

Eva Hild's Perpetual Motion in Snow

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Preface

In early 2010, Stan saw the Hyperseeing article [1] presenting the elegant negative curvature sculptures of Eva Hild. Their shape and whiteness were crying out to be interpreted in snow. His team had sculpted ten giant shapes, most emphasizing negative curvature, and upon learning of their experience [2,4,5], Eva saw the potential in the medium and agreed to join them in Breckenridge, Colorado, in January 2011, for their eleventh effort. The result, *Perpetual Motion*, was a striking sculpture carved from 20 tons of hard-packed snow. For a comprehensive discussion of Eva's work, see the beautifully produced book [6].

Introduction

Eva survived 24 hours of travel from Sweden and an altitude change of almost two miles, and joined the team in immediately attacking the 40% scale (4 feet by 4 feet by 5 feet) practice block Stan constructed. They carved that over two days, continually refining the plan and learning where the difficult parts were. The plan was based on measurements Rich and Stan made from Eva's model, sent earlier, and a sequence of cutting planes formulated, with help from *Mathematica*'s three-dimensional visualization, by Dan and Stan. Thus the team arrived at the competition site ready to start by cutting off some large prisms and tetrahedra. This year, for the first time, we had an effective wire saw and could cut giant planes fairly easily (see Fig. 6).

We did not receive a prize (for images of the prizewinners, see [2]). But we had a fantastic week of carving, adhering to our mission to make interesting, elegant, and challenging curves, surfaces, and tunnels. For videos (night and day) showing a 360-degree view of the finished piece, see [3]. All photos here are by Richard Seeley.

The model



Figure 1. Using her thin ceramic technique, Eva created the model and fattened it a little with plaster to match the thickness needed for snow. Her ceramic work is additive (built up from nothing), while the work in snow is purely subtractive (carving away material).

Practice

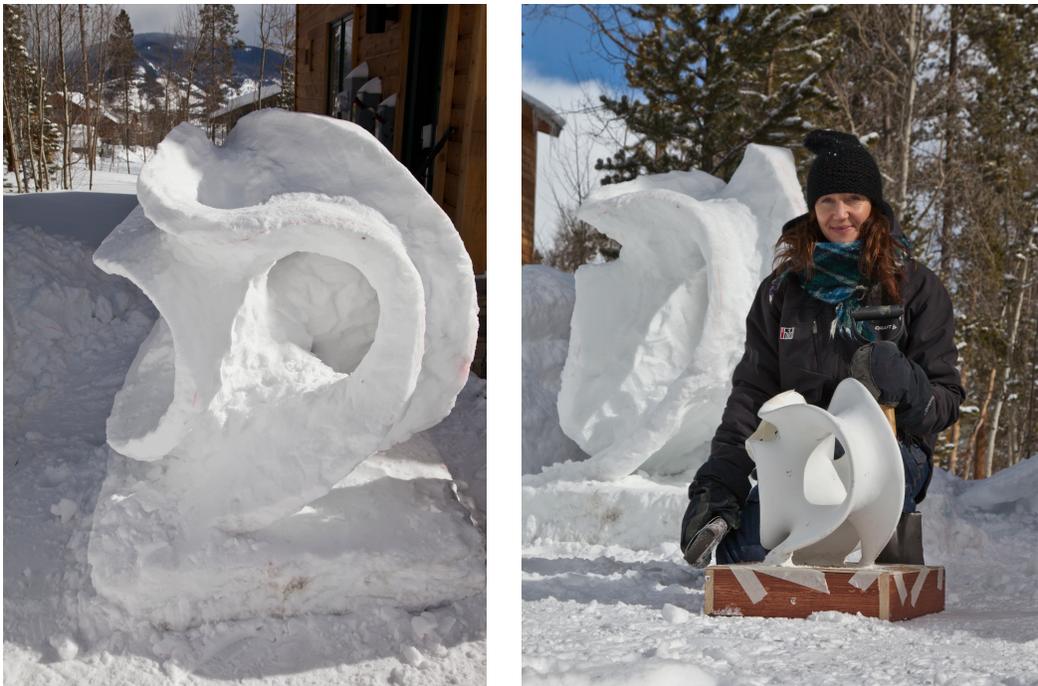


Figure 2. The practice sculpture may not be pretty, but it teaches us where the difficulties lie. In this case, we learned that great care would be needed at the stack of holes and troughs near the smaller of the two protruding horns. There is no room for error when carving in that region.



