

Better lighting can boost sleep, mood in dementia patients

ASU researchers use light that mimics circadian rhythm to help older adults

By Mary Beth Faller, ASU News
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A research team from Arizona State University has shown how certain lighting conditions can improve symptoms of dementia in older adults.

A [study](#) published this summer found that “biodynamic lighting,” or lights that mimic the natural rhythms of daylight, significantly improved sleep time — by an average of 82 minutes — and also alleviated depression symptoms in older adults with dementia.

The researchers¹ included Nina Sharp, the primary investigator and an assistant professor in The Design School, and Jason Yeom, who was until recently an assistant professor in The Design School.

Sharp leads the [DESmart Lab](#) at ASU, which researches smart building technology and human-building interactions.

“Optimized lighting can be a very simple and cost-effective solution to make people happy and healthy and smarter,” Sharp said.

The study, which was funded by the Arizona Alzheimer's Consortium, took place at Sunshine Village, a memory-care facility in Phoenix.

The team worked with 10 people in their 70s who have dementia. During the seven-week trial, the participants were exposed to biodynamic lighting for three weeks and “constant moderate” lighting for three weeks. Sleep quality, depression and agitation were measured.

“For older adults with dementia, it's important to measure everything in their living environment rather than bringing them to the lab. It's essential to our research but it makes it very difficult, very time consuming and very expensive, but this is the value that we really want to keep,” Sharp said.

After the study ended, the caregivers told the researchers that the residents tried to turn on the lights themselves because they liked the effect so much.

Better sleep is critical because poor sleep in dementia patients is tied to depression, anxiety, agitation and reduced cognition.

“One of the reasons that family members move their loved ones to a memory care facility is poor sleep quality,” she said.

“So this is the real effect of our studies — how it can make people, especially older adults with dementia, happier and the quality of life a little bit better in those facilities.”

Results depended not just on the lighting type but also the timing. Sharp and Yeom have launched Beyond Link, a startup developing an indoor environmental-control system focusing on adults with dementia.

“It’s an AI-based lighting condition based on preference, physiological signals and schedule,” Sharp said.

“And we assume that it can reduce the progress of cognitive decline. We need a long-term study to understand that, but this is the assumption based on the initial data that we collected.”

(Video: {<https://www.youtube.com/watch?v=vYdvuvvjs1A&feature=youtu.be>})

Mimicking day and night

So how does biodynamic lighting make us feel better?

Light plays a powerful role in regulating our biological clocks, also known as circadian rhythm, which controls sleep, cognition and mood, Sharp said.

It works this way: The brain connects to “intrinsically photosensitive retinal ganglion cells” in the eyes. These cells signal daytime when exposed to enough light, keeping the brain alert. Without it, the body prepares for rest.

“We need to receive this bright light at the right time, so our body clock is in line with the Earth’s light-dark cycle,” Sharp said.

“If we are not in alignment, we get a sleep disturbance, which can cause mood disorders and reduction in cognition.

“If we receive bright light in the morning, especially early in the morning, we not only have better cognitive performance and better mood, we also sleep better at night because our body is in line with the Earth’s dark-light cycle.”

Bright electric light at night can disrupt sleep.

In the Sunshine Village project, the biodynamic lighting simulated natural cycles: blue-enriched high-intensity light in the morning, neutral white in the afternoon and red-enriched low-intensity light in the evening.

Older people need more light because of age-related changes in the eyes.

“A 60-year-old person needs three times more light than a 20-year-old person to get the same circadian effect. For an 80-year-old person, it is six times more,” Sharp said.

But dementia patients, who spend much time indoors, can be sensitive to bright light, even though they need it.

In fact, during the study, the team had to reduce the intensity of the light because the participants found it uncomfortably bright.

Bridging the gap between research and practice

Yeom also studies human-building interaction, focusing on how indoor temperature affects productivity and cognition.

Sharp and Yeom say that many workplaces are uncomfortable because they’re full of dated technology — particularly fluorescent lights, which can decrease performance.

Often, designers are not connected with the most recent research findings, so there is a gap between science and practice, Sharp said.

“Jason and I are trying to bridge this gap. When we write a paper and when we go to conferences, we propose practical solutions so the designers can apply that,” she said.

For example, building temperature is based on old norms, Yeom said.

“A long time ago, researchers sent out a survey to thousands of people and then created an equation and decided that if 80% of them say, ‘This is a comfortable temperature,’ we’re just going to use that temperature as a rule of thumb,” he said.

“But now, because of machine learning and AI, we can micromanage these environments and predict the best temperature for this specific person with the best lighting condition.”

The right temperature can boost productivity and relaxation, he said.

In one [research project](#), Sharp and Yeom brought Mirabella residents to the lab and exposed them to different light and temperature settings.

They found men performed best with cooler temperatures and cool light, while women did better with warmer settings — with the gender gap wider among older adults compared with the young adults that Yeom had previously tested.

