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COGNIZING NON-TOXIC PRACTICES IN THE PRINT PROCESSES: A STUDY OF VARANASI

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ABSTRACT

Ecology, which is one of the essential practices of sustainable practice, is the talk of the town these days, and professionals from every domain are involved in such practices. This has also been observed in the print medium, where some artists and printmakers take prints using non-toxic materials. Since the ecological aspects of printing have been addressed in many research commentaries, most practitioners still use conventional printing methods and techniques, including materials (toxic), which derive from this research to investigate the significant reasons and construct the practicable framework for the non-practicing professionals and artists. It is well known that Varanasi is a city older than History; as Mark Twain said, thus on other cities can be a better option for conducting a comparative analysis of traditional and ecological print practices. After the argument, this paper reviews the advancements in printing processes used in Varanasi, focusing on toxic and non-toxic methods. It attempts to answer whether traditional printing practices are ecologically friendly. The first part of the paper briefly examines the spread of print media, the different trends and prevalent practices, and their impact on ecology in Varanasi. This part of the research and discussion is based on descriptive analysis. The second section of the paper focuses on current issues in ecology under three broad headings: theory and ecology, practice issues, and ecological effectiveness using discourse analysis to obtain responses from printmakers, and later it would be used to construct the research argument. An important thread running through the second part of the paper is related to discussions about the theory of ecology that is common in print practices and how these practices affect the various areas of ecology and their evaluation.

Keywords: Print Making, Ecology Art, Sustainable Practices, Non-Toxic Materials

1. INTRODUCTION

As a result of our enhanced awareness of ecology and the significance of environmental change brought on by human activity, ecology has become an essential component and the key principle of sustainable practices. According to the historians' observations, paper and print did not substitute for the early oral communication techniques; rather, they have fostered and enhanced them. In this way printed matter has become the culture of communication as a part of development across the globe with the practice of conventional printing techniques. It is now common practice to adopt print as a form of communication, and printing is connected to a wide range of interests among people for a variety of

communication purposes. In the process of advancement to means of communication, the conventional method of print making includes toxic material and can be responsible for ecological alterations. According to the study conducted by the researchers, every print that is taken will have a detrimental impact, and conventional toxic procedures used can be one of the reasons for it. In 1713, the father of occupational medicine, Bernardo Ramazzini, released his book, "Diseases of Workers", Occupational hazards were noted in the 18th century and were the first concerns about the art occupation Ramazzini (1940), Fee and Brown (2001), Radaydeh & Otoom (2004). The printing industry plays an important role as one of the biggest polluters among various other parts of industry Mollah et al. (2000), Huang and Shih (2008), and Kiurski et al. (2016a). The components used in printing have affected most of the nature elements such as air, water, soil along with human, plants, and animal life. Besides that, recent studies by Kiurski et al. (2016a) on the influence of emissions of deteriorating organic products on printing in an indoor atmosphere have shown that changes in the microclimate parameters—light intensity, temperature, and relative humidity—affect the health of the workers. The art materials in general and printmaking materials include a vast array of hazardous chemicals such as acids, toxic and flammable solvents, lead compounds, nickel, zinc, and pigments containing cadmium Hall (1988). These are the same chemicals that cause major occupational health problems in industrial workers Hall (1988), Radaydeh (2000). In general, iterative effort of printing carried out by human in its various processes, i.e., during cleaning wastes are produced like scrap paper, waste ink etc., which results in emission of volatile organic compound (VOC), and they can be possibly explosive and flammable mixtures with air Kiurski et al. (2016b).

The regional, economic, social, and cultural diversity in India has remained a problem for policymakers when drafting development policies as planning initiatives for sustainable practices in this instance Sarkar et al. (2022). To have sustainable development goals, the Government of India, through its newly established think tank, the National Institute for Transforming India (NITI) Aayog, launched the Aspirational Districts Program in 2018 Puri (2018). Mark Twain's observations on such social problems were noted in the form of criticisms in his book Following the Equator: A journey around the world, Twain (1897). As mentioned in the thesis of Siddiqui (1987). –

> *Mark Twain treated various problems such as cultural conflict and cultural disintegration which often a rise from Imperialism. The reformer in Mark Twain wanted to reform the whole world. His determinism on the other hand leads him to think that no reform is possible because there is something wrong with human nature itself. His heart dwells on the depravity, perversity, and meanness of the human race.*

