

BIO-JEWELRY, SUSTAINABILITY AND THE BRAZILIAN JEWELRY DESIGN: REFLECTIONS

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Abstract

The impact of the production chain of conventional jewelry has reached alarming levels in recent years, especially the deforestation of the Brazilian Amazon region and the unregulated activity of mining companies. The consequent concern with human interference in the environment has influenced the change of paradigms in contemporary jewelry design, boosting what we know today as bio-jewelry. These are inserted in the “era of ecoresponsible creativity”, as called by Lipovetsky (2015), in which the ethical dimension of respect for the environment is added to product development projects in today’s world. Bio-jewelry is a product intrinsically linked to Brazilian culture, being considered an identity and heritage asset, with a sustainable appeal, valuing regional raw materials and the craftwork communities of Brazil. Taking this as the object of analysis, the present study has as a methodological basis the exploratory qualitative research, of descriptive character, through a literature review. Thereby, it was possible to point out the rise of bio-jewelry in the contemporary scenario. By joining natural elements richly found in the country, with noble materials, the creation of bio-jewelry with a differentiated design can be seen as an instrument of innovation and boosting in the national and international jewelry market.

Keywords: Bio-jewelry, Jewelry, Design, Sustainability.

Introduction

The impact of human actions on the environment has become increasingly addressed in product development areas. Since the 1970s, when the world reached ecological overload, according to the National Footprint & Biocapacity Accounts (NFA) based on UN data (Global Footprint Network, 2021), the concern with human interference in the environment influences the conception of new paradigms in product development (Bürdek, 2006 apud Stralio, 2009).

An initiative of Global Footprint Network, each year is marked Earth Overshoot Day, a date "(...) when humanity has used all the biological resources that Earth regenerates during the entire year. [...] From Earth Overshoot Day until the end of the year, humanity operates on ecological deficit spending." Today, more than 74% of natural resources are consumed than global ecosystems can regenerate, the equivalent of "1.7 Earths" (Global Footprint Network, 2021).

In 2021 and 2022, the largest deficits since the 1970s were reported (Global Footprint Network, 2022; Global Footprint Network, 2021). According to the organization, among the critical factors compounding this worsening are "the 6.6% carbon Footprint increase over last year, as well as the 0.5% decrease in global forest biocapacity due in large part to the spike in Amazon deforestation" (Global Footprint Network, 2021). And, as verified by Instituto Escolhas' studies, the strong mining activity with gold and diamond extraction in the Legal Amazon causes an annual increase in deforestation in the region (Manso *et al*, 2021).

An analysis of the social and economic impacts of mining activity in the Legal Amazon by Instituto Escolhas in 2021

found that the effects on health indicators, education, and GDP *per capita* are very brief (Manso *et al*, 2021). Thus, considering all the negative effects of mining activity – deforestation, contamination by mercury of the ecosystem and local communities, the social disorder generated, with increased rates of violence, the incidence of slave-like labor, and prostitution –, it proves to be "incapable of changing the economic dynamics to one that generates lasting benefits, which depends on knowledge and innovation and will by no means offset the negative impacts that remain in place"¹ (Instituto Escolhas, 2021b, p. 4).

In the last years, it could be pointed out the increasing demand for mineral raw materials in Brazil (Salomon, 2020), known for its tradition, diversity, and quality of stone lapidation, according to a recent report by the Brazilian Institute of Gems and Precious Metals – IBGM (2018). Due to the sector's relevance in the country, it is worth discussing studies of the impacts of the jewelry industry. Considering the entire life cycle of the jewelry product, the authors Kraemer and Schumann (2003; 2006 apud Stralio, 2009) expose the main negative impact of jewelry development in the pre-production phase, with the extraction of "natural, rare, and non-renewable raw materials such as gems and precious metals"² (Stralio, 2009, p. 127).

Inserted in this scenario, researches on current market trends point to the transformation of the jewelry consumer and, therefore, of luxury and contemporary jewelry paradigms. According to the design consultancy Matter Of Form - MOF (2021), the new perspective of the jewelry market includes as crucial transparency in the production chain and the change of connotation of alternative materials, elevating them to the level of new luxury.

1 Translated by the authors. Original Citation: "incapaz de mudar a dinâmica econômica para uma que gere benefícios duradouros, o que depende de conhecimento e inovação e nem de longe compensará os impactos negativos que permanecem no local" (Instituto Escolhas, 2021b, p. 4).

