from an ethical and urgent question: what have we done with ourselves in the Anthropocene? The text materializes tensions and hopes by opening gaps so we escape, the authors argue,

[...] the solidified lines that are presented in daily educational routines, establishing fertile spaces for dreaming, for desire, for the defense of the multiple forms of life and, above all, for the possibility of mixing with them, of being another and of experiencing difference as a mode of habitation, capable of rehearsing oneself, in continuous co-creation with beings and things of the world, other ways of being, other perspectives, other bodily and mental bonds with possibilities to learn and educate.

Two other articles establish relations with the field of knowledge and practices of Environmental Education. The fragile possibility of establishing encounters between them reflects, to some extent, the vertiginous thematic, procedural and conceptual dispersion of the area itself. One of the articles is more densely articulated with an Environmental Education conceptualized in the article as *minor*, non-hegemonic, established in the interstices, in the cracks, of the utilitarian, involving, capitalistic and intoxicating discourses of sustainability. The other text has in Environmental Education an axis of explanatory analysis of the historical transformation in the school pedagogical practices of a teacher-character who dedicated her life to the defense of biodiversity.

In *Educação Ambiental Menor, Decolonialidade e Ativismo Artístico*, Fabiana Aparecida de Carvalho and Leonardo Aparecido de Souza Bergamo make visible artistic productions that erase the colonial dimension of knowledge spread in societies through the notion of sustainable development. By establishing the hegemony and privilege of certain modes of knowledge arising from privileged social and economic strata, the idea of sustainable development is utilitarianly imposed by collapsing the compositional lines of minority cultures. Many of them are woven in processes, although conflicting, of coexistence with various non-human beings. The artistic processes of indigenous people such as Denilson Baniwa, Daiara Hori, Jaider Esbell, Emerson Munduruku are examined in the article and, with them, the molecular strength of the sensitive and political knowledge of the different indig-

enous peoples is defended. In this movement, the article maps, through art, a *smaller*, forest Environmental Education. One of the questions that permeates the article, devised conceptually in a dense and consistent way, is how to think about other socio-environmental relations through the suspension and erasure of a *larger*, colonial Environmental Education.

The article *História Natural e Educação Ambiental em Diálogo no Ensino de Ciências*, by Rodrigo Cerqueira do Nascimento Borba and Sandra Escovedo Selles, allows the reader a delightful journey through the life stories of Nilza Vieira, a science teacher at a public school in Rio de Janeiro. In a biographical tone, but without being led by a personalist construction, based mainly on interviews and photographs, the essay presents to us an overview of the understandings and transformations of pedagogical practices related to the protection of biodiversity in science education in the late twentieth century, from the 1960s to the 1980s. The text discusses the tenuous interrelations between a teaching on ecology and the evolution of living beings and environmental education arising in societies in the late twentieth century and strongly related to the contestative ideals of emerging environmental movements. The article shows the repertoires of a teacher-ecologist who saw the direct contact of students with non-human animals as essential for an active ecological-evolutionary education in response to the passive, memorialistic and fixative pedagogical practices of living beings. According to the authors, Professor Nilza Vieira “[...] radically lived the environmentalist ideology by striving to resolve any separation between society, culture and nature”. The essay notes a turning point in the teacher’s intentions from the 1980s, which became increasingly related to the preservation of the environment and less to the teaching of ecology and the evolution of living beings. And it is exactly in the 1980s that Environmental Education begins to constitute an area, and in the following decade it spreads through societies and consolidates as a field of knowledge and practices. If initially, the authors argue, the teacher was driven by a “love of animals”, and this made her build a small zoo in the school, making her own home part of it; years later, the idea of an environmentalist teacher was constituted through the appreciation of ethical care with animals.

From another direction and perspective, the article *Gradismo e Cladismo no Ensino em uma Análise Foucaultiana* also opens a discussion about the teaching of biological classifications. Ana Laura Pureza Pantoja, Eduardo Paiva de Pontes Vieira, Silvia Nogueira Chaves show that there are historical discontinuities between different ways of thinking about the classification of living beings. The article basis its analyses of Michel Foucault’s theoretical and epistemological assumptions showing the power-knowledge disputes at play between the discourses of gradative or evolutionary systematics and cladist or phylogenetic systematics. The text provides readers the opportunity to apprehend such conceptual differentiations and encourages a teaching of science and biology in which scientific facts are studied through the conditions

that made their constructions possible, showing that something is not accepted, simply, because it is assumed from the onset and thoughtlessly as a discovered truth. The establishment of a scientific fact goes through the unveiling of a web of threads, through complex plots of power-knowledge, of participation of innumerable beings, things, phenomena and concepts.

Another text that talks closely with biological evolution is the inspiring essay entitled *Lições da Evolução: uma Abordagem Transdisciplinar a partir da Arte*. Hugo Fortes' article unfolds the process of creating an artistic video, which relates three different narratives:

[...] the imprisonment of ravens in the Tower of London over the centuries due to superstitions about their magical power in maintaining the British Empire; Darwin's trip to Tierra del Fuego and his perception of the local indigenous people; and the coexistence of these indigenous people with fur seals that today are threatened due to global warming.