Pogue (2012) provided revolutionary data on adapting petroleum-free, green, non-toxic material that meet the Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency (EPA) demands written in his published book *Printmaking revolution: new advancements in technology, safety, and sustainability*. In the area of research, it is noted that since the last decade, a few new patents have been issued on biodegradable materials and renewable bio-based substitutes for petroleum-based solvents that are widely used in a variety of industrial uses (such as food additives, pharmaceuticals, biofuels, coatings, cleaners, paints, and agriculture products) Pogue (2012). The facts make it remarkable and practicable to research non-toxic print making processes and implement them to improve environmental protection and sustainable development. Ecological print-making practices are a more recent idea to overcome ecological issues as these are

becoming worse daily. And, to reduce the negative impacts on the environment caused using conventionally toxic print making processes; it is vital to understand how artists, printmakers, and the printing industry can contribute with the use of non-toxic print processes.

2. METHODOLOGY

The proposed area of study has been derived from researchers' observation, later it has been conducted to a systematic review from various secondary sources. Finally, it is validated through primary source data, such as interviews. For this study a total of eight members were interviewed which was analyzed through qualitative appraisal method.

3. CHRONOLOGICAL DEVELOPMENT IN PRINT MAKING PRACTICES IN VARANASI

Varanasi has historically been a major urban center in various areas and has long held importance in political, religious, and cultural significance within India. The beginning of the print culture in Varanasi is difficult to date with precision.

During the latter half of the 19th century, with the beginning of the local print culture and the spread of lithography, the early printed maps were examined in Banaras. Numerous presses were in operation in the towns and cities of Delhi, Agra, Meerut, Bareilly, and Calcutta, including Banaras (Varanasi), during the period of the 1840s, as per the study Shah (2017). In the study by Gengnagel (2003) found a documented history of printed religious maps produced in Banaras (Varanasi) by Banarsis from1870's. Mapping the "Holy City" in the 19th century was not the sole domain of the British Gengnagel (2003). The British initially sponsored the innovation and introduction of printing technology, which was promptly adopted by the Indians, and continuous work fueled its growth in westward expansion in typeset edition and lithography, particularly the spectacular soar in Hindi publishing in Banaras Freitag (1989). In the area of printing industry new professions emerged such as publisher/proprietor, editor along with-it skilled laborers like coolies, sponge-men, cleaners, peons, and bheestis (watercarriers) for the maintaining the functionality of press. And the manual laborers and artisans like blacksmith were involved to fulfill the needs of skills in metalwork of typecasting for typography, the scribe and the material had a straight-forward relation to work for the lithography medium Shah (2017).

From the study of Kevin Lynch's seminal work Lynch (1960), noted by Rana P.B. Singh. the spatial organization of the holiness and pilgrimage journey has been represented with the printed maps of Hindu-codified imageries of Kashi. The first three maps of this series refer to yatras of Kashi made by Krishnachandra Sharma in 1877. The map (Kashi Darppana) corresponds to AD 1875 and Kailashanath Sukula, head of a renowned family in the Kalalbhairava mohalla of the city, prepared it. The map was lithographed in Varanasi at the Vidyodaya press by using five engraved stones slabs and the size of the map noted is 79 x 92 cm, printed on cloth and paper, and the circulation counted to 5000 copies prints. It has inscribed with text both in Hindi and in Sanskrit, the script is Devanagari. The copies of the map are found at various places like in private collections, the British Library, Bharat Kala Bhavan (Varanasi) as well Pieper (1979), Rana (1988) and Gengnagel (2003). Similar findings were noted by Gengnagel (2011), the three lithographed printed maps were the earliest one the Saptapurīyātrādiprakāśapatra (1873), Kāśīdarpaa (1876), and Kāśīdarpaapūrti (1877). The Mirror of KÁSÍ (Kashi Darppana) is a

counterpart to Prinsep's topographical map in so far as it is one of the first historical maps of Varanasi printed 1876 in that town Gengnagel (2003). The map Saptapurīyātrādiprakāśapatra Ðarpanam, printed for Babu Janga Bahadura Simha in 1873 at the Banaras Akhbar Press, is the only earlier printed map in notice of Gengnagel (2003)

At Banaras Hindu University, the Faculty of Visual Arts department, has the painting department has a section of a printmaking studio in it. There is no precise information about the initiation of the printmaking studio in Faculty of Visual Art's painting department.