2 Translated by the authors. Original Citation: "matérias-primas naturais, raras e não renováveis como gemas e metais preciosos" (Stralio, 2009, p. 127).

The authors Skoda (2012) and Straliozzo (2009) corroborate this idea, approaching the change in the concept of luxury and the rise of projects and products that contain at their core the environmental and social dimension, such as eco-design jewelry, with the use of recycled materials or alternative materials, renewable and abundant in nature: the case of bio-jewelry.

Bio-jewelry is understood as an adornment produced with the use of raw materials of natural origins, such as seeds, natural fibers, leaves, and dried fruits, shells, and feathers, among other elements sustainably extracted from nature, using only these materials or in joint with metals and precious stones, the latter in a smaller proportion (Jorcelino *et al.*, 2020; Jorcelino, 2019; Lana and Benatti, 2012; Skoda, 2012).

As part of the alternative jewelry production space, bio-jewelry is also inserted in the concept of bio-economy by creating alternatives to the use of non-renewable materials, collaborating to the preservation of biodiversity, while at the same time driving business across the country (Instituto Escolhas, 2021a; Instituto Escolhas e IRICE, 2020; OECD, 2009).

And, in addressing biodiversity, it is worth highlighting the relevance of Brazil in the bioeconomy agenda. The country is considered the most biodiverse in the world, containing 20% of the planet's species, more than 103,800 animal species, and more than 43,000 cataloged plants, most of which are found in the Amazon; it is also a highlight in terms of socio-biodiversity, as it shelters in its territory several indigenous peoples and traditional communities, who have extensive knowledge about native Brazilian species (Instituto Escolhas, 2021a).

Thus, once the link between gold and diamond extraction and deforestation is confirmed, and given the environmental vulnerability of the Amazon region and its importance

in the global panorama, the risks of negative impacts from continued mineral extraction are high. Activities related to the bio-economy are alternatives to this scenario by concomitantly encouraging the economy at local and national levels and its development potential in the design of bioproducts (Instituto Escolhas, 2021a), and valuing the maintenance and enhancement of Brazilian biodiversity and sociobiodiversity (Manso *et al.*, 2021).

To this end, this study has as its methodological basis the exploratory qualitative research, characterized by the descriptive study, aiming at the understanding of phenomena in their complexity (GODOY, 1995). The method used to obtain the theoretical reference was a bibliographic and documental survey of books and academic works, such as articles, dissertations, and theses, as well as reports from renowned organizations in the field.

1. Changing paradigms and the designer's role in the contemporary world

As previously mentioned, since the 1970s the ecological imperative has risen with greater grandeur, and in the 2000s it has become the greatest obstacle to human actions in the contemporary world. With the depletion of natural resources and the impacts resulting from industrial pollution, we are heading towards an increasingly alarming global scenario. Just as it contributed to the worsening of this condition, design can be a decisive factor in change (Global Footprint Network, 2021; Lipovetsky e Serroy, 2015; Straliozzo, 2009).

According to authors such as Cardoso (2016) and Fletcher and Grose (2011), the current world of design has as a new parameter the ethical dimension regarding the respect for the environment, which inserts contemporaneity in the "era of ecoresponsible creativity"³ (Lipovetsky and Serroy, 2015, p. 227). Thus, new symbolic values are assigned concerning

3 Translated by the authors. Original Citation: "era da criatividade ecorresponsável" (Lipovetsky e Serroy, 2015, p. 227).

product design. Sustainable design is about creating a new conception of the industrial world, combining aesthetics and functionality to the development of "products that carry values that transcend them: respect for the biosphere, imperative of the collective, responsible ecocitizenship"⁴ (Lipovetsky and Serroy, 2015, p. 259). Thus, a sustainable design comprehends, in equal value, the environmental, social, and economic pillars, to promote a harmonic relationship between humans and nature.

In this, the discussion about the issue of materials used is central. We are in a moment of insertion of new natural origin materials, allowing the opening for multiple possibilities to contemporary creators, expanded by material innovations combined with high technology (Gomes *et al.*, 2020).

Changes in the choice of raw materials for the manufacture of a product, based on sustainability, follow criteria such as the use of renewable sources, reduced levels of production inputs (water, energy, use of chemicals), appropriate working conditions and less waste of materials (biodegradable and recyclable) (Fletcher and Grose, 2011). However, while crucial, material change is only part of achieving sustainable development.