Figure 3. The blocks of extremely dense snow were carefully made by the town of Breckenridge for the 15 teams from Mexico, Austria, Australia, Germany, the Netherlands, Yukon, Quebec, Alaska, Colorado, Wisconsin, Vermont, and our joint Sweden/USA team.

Days 1 and 2, Tuesday and Wednesday

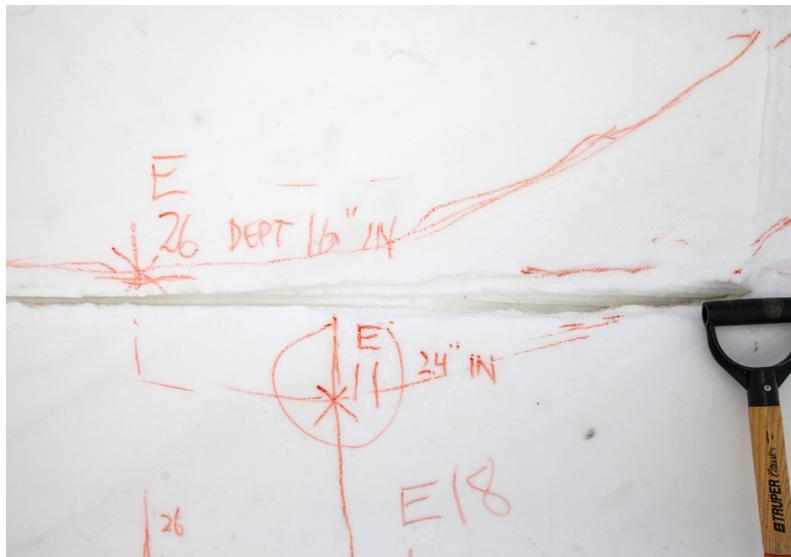


Figure 4. We spent the first hours marking up the block, using the wooden frame we placed around the base to translate measurements taken earlier from the model. The sculpture is bounded by a single edge, so our basic measurements were of 33 points along that edge.



Figure 5. We first tried out our new wire saw on a high tetrahedron.