These stories are intertwined in the video by the strangeness of the other and their subjugation by colonial, anthropocentric, capitalistic tessitures. The analysis of the video is not limited to signifying these stories, which are only apprehended by the reader through access to the backstage of their creation, by reading the essay itself. As an artifact of art, it evokes strangeness, opens questions, affects us in different ways through the experiential field of each spectator. In any case, our reading experience is greatly expanded if we see the video after reading the essay, which acts as a mediator-provocator of other perceptions and sensations.

In conversations with the field of art, there is also the article called *Pode um Museu de Ciências Sonhar? Notas sobre um Artefato Museal*, by Vinícius Abrahão de Oliveira. The text causes erasures and escapes from stereotypes about what it was, is, or could be a countryside dwelling in the Cerrado. Through the Cerrado Biodiversity Museum (MBC), located in Uberlândia, Minas Gerais, the author dreams of fabulous possibilities to create stories about the ways of inhabiting a house built in the museum, typified as "common" in relation to the countrymen's ways of living in the Cerrado. The fictional invitations dreamed up for visitors mix audiovisual artifacts, stagings, performances, and sensory objects such as smells and textures. A mixture of elements that, according to the author, "[...] (re)define and (re)signify, from the perspective of a cultural hybridization, residing and living in the Cerrado", seeking to connect poetic and visual lines that elicit sensations, questions and strangeness in the audience.

The following three texts have in common the urgency to rethink the relations between humans and plants – and, more: the urgency to reposition the teaching of Botany as part of the background that fosters the environmental crisis itself, since all human actions (including, there, the teaching actions themselves) can be intensifying factors for

the natural climatic processes of the planet. Thus, the problematization of some teaching practices in the classroom – when approaching plants (and all non-humans, in fact) in a hierarchical, scientific, utilitarian and decontextualized manner, sometimes quite dissociated from everyday life – becomes an important tool for deanthropocentricizing relations (or, also, a tool for decentering the human).

In *Encontros e Ficções: Conversando com as Plantas*, Eduardo Silveira discusses and problematizes the utilitarian, functionalist and comparative perspectives that usually characterize the relations between humans and plants and mark the teaching of Botany in High School. Articulating a series of powerful concepts (“botanical blindness”, “plant turn”, “breath”, “biophony”, etc.), authors from several fields of knowledge (Biological Sciences, Literature, Anthropology, Visual Arts, Philosophy, etc.) and examples from the very teaching activity, Eduardo builds possibilities of encounter between humans, non-humans and plants. He also points out other problems often related to the teaching of Botany at the University, such as excesses in the scientific approach, decontextualization and the consequent lack of interest of students about plants, and mentions some rare alternative approaches – usually undertaken through Cultural Studies in Education. The text is sensitive and fraught with concepts, ideas and reflections on the way plants permeate the daily lives of humans and non-humans. At the end, the author presents some artistic productions by vocational secondary education students, in the form of “conversations”, which show the possibility of humans relating to plants in other ways—according to him, “[...] establishing kinship and indulging in other ways of narrating, in the classroom”.

Another text that dialogues with plants is that of Susana Oliveira Dias, entitled *Alianças Vegetais – Espécies Companheiras de Ensino Diante do Antropoceno*. In fact, more than a dialogue: the text proposes that we consider plants as “companion species” (Donna Haraway’s concept that, according to Susana, “[...] requires an interest in listening to non-humans, a willingness to gain effective intimacy with them, a desire and commitment to develop procedures, tools, materials so that these listenings are possible, real and multiple”), going beyond what we obviously and historically do with them. Susana shows possibilities for thinking about teaching at the threshold between biology and the arts in the face of the Anthropocene, narrating her teaching processes (which mix trees, rivers, stones, stars and animals), as well as the alliances that humans seek to establish with trees (in practical classes of Botany offered to students of Biological Sciences), with the reference authors and works used in the area, as well as with the works of various artists—Marli Wunder, Fernanda Pestana, Sebastian Wiedemann, Marcelo Moscheta, Sara Melo, Tatiana Oliveira, Rodrigo Rodrigues, Mauro Tanaka, Silvia Figueroa and Paulo Teles. The results of such “vegetable alliances” are incredibly potent and inspiring!

In *Reencantar a Biologia: como Cresce uma Raiz quando Decidimos Olhar para Ela?*, Fabíola Simões Rodrigues da Fonseca, strongly in-

spired by Deleuze, Guattari and the writings of the Belgian philosopher and historian Isabelle Stengers, poses a series of questions for Biology as taught in school and for its teachers: “[...] how [Biology education] has entered this rhizome of the creation of sociability? How have we created the conditions to experiment with it [Biology, Botany]?” The author narrates a set of botanical experiments made throughout a course, which serve “[...] as an invitation to think *with plants* and no longer *about them*”.