According to the author Papanek (1985), regarding the pollution of the environment, the designer is one of the major responsibilities. Despite decades later, a phrase of the author remains relevant: "If design is ecologically responsive, then it is also revolutionary" (Papanek, 1985, p. 252). This addresses the great environmental and social responsibility of the designer when designing for a complex world. It is not only essential for the designer to understand the present, but also to think about what this will entail in the future.

Thus, in the current context, the designer's role takes on a new connotation, a "character of urgency" (Flusser, 2013, p. 200): a transformation of the entire production system is needed to make a design sustainable, creators must think of the complex production chain of the object as something cyclical and interconnected (Fletcher and Grose, 2011).

2. The Bio-jewelry

The bio-jewelry, inserted in the frontier space of art and design, characteristic positioning of the contemporary jewelry field, brings a new proposal of jewelry, with new materials and purposes. It is the scenario of the current complex world that, diluted the importance of the monetary value of the materials used in a jewel, and the new aesthetic, ecological, social, and symbolic values ascend (Cardoso, 2016; Passos, 2018; Szaz, 2020).

Below (Figures 1 to 7) are some examples of different style proposals of bio-jewelry made by Brazilian jewelry artists.

2.1 Cultural roots of bio-jewelry and its current meanings

The creation and use of bio-jewelry have their origins in the Brazilian indigenous culture and the African culture, influence suffered by the coming of African slaves to the country (Benatti, 2017; Fernandez, 2019; Lana *et al.*, 2012). According to Fernandez (2019), the most frequent use of the adornment began in the context of indigenous rituals, and, over time, other meanings and uses were given to bio-jewelry, which came to be taken as an identity and heritage good, being traded throughout Brazil, in addition to international markets (Fernandez, 2019; Jorcelino, 2019; Szaz, 2020).

Brazil, holder of the greatest biological wealth and genetic heritage on the planet emphasizes the importance of biodiversity as a strategic tool for sustainable development, to

4 Translated by the authors. Original Citation: "produtos portadores de valores que os transcendem: respeito pela biosfera, imperativo do coletivo, ecocidadania responsável" (Lipovetsky e Serroy, 2015, p. 259).



Fig. 1 Bio-jewels by Gabriela Lisboa (Nordestesse, 2021).



Fig. 2 Bio-jewel by Adeguimar Arantes (ARANTES, c2021)



Fig. 3 Bio-jewel by Angelsea Camargo (CAMARGO, c2021).

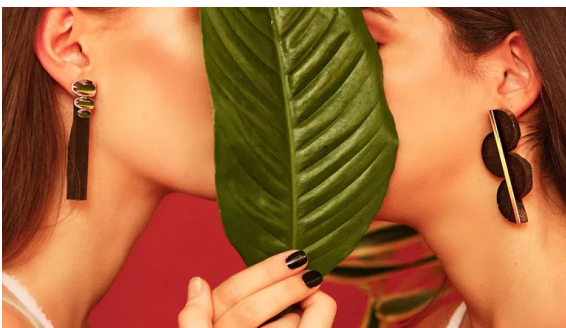


Fig. 4 Bio-jewels by Recoffee (RECOFFEE, c2021).



Fig. 5 Bio-jewels by Maria Oiticica (MARIA OITICICA BIOJOIAS, c2021)



Fig. 6 Bio-jewel by Rita Prossi (PROSSI, s.d.).



Fig. 7 Bio-jewels by Patricia Moura (MOURA, 2021).

conserve and enhance its differential (Jorcelino, 2019). As pointed out by Szaz (2020), bio-jewelry is inserted in this scenario propitiating the appreciation and rescue of the typically Brazilian culture, with the diversity of materials characteristic of each region, being the Amazon of great weight in the field of bio-jewelry.

According to the author Jorcelino (2019), each botanical species native to Brazil can be considered a genetic and eco-cultural heritage of the country and, through heritage recognition, with the appreciation of the craft of sustainable extractive communities and artisans, income and social inclusion can be generated for the national population. That said, bio-jewelry is not only inserted in this context but also plays a relevant role in approaching and spreading the theme.

Joining natural elements with noble materials, with artistic creations and differentiated design, added to the richness of colors, textures, and shapes of the Brazilian flora and the rescue of elements of the history, beliefs, values, and traditions of the Brazilian people in their regionality, bio-jewelry becomes a product of high added value, which has increasingly incited national and international interest (Fernandez, 2019; Jorcelino, 2019).

