From: Mike Day, Executive Vice President, Science Museum of Minnesota

To: Andrew J. Caven, Lead Biologist, Crane Trust

Andy,

My sincere and belated thanks for providing your published report from the 2017 total solar eclipse. Kudos to you and your colleagues for the excellent and thorough study and most interesting findings.

It was only well after my first total solar eclipse experience in 1972 that I realized how lucky I was. A gang of college boys summer road tripping from Chicago up through Maine into the Maritime Provinces of Canada, sleeping in youth hostel tents, and watching the eclipse from a sand dune on the shore of Prince Edward Island. All we had was once piece of welder's glass I bought to look at the partial phases. I was lucky in that we had clear skies and 2:05 of totality, but the real luck was learning not to bring cameras or telescopes, which we certainly couldn't afford at the time, and be distracted by those things for a solar eclipse. The other thing I learned was you wanted to be out in the open, preferably in the midst of a natural unspoiled environment, away from civilization and its buildings.

Over time I also learned that you want to be mobile in case weather forces you to move from your target viewing site. I chose Kearney as my base for the 2017 eclipse as you could drive 130 miles east to Lincoln, or 100 miles west to North Platte, all on I-80, while staying in the moon's shadow path. Thanks to the weather on eclipse day I didn't have to "chase" and successfully experienced with you what my eclipse app told me was 2 minutes and 33 seconds of totality at the Crane Trust property. My base camp for the eclipse was a motel in Kearney, with their buffet breakfast starting at 5:00 a.m. I had breakfast in that hour on eclipse day and then stopped at the Caribou Coffee in the neighborhood that opened at 6:00 a.m. and got two large iced coffees, each with a shot of espresso, to go. I arrived at the Crane Trust visitor center in the 7:00 a.m. hour and purposely parked my car facing out near the entryway in case I had to make a weather run. Fortunately a colleague of mine, who is a meteorologist with the CBS affiliate in Minneapolis, based on eclipse day out of Lincoln and kept me informed of weather developments via text messages. Another colleague, who went on to Casper, Wyoming for the eclipse, had stopped at the Crane Center and scouted it for me a week before the event. I got a good piece of advice that accompanied a picture of his spouse wearing shorts and sandals and smiling in sunshine on one of your grass trails. She reported she got chiggers. I wore my leather hiking boots, long pants, and Deeted-up to scout the Crane Trust property on Saturday-two days before the eclipse-on my way from overnighting in Des Moines heading to Kearney. I took some pictures with the sun shining exactly 48 hours before totality. I was there as a hiking club was coming back in. A woman gave me her map and a tutorial on where I might set up my camp chair for the eclipse.

Regarding total solar eclipses; I have now been to five and only clouded out once. That was to Aquazul, Colombia, for what was to be 50 seconds of totality. However, in Colombia we experienced something that I think only the group of us assembled there has ever seen in the history of humanity–what happens to a rainbow during a total solar eclipse.

Scanned and attached is a report from Sky & Telescope magazine from my trip to the October 12, 1977, eclipse in Columbia. The rainbow faded out as totality approached and then snapped back on 50 seconds later. The attached has the only photographs I have ever taken during an eclipse, being one that doesn't want to be distracted by trying to take pictures and miss the short moment of such an extraordinary event.

Following the Great American Eclipse in August, 2017, I especially loved reading reports from first time eclipse viewers. One of my favorites was from a guy who lives in Dundee, Oregon, a mile outside of totality. He and his wife wisely traveled into the path of the shadow in Evergreen where they got 55 seconds of totality. He wrote, "We decided it would be well worth the effort to get ourselves underneath the shadow. It turns out it would have been worth it even if we would have been forced to trek across a frozen tundra via arthritic sled dogs."

A little more than an hour before totality for the 2017 event I exchanged final text with my CBS meteorologist buddy. His text told me to stay in place at the Crane Trust property as I would find the same scattered high cirrus clouds no matter which way, or how far, I went in the final hour. At that point I put on my hiking boots, my bug spray, and put my folded camp chair and backpack over my shoulder and began my hike from your 60-car parking lot. I made one last stop in the bathroom in the visitor center and then headed out to walk across the pedestrian bridges across the Platte River and onto the vast tallgrass prairie acreage. Most of the crowd there stayed close to the building, which provided me the opportunity to hike to an isolated spot along the mowed grass trails, but stay within ear shot of the crowd, which I discovered at my first eclipse is part of the experience.

As most of the people assembled with us in Nebraska were eclipse virgins, I stopped along the hike out to my viewing spot to encourage people to take off those silly paper eclipse glasses they were wearing for the last half hour before totality. I also encouraged people, who like myself were wearing sunglasses, to take them off for that same final half hour. This to witness the illumination changes that would take place at an accelerated pace in the waning minutes before totality. Again, something I first learned when three of us hiked to an isolated sand dune on the shores of Prince Edward Island for my virgin eclipse experience in the summer of '72.

For myself at this eclipse I began to definitely notice the illumination change about fifteen minutes before totality, and when it became very pronounced I did look at my time piece to note it was 7 minutes before totality. At that point I looked around, including looking north at my sharper than ever shadow on the mowed grass and the tree line along the Platte River. The color of the grass and trees was foreign to me. This is when I really sensed the irregularity of what I was experiencing as I asked myself, "am I dreaming?"

