The implementation of biophilic design in co-working space design as a concept of healthy sustainable architecture

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Abstract. Humans have tendency to relate to nature. This is a human trait inherited from generation to generation. Where we can feel happy, interested or amazed by the beauty of nature. The rapid development and technological advances make our relationship with nature farther away. As a result, we become indifferent to the environment around us, the degeneration of ecosystems, and cause mental disorders and stress. Stress and stress disorders are problems that are often experienced by office workers in big cities like Jakarta. There are 60.8% of office workers experiencing depression and stress. One factor causing stress is the work environment, which is a dense urban area. Therefore, rebuilding our relationship with nature becomes more important in the field of conservation. The concept of biophilic design is a design approach based on biophilia aspects which aims to produce coworking spaces that can reduce stress and provide mental and physical healing to its users.

Keywords: Biophilic design, coworking space, sustainable architecture.

1. Introduction
Stress is something that is often experienced by the people of Jakarta, especially among office workers / employees. 60.8% of workers in Indonesia experience stress and depression. Stress and depression in office employees can be caused by the work environment. Where the work environment such as an uncomfortable workspace, the absence of interaction with nature, and so on. During industrial 4.0, the creative economy sector in Jakarta in 2016 increased from 15.96 million to 16.91 million. From the development of the creative economy that continues to increase every year, so we need space to accommodate the creative economy workers.

Biophilic design is a design based on aspects of biophilia that has the aim of producing a space that can participate in improving the welfare of human life and nature [2]. Biophilic design provides the opportunity for humans to live and work in a place that integrates nature, both with natural materials and forms naturally into design.

According to “Human Space Report: Workplace” (2015) research, said that biophilic design has an influence on office workers especially in:
1.1. Welfare. 
The quality of office design can affect office workers, with aesthetically beautiful space having a positive impact on welfare. Research shows the presence of natural elements in the room can generate the same benefits as the outside environment that supports biophilic designs. According to the study report, the level of welfare in offices that use biophilic designs is 13% higher compared to offices that do not use biophilic designs.

1.2. Productivity. 
Productivity is found to be increased among employees in the environment that complements human biophilic needs. Research at Cardiff University reports the relationship between nature and productivity in the work environment in Europe. By comparing the productivity of two offices, one with natural elements and one without natural elements, they found that offices with natural elements increased 15% of output among employees after 3 months.

1.3. Creativity. 
Research shows that offices differ in terms of their creative potential with various effects on those who work therein. Offices with low creative potential are those that have dim lighting, some natural elements, blurred colors and complex designs. The office which is considered to have high creative potential is very simple in design, bright colors, and natural elements. Research shows that those who work in a bright and wide environment with green plants can stimulate high enthusiasm and creativity.

2. Literature Review

2.1. Nature in Space 
The term "Biophilic Design" was first put forward by Steven Kellert. The purpose of biophilic design is to translate the understanding of biophilia into the design of the built environment, supporting the relationship between humans and nature in buildings to be realized [4]. According to [5], biophilic design is a design based on the biophilia aspect which has the aim of producing a space that can facilitate the improvement of human and physical well-being with a mental that fosters positive relationships between humans and nature.

Biophilic design provides an opportunity for humans to live and work in a place that integrates nature, both with natural materials and natural forms into the design.

According Browning and Clamer (2008) Conceptual framework for biophilic design establish into 3 categories that means to help define biophilic buildings which are:

2.2. Nature in Space 
Nature in Space discusses the existence of nature directly in space. Natural experience in space can be achieved by creating meaningful direct relationships through diversity, movement, and multi-sensory interaction. Nature in space includes 7 biophilic design patterns:

1. Visual connection with Nature
2. Nonvisual connection with Nature
3. Non-Rhythmic Sensory Stimuli
4. Thermal & Airflow Variability
5. Presence of Water
6. Dynamic & Diffused Light
7. Connection with Natural System

2.3. Natural Analogues
The analogy of nature to the organic formations of nature, disorder, material, color, shape, sequence and pattern which becomes the analogy of nature / which encapsulates nature. The analogy of nature is divided into 3 biophilic design patterns:

1. Biomorphic forms and patterns
2. Material Connection with Nature
3. Complexity and Order

2.4. Nature of space
Nature a space discusses the spatial configuration in nature. This includes an innate desire to be able to see the environment, interest in things that are dangerous or unknown, and a feeling of security. The natural experience of space can be achieved by creating spatial configurations using natural patterns in space and natural analogies. Nature of space divided into 4 biophilic design patterns:
1. Risk/Peril
2. Prospect
3. Mystery
4. Refuge

3. Methods
The design method used is the author uses several alloy books and comparative studies. The book used to design co-working space is the alloy book How to create a coworking space as the main book, while for the biophilic design approach using the book 14 Patterns of biophilic design improving health & well-being in the built environment. Coworking space comparative study to determine the area and workspace capacity needed in the design.

4. Result and Discussion
In detail the biophilic approach to building coworking space in question is to reduce / reduce the level of stress and to improve the quality of life for building coworking space users. So out of the 14 biophilic patterns of design, the authors only applied 11 biophilic patterns of design. Because not all patterns can reduce user stress. The biophilic pattern used is:

- Visual Connection with Nature applied through the park. Through visuals in the form of plant colors, flowers and also the colors on the walls of buildings.
- Non-Visual Connection with Nature, applied through the sound of birds, plants, textures on the interior and exterior of buildings.
- Presence of Water applied to areas where users spend a lot of time. Application of water features in the park.
- Prospect, applying openings in all rooms so that all rooms have access to view all rooms. The park area is the point of view in the building co-working space.
- Refuge, applied by providing protection such as canopy, cantilever in buildings. The refuge aspect can also be applied by providing protection and direction trees around the building.
- Risk / Refuge is applied by providing a cantilever and using transparent material such as glass so that it gives a dangerous impression but is still safe to trace.
- Dynamic & Diffuse Light is applied to all spaces by providing comfortable lighting for users (does not cause glare). Artificial lighting can also be used in spaces that are not exposed to natural light such as corridors, so the room does not seem boring.
- Complexity and Order applied to the organization of space and the arrangement of the grid so that it can regulate the lighting coming into the building.
- Biomorphic Form and Pattern applied to building facades. The shape of the wood is applied to the facade which has no openings, so it doesn't seem boring. this pattern can also be applied to interiors.

5. Conclusion
Applying a biophilic design approach to building coworking space can provide psychological and physical effects on building users. seeing and feeling nature can have a healing effect on healing. 14
biophilic approach patterns can be used to help define biophilic into the design of building coworking space.

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