In turn, *A Ciência e os Conhecimentos da ‘Cidade Invisível’*, by Erica Mariosa Carneiro, addresses other ubiquitous issues in Science and Biology education: Scientific Communication and Dissemination. Through analysis of the first season of the TV series “Invisible City”, the author stimulates us to think about Science and its communication in other ways:

[...] understanding that the TV series could not be for scientific dissemination, precisely because it is not about Science, is ignoring that Science is also about popular culture and traditional stories, and that discussing the erasure of a culture by the imposition of capitalism and presenting environmental problems faced by traditional communities and their difficulty in maintaining their culture, traditions and lifestyle is also talking about Science.

By mixing entities from Brazilian legends – such as Saci Pererê, Boto cor-de-rosa and Cuca – with humans in a peripheral community of Rio de Janeiro, the series proves potent to “[...] stimulate critical thinking about which culture we are leaving for future generations and which cultures we are erasing” and provide, at the limit, discussions (inclusive, productive, non-exclusive, “blurred”) between scientific and popular knowledge.

In *Trazendo a Prática da Educação em Ciências e em Biologia de volta à Vida*, Lilian Alves Schmitt, Alci Albiero Junior and Isabel Cristina de Moura Carvalho make a series of provocations about science teaching practices based on two experiences: one in the scope of Youth and Adult Education, with a High School Biology class strongly impacted by the coronavirus pandemic; and the other with *stricto sensu* graduate students, enrolled in scientific methodology courses and scientific residency in Forest and Environmental Sciences of the Amazon. Based on such experiences and inspired by authors such as Timothy Ingold, Bruno Latour and Emanuele Coccia, the text asks: what lives are present in the pedagogical practice of science and biology teachers? What are these lives worth living, learning and teaching? How to “bring Biology back to life” in Science and Biology education? How is it possible to rethink the methods considering the contingency of pedagogical practices?

In *Drosophila melanogaster: un Punto de Encuentro de la Historia, la Filosofía, la Sociología y la Didáctica de la Biología*, Julio Alejandro

Castro Moreno and Irma Catherine Bernal Castro wonder about a model organism extremely relevant in biological research – the *Drosophila melanogaster* fly. The authors, throughout the text, position the fly at a crossroads of knowledge – or, as the title itself says, at a point of intersection between History and the Philosophy of Science, Ecology, Natural History, Sociology and Didactics of Biology, establishing some aspects that we can learn (and teach) with this being that is small and often unfairly considered as insignificant. The reading, fraught with historical and cultural aspects, is delicious both for biologists who have ventured – or still venture today – into “laboratory life” (since the fly is ubiquitous in Genetics, Molecular Biology and Embryology laboratories around the world, extensively bred, crossed, tested, “mutated” and coldly discarded) and for those who have already encountered a fruit fly inside the house, practically domesticated and intertwined with the lives of humans.

Finally, in *Zoologia, Ambiente e Sociedade no Planejamento Didático da Formação Inicial*, Gabriel de Moura Silva and Rosana Louro Ferreira Silva present some of the results of didactic sequences focused on Zoology prepared by teacher training students, over five years, in an undergraduate course of a public university in the state of São Paulo. These sequences were analyzed by the students themselves and organized into two dimensions: socioenvironmental and health dimensions. The activities are interesting and thought-provoking, involving anthropomorphization; use of traditional knowledge; various practices related to ethics, aesthetics and animalities; criticism of zoos and practices of “collecting” specimens, etc. In addition, the students’ own perceptions show that the possibility of articulation between zoological knowledge and sociocultural issues is extremely potent – especially in curricular and classroom settings, where there is a prevalence of technical-utilitarian views of nature, essentialist (and fragmented) understandings of taxonomy, and the logic of progressive ordering of knowledge about biodiversity.

By sharing their experiences and reflections, the authors gathered here produce a text with multiple voices – voices that “[...] unbalance us, invite us to clash and debate” (Serpa, 2018, p. 94, our translation) and provide new possibilities for fruitful encounters between humans and non-humans at school and outside it.

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Notes

- 1 See more in the thematic section *The lessons of the pandemic* published in *Educação & Realidade* (2020), available at: <https://www.scielo.br/j/edreal/i/2020.v45n4/>.
- 2 The webpage address is as follows: <https://seer.ufrgs.br/index.php/educacaoe-realidade/>.

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Leandro Belinaso holds a Bachelor’s degree in Biology from the University of São Paulo (USP), a Master’s degree and PhD in Education from the Graduate Program in Education of the Federal University of Rio Grande do Sul (UFRGS). He is a professor at the Centro de Ciências da Educação of the Federal University of Santa Catarina (UFSC).

ORCID: <https://orcid.org/0000-0003-3275-7238>

E-mail: lebelinaso@gmail.com

Daniela Ripoll holds a Bachelor’s degree in Biology from the Federal University of Rio Grande do Sul (UFRGS), a Master’ degree and PhD in Education from the Graduate Program in Education of the same university. She is a professor in the Biological Sciences program and in the Graduate Program in Education – emphasis in Cultural Studies at the Lutheran University of Brazil (ULBRA).

ORCID: <https://orcid.org/0000-0002-7247-2600>

E-mail: daniela.ripoll@ulbra.br

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