I have always contended that this illumination change is completely foreign to us as humans, something we have not experienced during our millions of years of evolution since we split off from those that became chimpanzees, and so our eye-mind system can only regard it as alien. It is though we have been transported to another world, where in a matter of minutes totality will begin and the place we are at will, with a snap of a finger, become even more extraordinary. Below is an article about this experience

with "some" scientific explanation. While it does provide some interesting background into the physiology of the eye, it doesn't extend to what is happening in your brain as you experience the illumination change with a total solar eclipse. My verbiage (from my now five total solar eclipses with only one clouded out) still lands on a "dream-like" or "alien" experience, however one might add after reading this material that for a brief period a solar eclipse gives us "super-hero like vision."

"*If you were fortunate enough to witness the recent total solar eclipse in all its glory, you might have noticed something surprising. It was dark like night, yet people and objects were easier to see than on a typical moonless night. Scientists at The Ohio State University have discovered a possible biological explanation–the presence (or absence) of a protein in the retina known as a GABA receptor. GABA, short for gamma-aminobutyric acid, is a chemical messenger responsible for communication between cells, especially those in the brain. The GABA receptor is in abundance on certain cells in the retina on sunny days, and enhances the ability to see details and edges of objects. At night, it disappears. But that process is normally gradual. When the total eclipse took viewers from brightness to darkness in minutes, the GABA receptor would have still been present on those cells in their eyes, giving them super-sharp night vision for a brief time, said lead researcher Stuart Mangel, a professor of neuroscience at the Ohio State University College of Medicine…. The research appears in the journal Current Biology"* (https://www.sciencedaily.com/releases/2017/09/170905164034.htm).

My scouting of the Crane Trust property 48 hours in advance of the total eclipse allowed me to pick a position and know where the sun would be in the sky come totality. The thing of note when I was standing alone on the edge of the tall grass prairie in the heat and humidity of the August afternoon in Nebraska was how noisy it was. There was the constant buzzing and clicking of insects in the tall grass.

So, two days later on a gorgeous afternoon for a total eclipse, I am within earshot of the crowds of people who have made the Crane property their eclipse viewing sight and sitting comfortably in my camp chair. I am a practitioner come total solar eclipses to not film, photograph, or record data, and not to wear eclipse glasses to watch the partial phases. I am there to experience it.

In the midst of totality I remember to go through a mental check list of what I should look for. Oh, turn all the way around to observe the 360 degree sunset effect on the horizon. And, scan the whole sky to see if there are any stars. (Other than the eclipsed sun the only other object I saw was the planet Venus. For my entire life I have only seen Venus, which is always close to the sun in the sky, as the evening star or the morning star. This is the first time I have ever seen it as the 1:00 o'clock in the afternoon star.)

Then, in the midst of totality I sense something I never anticipated. It had gone quiet and still. There were bursts of a breeze leading up to totality, noticeable as it was refreshingly cooling in the mid-day heat. During totality there was no breeze. But the most surprising thing of all was–it went silent.

Was I dreaming? Had I gone numb and dumb? Did I just want to believe that this space ballet had for mere minutes hypnotized living creatures–including myself–in the shadow of the moon?

Enter you, Andy Caven, who on eclipse day told me what insects I was hearing in the tallgrass prairie standing alone on my scouting trip two days before. You indicated there were cicadas, leaf hoppers, and

short horned and pygmy grasshoppers and the populations are high in August. I emailed you after the eclipse to inquire as to if you or any of your staff had the same experience as myself and was excited to have you write, "we actually quantified" the experience.

Needless to say I was thrilled to get your article, "Assessing biological and environmental effects of a total solar eclipse with passive multimodal technologies," published by you along with principals from the Department of Forestry and Natural Resources at Purdue University, the Center for Global Soundscapes at Purdue, the Department of Biology at the University of Nebraska at Kearney, and the Department of Agricultural Leadership, Education and Communication at the University of Nebraska-Lincoln. Your photography of common and prairie sunflowers, morning glories and moon flowers to see if there would be any flowering response during the eclipse showed none recorded. Also, your motion triggered cameras were on game trails and in roosts of bats to record any wildlife movement and showed none recorded.

However, then I read your acoustical record;

"at the onset of totality, sounds of howling, cheering and yelling, ranging from 5 to 15 seconds, were recorded at all sites from people congregated in the path of totality," and "sounds of wind through dry, late summer vegetation, which appeared on spectrograms as broadband vertical streaks and energy from 0 to 1kHz, generally decreased about an hour before, quieted during, and restarted about an hour after totality," and "calls of cicada . . . declining up to and ceasing before the period of 95% eclipse coverage, and increasing again after light returned . . . ground cricket calls ceased during the period of 95% eclipse coverage."

All I could mutter to myself at this point in reading your report was "amen." Once again my eclipse chasing luck was with me as I found myself in what was probably the best place to experience the Great American Eclipse.

Thank you.

Mike Day, Executive Vice President

Science Museum of Minnesota