In an interview taken by Shashi Kala Singh (1988) with Prof. Dipti Prakash Mohanty as part of the international workshop *IMPRESSIONS* organized by the Department of History of Art (Faculty of Arts, BHU) from March 9–11, 2016, Prof. Dipti Prakash Mohanty, Dean of the Faculty of Visual Arts, said D. P. Banerjee, an eminent printmaker, was his teacher. Prof. Mohanty has added (in another interview taken by researcher), printmaking practice started in Faculty of Visual Arts under the painting department under the guidance of D. P. Banerjee with his expertise in printmaking skills, he practiced printmaking and continued teaching in Banaras Hindu University. Some of the students of Prof. Dipti Prakash Mohanty name like Prof. Saroj Rani and Uma Shankar are prominent practicing printmakers. Dr Sanjeev Kishor Gautam Rajput, worked in printmaking section a few years back, and currently, Dr Mahesh Singh is teaching. Few young printmakers who studied in Faculty of Visual Arts in Banaras Hindu University are doing printmaking. Dr. Alok Kumar, Anant Ratna, Umesh Singh, Tribhuvan Kumar, Sachin Gond, Anita Mala, Priyanshu Chaurasiya.

The printmaking practices done till now in the printmaking department are the conventional toxic methods. In an interview taken by researcher, with these printmakers, Dr Mahesh Singh, and Priyanshu Chaurasiya they said they are slowly adopting safe methods. Dr Mahesh uses waste-based inks in his practice for monoprints. Priyanshu is currently working in Garhi Artist Studio Lalit Kala Academy practicing dry point, mezzotint, wood cut and plate lithography. The safe printing inks example such as the soya based Akua ink which can be thinned with the use of water and in this case use of hazardous solvents can be avoided as these inks can be washed with water to clean the inks. In recent a workshop was organized in Faculty of Visual Arts painting department, in printmaking studio on New Techniques in Printmaking, the workshop could be the first step to take initiation towards the non-toxic methods implementation in practice.

4. ECOLOGY AND PRINTMAKING

The definition of "ecology" is extensive and can refer to anything from a considerable area unrelated to the scientific fields to biological sciences. In nineteenth century, a German biologist formulated the term "ecology". Contrarily, the coordinated pro-ecological groups, which were also represented in art, began in the early 1960s Winczek & Winczek (2018). It is challenging to avoid looking back at historical practices and spotting ecological elements in their works of art while researching different facets of the interactions between printmaking art and ecology. The printmaker's studio relies on the technological side of all creative endeavors. Due to the unique feature of printmaking processes, formerly employed in reproductions of prints that are still in use, the working environment of the artist may contain harmful elements. Considering today's concern for the environment, the choice of the printmaker to use material in the creation of prints for expression can relate to the common area between printmaking art and ecology. With increased

awareness, the artists' choice to use non-toxic materials, which do not include any toxic ingredients in his or her creation, has become a requirement.