As previously pointed out, the identity of bio-jewelry is closely linked to cultural history, and its aesthetic value transcends the intrinsic, associated with the materials, passing also to the symbolic and affective (Passos, 2018; Szaz, 2020). In the creation of bio-jewelry, the use of natural, regional, and sustainable materials can be interpreted in its essence and affectivity, bringing the representational aspect, by uniting in an object a "set of memories, representations, and meanings"⁵ (Szaz, 2020, p. 59).

2.2 Sustainability in the bio-jewelry production chain

Bio-jewelry is widely associated, both in academic studies and in a collective mentality, with the concept of a sustainable product because it uses natural materials and does not involve great generation of production waste (Lana *et al*, 2012; Jorcelino, 2019). However, the use of this type of material, only, does not ensure the sustainability of a product, since the concept "sustainability" are related to social, economic, and environmental aspects throughout the product life cycle (Benatti, 2017; Fernandez, 2019; Fletcher and Grose, 2011).

Addressing the environmental aspects of bio-jewelry production, Benatti (2017) analyzes the process from the collection of ornamental seeds used in the adornment to the material processing, which questions the concept of bio-jewelry as a sustainable product. For bio-jewelry to have sustainability at its core, it must pay attention to the fact that the extraction of some seeds makes it necessary to exploit the original plant; as well as the procedures during the material processing.

Among the aspects to be pointed out regarding the products' processing is the energy expenditure with the machinery that, for the seed sanding, reaches high levels, but, given the handmade production of the equipment it makes it difficult to carry out measurements and analyses of these indexes. Just as occurs in the dyeing process of the collected materials: when a synthetic dye is used to make the object, it must be correctly discarded. However, due to misinformation about these aspects, the disposal is done in an inappropriate way, which can generate a great environmental impact (Benatti, 2017). Thus, for the truly sustainable development of bio-jewelry production, these points must be considered.

As for the social and economic pillars of a sustainable product, one can highlight the contribution of the bio-jewelry production chain to the community (Jorcelino, 2019). The sustainable exploration of non-timber forest products (NTFPs)

5 Translated by the authors. Original Citation: "conjunto de memórias, representações e significados" (Szaz, 2020, p. 59).

made by local workers is an important element to the conversation of the environment and its diversity, as well as to the improvement of traditional communities' income in the forest region. And the collection and management of NTFPs have a great correlation with the production of bio-jewelry because, for the most part, it is an exploration that does not impact the original plant, unlike the logging interest that requires the felling of trees.

Therefore, the creation and production of bio-jewelry that uses natural and genuine raw materials from Brazil can be taken as "a strategic action of sustainable production, which adds value and income to the community, in environmental, economic, social aspects, given the concern and care to preserve and conserve the standing forest over the years"⁶ (Jorcelino, 2019, p. 50).

Conclusion

In the current design world, a new parameter is the ethical dimension regarding respect for the environment, being attributed to new symbolic values regarding product design (Lipovetsky and Serroy, 2015). And, within this scenario, one can point out the great environmental and social designer's responsibility when designing for the contemporary world to consider the consequences of the object and its production in the future (Cardoso, 2016; Flusser, 2013; Papanek, 1985).

As discussed during the study, the major impact of contemporary jewelry production is in the pre-production stage, with the extraction of natural, rare, and non-renewable raw materials, which are precious metals and gems (Stralio, 2009). The strong mining activity with the extraction of gold and diamonds was pointed out as largely responsible for an annual increase in deforestation in the Amazon region (Manso *et al.*,

2021), impacting the world's ecological panorama, increasingly alarming (Global Footprint Network, 2021). Considering these and other negative effects of mining activity, mineral extractivism proves destructive to the environment and local communities and incapable of generating solid benefits for the regional economy (Manso *et al.*, 2021).

In this scenario, bio-jewelry rises. This artifact intrinsically linked to Brazilian culture can be considered an identity and heritage good, which contributes to the appreciation and rescue of the typically national culture, with the great diversity of materials from each region and the relevant presence of the Amazon in the bio-jewelry field (Szaz, 2020).