Sharp said that ASU is the perfect place to pursue her research and she draws student workers from majors across the university.

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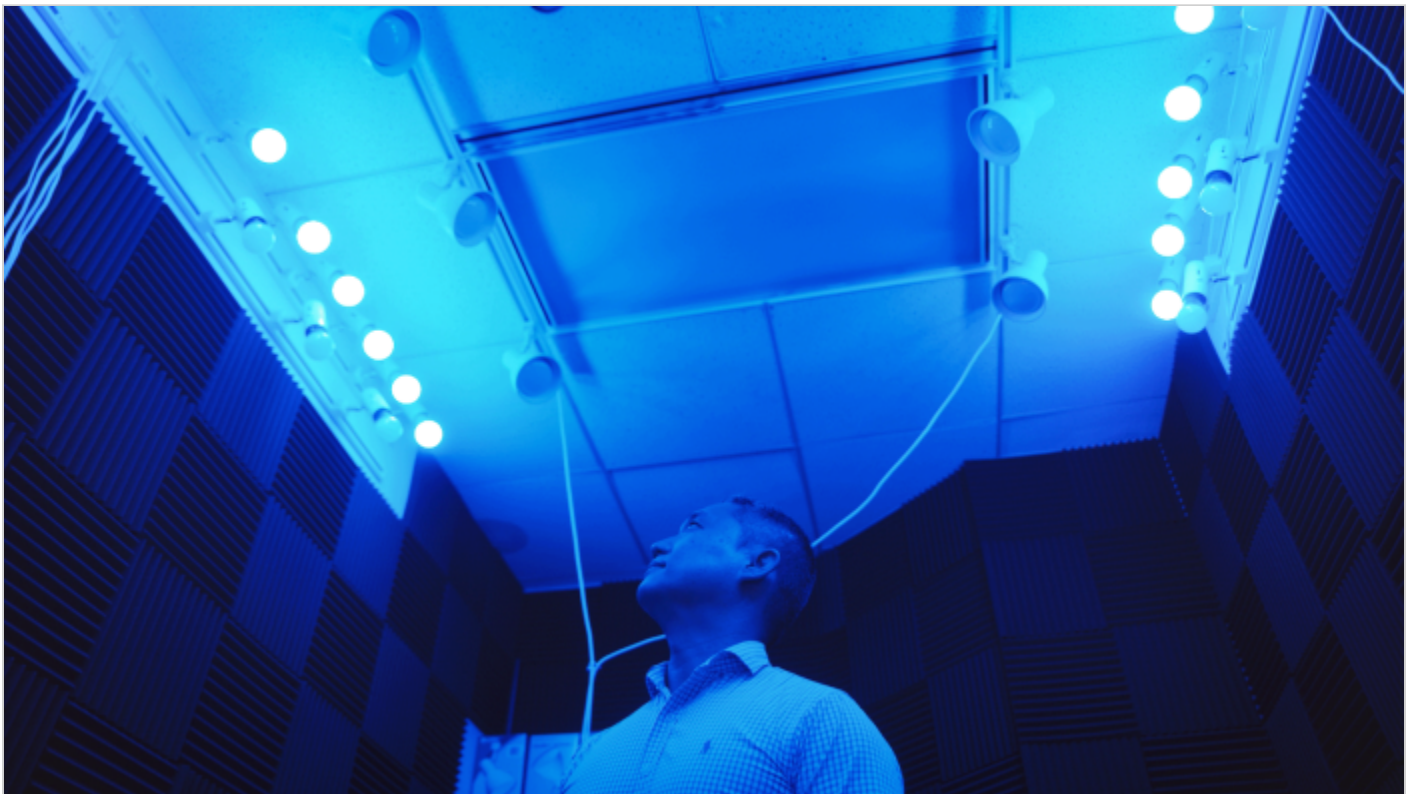
“What I’m doing is really multidisciplinary,” she said.

“It’s at the intersection of architecture, engineering and medicine.”

This story originally appeared on [ASU News](#).

¹ Mohammed Alrahyani, a PhD student in The Design School, conducted the study as part of his dissertation. Other team members were Shawn Youngstedt, professor in the Edson College of Nursing and Health Innovation; Mahya Fani, a graduate student in The Design School; Ndeye Yague, an ASU alum who was a graduate student worker in the DESmart Lab at the time of the study; Fang Yu, a professor in the Edson College; and Aaron Guest, an assistant professor in the Edson College.

Main image



Jason Yeom, who was until recently an assistant professor in The Design School at Arizona State University, adjusts lighting in a lab on the Tempe campus. Yeom, along with Nina Sharp, an assistant professor in The Design School, published a study recently that showed how biodynamic lighting conditions added sleep time to adults with dementia. Photo by EJ Hernandez/ASU News

Text image(s)



Nina Sharp (left), assistant professor in The Design School, works in the lab with graduate research assistant Aachal Mahakale (center) and Mohammed Alrahyani, a PhD student in The Design School. Photo by EJ Hernandez/ASU News