5. ADVERSE EFFECTS OF TOXIC PRINTMAKING METHODS AND PRACTICES

In recent years issues related to material used in printmaking processes have been a concern for the past few years. A combination of hazardous, damaging, toxic, and sometimes dangerous materials and techniques are employed in conventional printmaking work practices today, which are unmatched by most other artistic fields. Each ingredient can negatively impact an artist's health when used alone, but when combined, they pose a danger to individuals who regularly practice printmaking. The creative potential of the medium was enlarged by other significant printmaking techniques such as fine art lithography and screen-printing, that were created and developed, but they also added further chemical dangers to an already lengthy list. The Alberta Labor, Occupational Health, and Safety Division in Edmonton published "Health and Safety in Printmaking: A Manual for Printmakers" in Moses (1978). It states that traditional printmakers frequently use 112 toxic and noxious substances Sabour (2017). Numerous chemicals and acids are used in printmaking, and nitric acid is one of them that is frequently used in print workshops as part of the etching process. According to the Center for Safety in the Arts, "Nitric acid" (HNO_3) in concentrated form has a powerful oxidising effect and can react violently with other acids, solvents, etc. Numerous nitrogen oxide gases, including nitrogen dioxide, which is a potent respiratory irritant [despite being odourless] and can lead to emphysema, are released when nitric acid is heated. Both continuous exposure and significant acute overexposures have the potential to result in emphysema and pulmonary edema (chemical pneumonia). Hydrogen gas that is flammable is also generated during the etching procedure." Numerous researchers also draw attention to the environmental issues that toxic print materials have on our ecosystem in addition to these health issues Aydemir & Ayhan Özsoy (2020) and Khan (2022). For example, discuss the detrimental environmental impacts of various printing materials. However, as Jemai et al. (2021) and Khan (2022) noted, "Organic solvents, such as the from the aldehydes and ketones family example toluene and isopropyl in general, are one of the most underappreciated risks in art supplies. In printing, organic solvents are used to clean plates, rollers, tools, and even hands in addition to blending and dissolving oils, resins, varnishes, and inks" Khan (2022). Toxicology is the study of the effects of toxic substances on living things, whether they are synthetic or natural Wheeler (1980), Pengelly (1997). It states that a substance's "invasive capability" determines its toxicity; the finer the particles or the greater the ability to absorb, the greater the degree of interaction and solubility. Three different routes exist for these compounds to reach the body: ingestion, gaseous inhalation, and skin contact Pengelly (1997).

- ***Inhalation:*** Breathing in fine particles, gases, and vapors can enter and pass through blood stream along with oxygen and there are possibilities where the tissues of respiratory system may be in danger. A variety of dusts and sprays, including rosin, aspheltum, chalk, wood dust, and the atomized stray (possibly solvent-laden) that comes from pressure washing screens, are produced during the printing process. All these substances are potentially dangerous and are easily inhaled Pengelly (1997). The closed working space, less ventilation and equipment like open containers used for acids and solvent and its overexposure incur symptoms of eyes, nose and throat irritation, headache, narcotic effects like dizziness, drowsiness.

- ***Skin (Dermal) & eye absorption*:** The first defenses against a poison entering the body are the eye and skin (dermis and epidermis). How rapidly a toxin is absorbed depends significantly on which portion of the body is exposed to the substance (chemicals). For instance, the hands exhibit greater resistance than the upper arms or abdomen Pengelly (1997). The absorption of chemicals in a solid, liquid, vapor, or gas state is another possibility for them to enter the skin and eyes. A chemical that encounters the skin can cause a local reaction like a burn, irritation, or rash. It can also cause absorption into the bloodstream without causing a skin reaction. The chemical could then have hazardous effects on other bodily parts after being absorbed into the blood. Exposure to the chemicals to the skin may cause dry skin, swelling, blisters, or itching. In the case of eye contact with chemicals can be very dangerous and its extremes lead to blindness.
- ***Ingestion*:** Consuming a toxin is the most common means for it to enter the body. Poor workplace hygiene, such as handling materials, blending colors, or printing, can expose printmakers to contamination. Given the typically "informal" atmosphere of the printmaking class, bringing food or beverages into the workspace is the most frequent source of contamination, according to the researcher's experience Pengelly (1997)

6. CHALLENGES IN ADOPTING THE NEW NON-TOXIC PRINTMAKING METHODS AND PRACTICES:

- ***A Fascination for the outcome of the toxic methods*:** Diverse presentation methods and styles for artistic creations are already available and printmaking is one of them. Even though we recognize its significance, few printmakers do not give much thought to the fact that certain negative effects could be caused by its method, which can harm the environment and the printmaker themselves. The fascination with that elusive quality resulting from merging concepts and the satisfaction of working with printing materials have driven the artists to devote time and again to printmaking tools, metal plates, wood blocks, and stone blocks Chesney (2015), Dumsopee (2020). In etching process, many printmakers still use nitric acid due to its visual effect, and make use of commercially available inks, which are one of the prominent factors affecting ecological alterations.
- ***Least awareness:*** Ecological crisis became a national issue in America after learning of the detrimental environmental effects caused by use of DDT, through the study by Rachel Carson in the book *Silent Spring* written in 1962 Carson (2015). Twenty million Americans joined in to celebrate the first Earth Day on April 22, 1970, as Congress recessed, and teach-ins were held across the United States to inform citizens about what was happening to our environment and discuss potential solutions Pogue (2012). But, despite growing concern about hazardous materials, college screen-printing and etching students were still inhaling fumes from photoresists, nitric acid, and extremely toxic solvents. Lithography students used toxic ProSol as a plate etch and benzene as an ink cleaner Pogue (2012). Looking at the awareness campaign organized in western countries and its effects, if compared in India there is least awareness canvassing has occurred till now. And this could be one of the reasons for not adopting the new methods.