One can also highlight the appeal of bio-jewelry to the sustainable, valuing regional raw materials and craft communities in Brazil. Composing the space of alternative jewelry production, bio-jewelry, inserted in the concept of bio-economy, creates, through scientific knowledge and technological innovations and guided by principles of sustainable development (OECD, 2009), alternatives to the irresponsible use of non-renewable materials in jewelry and contributes to the recognition and maturation of the local production chain by relating intrinsically to the craft of sustainable artisan and extractive communities, formed by local workers, generating income and social inclusion to a large portion of the Brazilian population (Jorcelino, 2019).

By joining natural materials richly found in the country, with noble materials, the creation of bio-jewelry with a differentiated design can be seen as an instrument of innovation and boosting of bio-jewelry in the national and international jewelry markets (Benatti, 2017). The association of these materials is mutually beneficial to traditional jewelry and craftsmanship: the jewelry segment provides a greater appreciation of

⁶ Translated by the authors. Original Citation: "uma ação estratégica de produção sustentável, que agrega valor e renda à comunidade, nos aspectos ambiental, econômico, social, visto a preocupação e o cuidado em preservar e conservar a floresta em pé ao longo dos anos" (Jorcelino, 2019, p. 50).

the natural raw material and the seeds attribute innovative aspects to the jewelry (Benatti, 2017; Lana, 2012). In this, the designer's role is to boost this segment as an alternative sustainable product and, concomitantly, to raise the added value of bio-jewelry.

Given this, the next steps of the investigation are research work in conjunction with Brazilian artisan communities and jewelry designers, emphasizing the study of these alternative materials and techniques applied to jewelry; contemplating, also, surveys about innovations in the international jewelry design sector.

Therefore, considering the current panorama of product development that inserts the concept of eco-responsibility in jewelry design, and given the increasing value attributed to Brazil's natural heritage that is currently under threat, bio-jewelry is positioned as an important element of innovation on the rise in the contemporary jewelry industry.

References

- Arantes, A. (c2021). Adeguimar Arantes, Joias de autor, available at: <https://adeguimارانtes.com/> (accessed: 7 November 2021).
- Camargo, A. (c2021). Arte em Biojoias - Página do Facebook, available at: <https://www.facebook.com/angelseacamar-goartembiojoias/> (accessed: 7 November 2021).
- Cardoso, R. (2016), *Design para um mundo complexo*, Ubu Editora, São Paulo.
- Benatti, L. P. (2017). *Inovação nas técnicas de acabamentos decorativos em sementes ornamentais brasileiras: design aplicado a produtos com perfil sustentável*, Blucher, São Paulo.
- Factum, A. B. S. (2009). *Joalheria escrava baiana: a construção histórica do design de jóias brasileiro*, Universidade de São Paulo, São Paulo.
- Fernandez, K. V. (2019). *A produção de biojoias e sua correlação com os aspectos de uso: o estudo de caso das artesãs do Ceprama*, Universidade Federal do Maranhão, São Luís.
- Fletcher, K. e Grose, L. (2011). *Moda & sustentabilidade: design para a mudança*, 1ª. ed., Editora Senac São Paulo, São Paulo, SP.
- Flusser, V. (2013). *O mundo codificado: por uma filosofia do design e da comunicação*, Cosac & Naif, São Paulo, SP.
- Godoy, A. S. (1995). "Introdução à pesquisa qualitativa e suas possibilidades", *Revista de Administração de Empresas*, v. 35, n. 2, p. 57–63.
- Gomes, J. N., Avelar, S. H., Costa, S. M. e Costa, S. A. (2020). "Impressão 3D para vestuário: novos paradigmas de design e consumo", *ModaPalavra*, v. 13, n. 29, p. 136–156.
- Global Footprint Network (2021). *Earth Overshoot Day creeps back to July 29*, available at: www.overshootday.org/newsroom/press-release-june-2021-english (accessed: 25 July 2022)
- Global Footprint Network (2022). *This year, Earth Overshoot Day lands on July 28*, available at: www.overshootday.org/?_hstc=104736159.ce9cdc285e104dc0bfb6635ff096eea2.1658865987081.1658865987081.1658932518203.2&_hssc=104736159.1.1658932518203&_hsfp=639984926 (accessed: 25 July 2022).
- Instituto Brasileiro de Gemas e Metais Preciosos (IBGM) (2019). *O setor em grandes números*, IBGM, São Paulo, available at: ibgm.com.br/publicacao/o-setor-em-grandes-numeros-2015/.