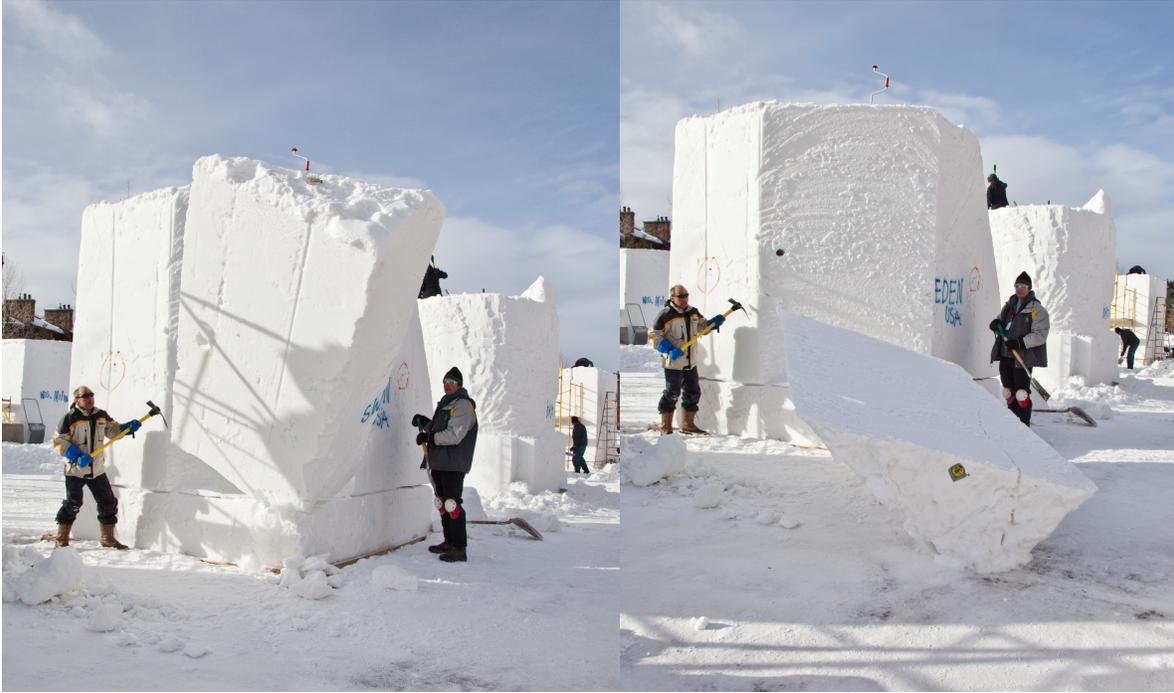


Figure 6. Once we started to cut, the large prisms came off quickly and cleanly. Dropping a block of snow that weighs over five thousand pounds is always fun.



Figure 7. The initial carving goes very slowly. Here Eva uses a curved shovel to start one of the many troughs between the edges.

Day 3, Thursday



Figure 8. At the beginning of the day there were no holes at all. But now we could no longer hold back, and quickly brought out the ice-fishing augers to start developing the topology.



Figure 9. By 9 pm we had all the holes defined but one. Sculpting is allowed from 7 am Friday straight through to the end, 10 am on Saturday. We worked for almost that whole period, napping from 2 am to 5 am on Saturday.

Day 4, Friday



Figure 10. Little kids enjoy traveling through the inside of the sculpture. The cloth in back is a sail used for shade during the sunny part of the day.



Figure 11. Most of the time was spent refining the curves and reducing the surfaces. Carving the circular base was straightforward by first slicing a circumscribed 16-gon and then using a specially designed tool to get the nine-foot diameter.



Figure 12. The result has rounded edges and nicely thin faces and was a perfect reproduction of Eva's model.



Figure 13. The horn on the right is the crux of the sculptural difficulty, as there is a hole through the horn, and below it, a tunnel below that, a trough behind the horn, and a hole exiting the trough on the right.



Figure 14. The team — Beth, Rich, Eva, Stan, and Dan — felt the effort was well worth it.



Figure 15. This view emphasizes the similar curves and the play of light and shadow, so much a part of Eva's vision.



Figure 16. The north view emphasizes the single continuous curve that bounds the entire surface.



Figure 17. The new LED lighting system yielded some interesting effects. This northwest view was taken at 5 am on Monday.

Excluding the tunnel just above the base, the design has six holes. You will have a hard time finding them all since two are invisible in the photos. In Figure 17, one goes straight down just below the central small

circle, while another goes straight up from there to the roof. This meant that any work done on the roof caused snow to fall down through both holes to the tunnel, where it had to be scooped out by hand. The photos would have looked much the same if those holes had been left uncarved, but integrity to the design takes precedence.

Our prior experience served us well as we knew how to deal with many of the issues that arise: the strength of the sun, the hardness and variability of the snow, and, most important, how to introduce a new teammate to the rigors of snow sculpture at high altitude. Eva Hild's designs are extremely elegant; we believe we translated this one well to the giant size.

References

[1] Nat Friedman, *Eva Hild: Sculpture and Light*, Hyperseeing, Aug. 2007, <http://www.isama.org/hyperseeing/07/07-08.pdf>

[2] Stan Wagon, Snow sculpture web page, <http://stanwagon.com/wagon/SnowSculptureRedirect/snowsculptureindex.html>

[3] Richard Seeley animations : <http://www.youtube.com/watch?v=Owi2SfwKbaw>; <http://www.youtube.com/watch?v=1nhAKINxb4U>

[4] David Chamberlain, Dan Schwalbe, Rich and Beth Seeley, and Stan Wagon, *Cool Jazz: Geometry, Music, and Snow*, Hyperseeing, Feb. 2007, www.isama.org/hyperseeing/07/07-02.pdf

[5] Stan Wagon, *Breckenridge Snow Sculpture 2008: David Chamberlain, Cold Hands, Warm Heart*, Hyperseeing, Jan-Feb 2008, 7-14. <http://www.isama.org/hyperseeing/08/08-a.pdf>

[6] Petter Eklund and Love Jönsson, *Eva Hild*, Carlsson BokForlag, Sweden, 2009; <http://www.carlssonbokforlag.se/boecker/konst/eva-hild.aspx>