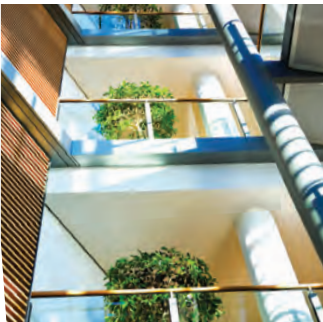


# Wood and Human Health




**Executive Summary:** A recent study at the University of British Columbia and FPInnovations has established a link between wood and human health. In the study the presence of visual wood surfaces in a room lowered sympathetic nervous system (SNS) activation. The SNS is responsible for physiological stress responses in humans. This result opens the door to a myriad of stress-related health benefits that the presence of wood may afford in the built environment. The application of wood to promote health indoors is a new tool for practitioners of evidence-based design.





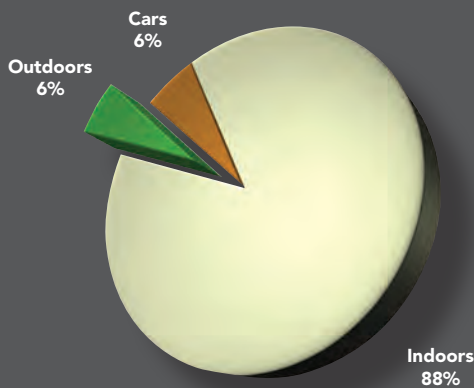
“The application of wood visual surfaces indoors is one way to reduce stress and promote health in building occupants.”

A young child is captured in mid-air, jumping on a wooden play structure. The child is wearing a dark shirt and shorts. The background is a bright, wood-paneled room with large windows. The floor is made of light-colored wood. In the foreground, there is a green plant with large leaves in a red pot.

The effect of plants on humans indoors raised the possibility that wood surfaces may also provide some health effects. This study provided evidence that such a relationship exists between humans and wood surfaces applied indoors.

# Theoretical Background

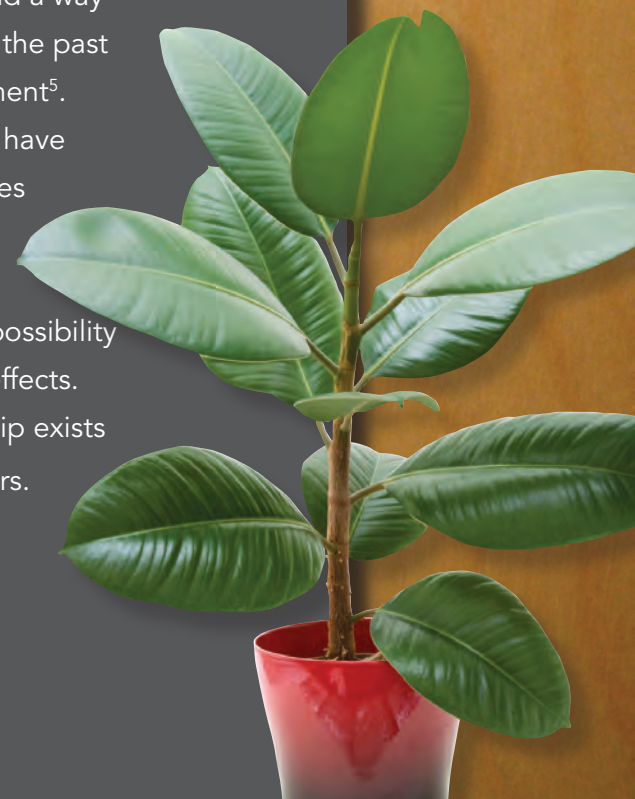
The stress reducing effects of outdoor nature are well documented from a scientific perspective. Exposure to nature has been shown lower blood pressure, heart rate, and aggression<sup>1</sup>. Nature also increases the ability to focus attention and perform concentration and creative tasks<sup>2</sup>. One landmark study of hospital patients recovering from abdominal surgery found that patients in rooms with a view to nature had shorter post-operative hospital stays and required fewer analgesics than patients with a view of another building from their window<sup>3</sup>.



The positive benefits of nature are highly desirable for stress reduction, recovery, attention, and general healthy living. However, the average Canadian spends only 6% of their time outdoors<sup>4</sup>. They spend an additional 6% in their cars and the remaining 88% of their time indoors.

If we are to benefit from the stress-reducing properties of nature we need to spend more time outdoors or find a way to bring nature indoors. This has been achieved in the past by introducing plants into the built indoor environment<sup>5</sup>. The same stress reducing effects of outdoor nature have repeatedly been shown to apply to human responses to plants indoors.

The effect of plants on humans indoors raised the possibility that wood surfaces may also provide some health effects. This study provided evidence that such a relationship exists between humans and wood surfaces applied indoors.



<sup>1</sup> Eg. see Hartig et al. (2003), Laumann et al. (2003), and Kou and Sullivan (2001).

<sup>2</sup> Hartig et al. (1991), Cimprich (1992), and Shibata and Suzuki (2002)

<sup>3</sup> Ulrich (1984)

<sup>4</sup> Leech et al. (1997)

<sup>5</sup> Lohr et al. (1996), Lohr and Pearson-Mimms (2001), Fjeld et al. (1998), Fjeld (2000)



# The Study

Four office environments were created to study the effects of natural materials in the built environment on autonomic nervous system responses. The effects of both plants and wood were studied on a sample of 119 university students.

In studying the effect of wood finishings, identical office furniture and window blinds were obtained in birch veneer and white. This created a wood treatment room and a white non-wood control room. The plant treatment was created through the placement of three plants in the offices and a control was created by replacing the plants with non-natural artefacts.