- ***Initial stage of adopting the new methods:*** Despite being a comparatively recent trend, moving toward non-toxic printmaking, it is undeniable that non-toxic prints have had amazing success in recent years. As printmakers have taken a few initiatives to adopt new, non-toxic printmaking methods into their practice, toxic printmaking methods are still in use. Australian artist Dan Welden, who created the first photopolymer plate and subsequently offered it to the artists as an alternative to conventional metal plates, is credited with first introducing the idea of non-toxic printmaking to the art world in 1972 Sabour (2017). Workshops are being organized on new methods, which can be said to be an "initiation" towards raising awareness and adopting the new methods. The creative experimentation of the artist printmaker and students is the influence of every aspect of new advancements in printmaking processes. They have shown that contemporary printmaking is more about expression, creativity, and substance than craftsmanship.

7. CONTRIBUTION IN SAFETY MEASURES- ENVIRONMENTAL MEASURES OF NON-TOXIC PRINTMAKING METHODS AND PRACTICES

The use of non-toxic print techniques marks a revival of printmaking as a crucial, innovative force in the field of art education and printing. The modern new printmaking technique uses sufficient substitutes that are safe for printing and use fewer toxic chemicals overall. The non-toxic approach has been consciously adopted and implemented in printmaking by artists in Europe and the United States. Rossol (2001) industrial hygienist talks in her workshop on hazardous artist materials that comply with OSHA regulations Pogue (2012). It wasn't until the 1980s that practices in college studio art and science began to affect because of increased industrial knowledge of health hazards Pogue (2012). If printmakers educate themselves and their students about nontoxic materials like petroleum-free, bio-solvents. In that case, they can bring awareness about the new methods and begin a new step towards ecological practices to meet professional technical standards, in the industry. D-limonene (C10 H16), ethyl lactate (C5 H10 O3), and methyl soyate (C93 H174 O10) are just a few of the novel, highly efficient solvents that are based on foods like citrus fruits, corn, and soybeans Pogue (2012). The cost-effective non-toxic techniques don't require sacrificing the print's quality. The institutions and printing studios that maintain traditional print practices can upgrade the studio level and accept the level of safety. Since the non-toxic methods only use safe printing materials, they do not necessitate costly respirators and a fume-exhaust system.

The development of printmaking processes, i.e., non-toxic methods, has impacted not only safety measures but also the creative explorations of the printmakers. In the new medium, there is significant freedom compared to traditional methods. The limitation of medium in visual representation does not appear to be a barrier to artists' creative expression, as it has reduced craftsmanship and allowed one to focus on the creative aspect, which has changed the ideologies of contemporary printmaking.

8. CONCLUSION

As Mark Twain mentioned about social problems, i.e., cultural conflict or cultural disintegration, in his book *"Following the Equator: A Journey Around the*

World" Twain (1897), he had a focus on the health of the craftsmen (artisan). In terms of non-toxic printmaking practices, any artisan or printmaker should ensure their health through their practices. Every artisan or printmaker in this field must empower in five issue areas: education, health and nutrition, financial inclusion, infrastructure, and skill development. In this case, if we incorporate the government bodies, the policymakers are lacking behind in implementation at a certain point in ensuring the health issues in the various schemes such as Aspirational Districts Program. One of the factors considered in the Aspirational Districts Program is the health of the artisans and printmakers. And printmaking deals with many such techniques that are not advisable for them to practice. So, the (researchers) recommendation made in this paper should be included, and it should be practicable for any artisan or printmaker, and this is the need of the hour.

CONFLICT OF INTERESTS

None.

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