Instituto Escolhas (2021a). *Destravando a agenda da bioeconomia: Soluções para impulsionar o uso sustentável dos recursos genéticos e conhecimento tradicional no Brasil*, Instituto Escolhas, São Paulo.

Instituto Escolhas (2021b). *Qual o real impacto socioeconômico da exploração de ouro e diamantes na Amazônia?*, Instituto Escolhas, São Paulo.

Instituto Escolhas e Instituto Relações Internacionais e Comércio Exterior (IRICE) (2020). *Agenda para o destravamento da bioeconomia*, available at: www.escolhas.org/wp-content/uploads/2020/07/BIOECONOMIA_2-1.pdf (accessed: 27 June 2021).

Jorcelino, T. M. (2019). *Patrimônio natural e genético: cuidados no uso de sementes ornamentais brasileiras na cadeia produtiva das biojóias*, Universidade de Brasília, Brasília.

Jorcelino, T. M., Streit, J. A. C. e Freitas, C. R. C. (2020). "Relevância da pesquisa científica, educação, ciência, tecnologia e inovação florestal à cadeia produtiva do artesanato biojóias". *Humanidades & Tecnologia em Revista Multidisciplinar (FINOM)*, v. 21.

Lana, S. B. e Benatti, L. P. (2012). "Usinagem aplicada a sementes ornamentais brasileiras: utilizando o design para tornar o setor da biojoia mais competitivo", *Projetica*, v. 3, n. 1, p. 241.

Lana, S. L. B., Krucken, L., Silva, A. C. M. e Benatti, L. P. (2012). "Design de biojóias: desenvolvimento de produtos com perfil sustentável", *VI Encontro Nacional da ANPPAS*. Belém.

Lisboa, G. (2020). Biojóias Gabriela Lisboa - Publicação do Instagram, available at: <https://www.instagram.com/p/ClDOWHIBiWi/> (accessed: 9 November 2021).

Lipovetsky, G. e Serroy, J. (2015). *A estetização do mundo: viver na era do capitalismo artista*. 1ª ed., Companhia das Letras, São Paulo.

Manso, C., Bastos, F. e Finatti, R. (2021). *Qual o real impacto socioeconômico da exploração de ouro e diamantes na Amazônia?*, Instituto Escolhas, São Paulo.

Maria Oiticica Biojóias (c2021). Biojóias artesanais criadas pela designer Maria Oiticica: Brincos, colares e acessórios sustentáveis, available at: <https://loja.mariaoiticica.com.br/> (accessed: 9 November 2021).

Matter Of Form (MOF) (2021). *The future of the jewellery industry: trends & insights*, Matter Of Form, available at: www.matterofform.com/news/articles/jewellery-industry-trends (accessed: 25 July 2022).

Moura, P. (2021). Patricia Moura Biojóias - Publicações no Instagram, available at: <https://www.instagram.com/patriciamourabiojoias/?hl=pt-br> (accessed: 9 November 2021).

Nordestesse (2021). Proteção preciosa. Moda – BA, available at: <https://nordestesse.com.br/protacao-preciosa/> (accessed: 9 November 2021).

Organization for Economic Co-operation and Development (OECD) (2009). *The bioeconomy to 2030: designing a policy agenda*, OECD, Paris.

Papanek, V. (1985). *Design for the Real World: Human Ecology and Social Change*, 2nd ed., Thames & Hudson, London.

Passos, A. C. B. M. (2018). *De matéria a afeto: a construção do significado da joia*, Universidade Presbiteriana Mackenzie, São Paulo.

Prossi, R. [s.d.]. Rita Prossi: precursora no uso da natureza amazônica em joias, available at: <https://www.ritaprossi.com/> (accessed: 9 November 2021).

Recoffee (c2021). Sobre nós - Recoffee Design, available at: <https://www.recoffeedesign.com.br/> (accessed: 7 November 2021).

Salomon, M. (2020). *A nova corrida do ouro na Amazônia*, Instituto Escolhas, São Paulo.

Skoda, S. M. O. G. (2012). *Evolução da arte da joalheria e a tendência da joia contemporânea brasileira*, Universidade de São Paulo, São Paulo.

Stralio, L. M. (2009). *Ciclos: estudo de casos de ecodesign de jóias*, Universidade Federal do Rio Grande do Sul, Porto Alegre.

Szaz, N. D. S. (2020). *Biojoia: entre a arte e o design*, Universidade de São Paulo, São Paulo.