In the study, students were assigned to one of the four treatment conditions. They were told only that they were going to participate in an office performance task, and were not informed that the effects of materials were being studied.

Heart rate (EKG) and skin conductivity (GSR) were continually monitored during the experiment. The study consisted of three distinct periods. A baseline period, test period, and a recovery period. In the baseline period subjects spent ten minutes alone in the office. During this period subjects displayed apprehension stress with respect to the upcoming test. In the test period subjects were administered an audio-based mathematics test. The test provided moderate to high levels of stress activation. Finally, in the recovery periods subjects were left alone in the office so that stress recovery could be measured.

“Stress, as measured by sympathetic nervous system activation, was lower in the wood room in all periods of the study.”

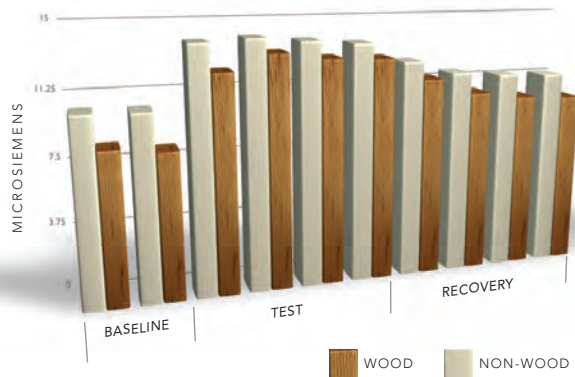


## Results

Stress as measured by SNS activation was lower in the wood room in all periods of the study. SNS activity was monitored by measuring the conductivity of the skin. When one is excited the conductivity of the skin increases.

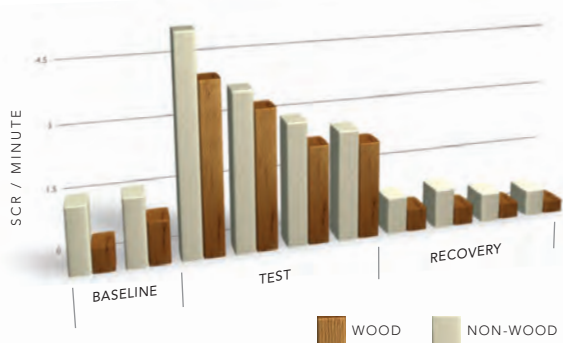
The average skin conductance level (SCL) was statistically lower in the wood room in the baseline period<sup>6</sup>. This is to say that the SNS activation, or stress, was lower on average in the wood office when compared to the non-wood office.

**Skin Conductance Level (SCL)**



The other measure of SNS activation is the number of skin conductance responses (SCR's) per minute. SCR's are temporary spikes in skin conductivity brought on by stressful thought or stimuli<sup>7</sup>. In all periods of the study subjects in the wood room had statistically fewer skin conductance responses. This is to be interpreted as subjects in the wood room had fewer stressful or startling thoughts while sitting in the room.

**Skin Conductance Responses per Minute (SCR)**



<sup>7</sup> The tingling feeling felt in the skin immediately following a stressful stimulus in a skin conductance response.

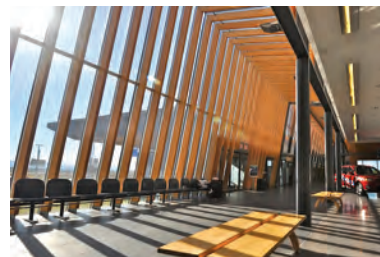
<sup>6</sup> In the test and recovery periods skin conductance level was lower in the wood room but not statistically so.

## Interpreting the Findings

This study has shown that the presence of wood in the built indoor environment reduces SNS activation. SNS activation is the way that the body prepares itself to deal with stress. SNS activation increases blood pressure and heart rate. It also inhibits digestion, recovery, and repair functions in the body in order to deal with immediate threats. However, when the body spends prolonged periods in an SNS activated state health suffers both physiologically and psychologically. Wood, therefore, is one way to create a healthier built environment.



1. Vancouver Convention Centre  
Photo: [www.naturallywood.com](http://www.naturallywood.com)
2. Whistler Library  
Photo: [www.naturallywood.com](http://www.naturallywood.com)
3. Prince George Airport  
Photo: David Fell





# Building Health with Wood

The application of wood visual surfaces indoors is one way to reduce stress and promote health in building occupants. In architecture, “evidence-based design” is a growing field that seeks to promote health and optimize outcomes<sup>8</sup> based on scientifically credible evidence. This study establishes wood as a tool in the pursuit of evidence-based design and healthy building occupants.

Healthcare environments have been the top priority with respect to evidence-based design to date. However, school and office environments are now being considered as the amount of time spent in these environments is great and can influence one’s overall health. The application of wood in hospitals, schools, and offices should be a priority as we consider not just sustainability, but occupant health in the new decade.

## Select Health Benefits of Nature

- lower pain perception
- faster recovery
- fewer reported illnesses
- fewer sick days
- greater attention
- greater creativity
- lower aggression
- better interpersonal relations



1. **Credit Valley Hospital**  
Photo: Timber Systems

2. **Nita Lake Lodge**  
Photo: [www.naturallywood.com](http://www.naturallywood.com)

3. **Brentwood Skytrain Station**  
Photo: [www.naturallywood.com](http://www.naturallywood.com)

4. **Private Residence**  
Photo: [www.naturallywood.com](http://www.naturallywood.com)



**For more information contact:**

David Fell, FPInnovations  
[david.fell@fpinnovations.ca](mailto:david.fell@fpinnovations.ca)

**in collaboration with:**



<sup>8</sup> On average, adults have two measurable skin responses per minute. For example, recovery time in hospitals, productivity in offices, and grades in schools.