Hands-on Science, Literally
By David Sims

Pass by Thomas Butkiewicz’s CCOM office at just the right mo-
ment and you might do a double take. He’s sitting in front of
his monitor wearing a pair of 3D glasses and making gestures
with his hands towards the screen, on which slightly amorphous
3D models of his hands play with a point cloud of sonar data
like so much sand in a sandbox.

A closer look reveals that Butkiewicz, the newest member of the
Data Visualization Lab, and a Tyco postdoctoral fellow, has a
Microsoft Kinect, an inexpensive 3D camera originally intended
for use in playing video games, mounted on the ceiling. He
has repurposed it so that he can project his hands into a virtual
space and experiment with cutting-edge interaction and visual-
ization techniques. In this case, he’s using his 3D hands as tools
“inside” the screen to edit a “point cloud”—a large volume of
individual sonar points or soundings.

With his virtual hands projected into the space, Butkiewicz demon-
strates the process. “This is a whole bunch of points that I’ve
made into a surface so they’re easier to see. I want to edit some
of them out, so I can take my hand and make a boundary here,
blocking off a certain amount, and then I might delete these by
pushing them away or select a subset by cupping it in my hand.

The idea is to actually use my hands as tools.”

The work is part of the burgeoning field of “natural inter-
action”—where man and machine interact the way humans naturally
do, through voice and touch.

“Keyboards and mice are not natural input devices. There’s a push
towards using more voice recognition, touch screens, and
gesture-based interfaces, where, for example, if I want
to delete something I can just make a slashing gesture with my
finger or hand,” Butkiewicz says.

The ultimate goal of this research is to create a viable tool with
which colleague Brian Calder can edit massive collections of
sonar data with the flick of the wrist.

Referring to the algorithm Calder developed that processes huge
amounts of sonar data quickly and accurately, the Combined
Uncertainty and Bathymetric Estimator or CUBE, Butkiewicz
says that although the state-of-the-art software edits the data
automatically, “there will always be bad points or those with
too much uncertainty or that don’t fit the model. Eventually a
human will have to be in the loop to analyze the data, and the
goal of this work is to make that person’s job as quick and easy
as possible.”

Butkiewicz, who comes to UNH from the University of North
Carolina at Charlotte, refers to himself as “a toolmaker for other
scientists” and aims to provide new visualization techniques that
will help CCOM/JHC colleagues quickly and easily manage datas-
sets that grow exponentially with improvements in technology.

“Researchers get a lot of data, but don’t always necessarily
know what to do with it. A lot of the existing commercial meth-
ods are just not sufficient or they go in the wrong direction.” For
example, Butkiewicz asserts, many traditional geospatial data
processing tools, like ArcGIS for example, require that you know
what you want to find before you can examine it. Butkiewicz
approaches visual analysis from the opposite direction.
DETECTING THE UNEXPECTED

“I like the idea of exploratory interfaces, of being able to go into the data not knowing exactly what you’re looking for, and coming out with new insight.” He adds, “The tools I build remove a lot of the barriers to exploration, allowing users to go in and play around and look for things they didn’t know existed. The underlying software tries to remove as much of the cost of querying the data as possible. So instead of having to set up a complex query and load layer upon layer of data, you just circle an area you find interesting and a deeper analysis pops up on the screen immediately.”

This is precisely what his Ph.D. work in Charlotte involved. As part of an effort to create a more intuitive and effective interface for exploring the results of an urban growth simulation, Butkiewicz developed software tools he termed “probes,” which allow users to define regions of interest in their data by, for example, simply circling the area with a finger; the software then immediately extracts and displays relevant statistics and analyses of the particular regions.

In the parlance of visualization this is known as getting “details on demand”—a method whereby a user/viewer is given an overview first and then initiates some type of filtering mechanism that drills down into the data for greater detail.

According to Butkiewicz his method becomes especially powerful when multiple probes are used at the same time, allowing for complex comparisons to be made between any number of spatial regions.

“When you query the data layers by probing an area, it calculates statistics and totals for everything, and a panel will pop up with a number of different visualizations. You can modify and tweak simulation parameters for specific areas to try out different scenarios. It will even monitor the comparisons you are making and alert you if it detects any potentially misleading analyses due to unforeseen differences. So it really is an exploratory spatial analysis tool that allows users to do things quickly and effectively.”

Butkiewicz predicts, “In the future you’re not going to see people loading gigantic datasets and complicated software packages into their computer. I foresee a move toward more of a client-server model approach, where all the heavy processing and storage will be done remotely.” All of which will lend itself to making data more accessible to the public and other researchers.

He adds, “Which is not to say there won’t be a place for number crunching and rigorous analysis, but I just see this as a good way to make data accessible to more people.”

Butkiewicz also believes he will be able to assist in making sonar and lidar data generated by CCOM scientists more visually accessible by taking the same approaches he used in his probe work and, now, his experiments in 3D interaction techniques.

Regardless of whether it is data generated by lidar or sonar, and regardless of how dense the point clouds are from modern multi-beam sonars, as a data person, Butkiewicz sees it all as pretty much the same stuff — point clouds to manipulate and visualize.

Of course, it becomes more challenging with big, volumetric, three-dimensional datasets like sonar data that include not only the bottom soundings but everything in the water column as well — fish, bubbles, gas plumes, etc.

Says Butkiewicz, “That becomes a little overwhelming so you have to work on ways to reduce the complexity by separating the wheat from the chaff.” He adds, “That’s the challenge of visualization — understanding what the end user needs to see and then bringing out those relevant features, the salient artifacts and structures, and making those visible, distinguishable, and understandable.”

Butkiewicz demonstrates a rotation gesture, and integration of other multi-touch gestures for navigation.
In an effort to get to know some of our newer staff members, we asked Paul Johnson and Jodi Pirtle a few questions. Paul is our new Data Manager and Jodi is a post-doctoral research associate.

**Paul Johnson**

**Tell us about your background and research interests.**

After starting my college experience at the University of Massachusetts Amherst as a Geology major, I decided to go check out volcanoes for real and transferred to the University of Hawaii at Manoa. While I originally had only planned on spending a couple of years in Hawaii, somehow 21 years went by. After finishing my B.S., I stayed on and got an M.S. studying the tectonics and geophysics of the East Pacific Rise spreading center Southwest of Easter Island. This was my first real experience with seafloor mapping using the GLORI-B (a modified GLORIA system capable of collecting bathymetry) and a SeaBeam 2000 multibeam.

When I finished my Masters, I worked for the NOAA vents program in Newport, Oregon for about a year and then went back to Hawaii to work with a hyperspectral airborne mapping company. When I was 5, I was convinced that I was destined to be a ballerina. That soon changed to wanting to be a veterinarian. That soon changed to wanting to be a marine scientist.

**What did you want to be when you grew up?**

When I finished my Masters, I worked for the NOAA vents program in Newport, Oregon for about a year and then went back to Hawaii to work with a hyperspectral airborne mapping company. When a position opened up at the Hawaii Mapping Research Group at the University of Hawaii, a group which specialized in building and operating phase difference mapping systems, I thought it would be fun to go back to the academic world. At HMRG, I was the primary sea-going data processor, which at the time I thought was great.

For a number of years, I spent between three and eight months a year at sea and, in turn, checking out the world. However, when I met my future wife, Tara, I thought it would be a whole lot better to be on land a lot more and went back to the commercial world, once again doing hyperspectral mapping for another Hawaii company (NovaSol). Then the academic world called again, and I ended up back with HMRG where I moved up first to Director of Field Operations and then on to Director of the HMRG.

**Where are you originally from?**

I am originally from Holden, Massachusetts.

**What did you want to be when you grew up?**

I originally wanted to be a musician (I played the tuba until I moved to Hawaii, never picked up the ukulele though).

**Favorite holiday and why?**

Thanksgiving, it was during a Thanksgiving holiday that I met my wife.

**Favorite vacation spot?**

Pacific Northwest (Oregon and Washington).

**A place in the world you’ve never visited but would like to see some day...**

After seeing a large chunks of the countries bordering the Pacific Ocean, I would really like to start exploring Europe more.

**Favorite ice cream flavor?**

Whatever my kids want—I usually end up having to clean up their leftovers.

**Favorite movie or TV show when you were a kid?**

Star Wars, of course.

**Jodi Pirtle**

**Tell us about your background and research interests.**

I am a Fisheries Habitat Ecologist. For my MS, I characterized groundfish habitat on deep rocky banks along the US West Coast, including Heceta Bank near Central Oregon and Cordell Bank off of Northern California, and areas of the Olympic Coast National Marine Sanctuary in Northwest Washington. Camera work using underwater vehicles and dives in the Delta submersible were highlights of this research that informed the Groundfish Essential Fish Habitat Environmental Impact Statement for the US West Coast. For my PhD, I returned home to Alaska to study habitat function for managed species in North Pacific marine ecosystems. I investigated nearshore subtidal biogeography linked to environmental variability in the fjord estuary system of southeast Alaska, and red king crab nursery habitat ecology using an experimental approach. My research involved over 250 scientific dives using SCUBA—cold, intense, fun!

My interests in the habitat ecology of harvested marine species and their ecosystems brought me to CCOM. Fisheries biologists are end-users of seafloor mapping products. However, there is often a disconnect between the scientists who create these products and the biologists who use them to interpret fish habitat for management decisions and research. For my post-doc at CCOM I am collaborating with Tom Weber and a team at the NOAA Alaska Fisheries Science Center in Seattle to map areas of the Gulf of Alaska, collect groundtruthing video, and ultimately create habitat maps for groundfish in those locations to inform NOAA Fisheries. This collaboration is a fantastic opportunity to gain skills in seafloor mapping and to facilitate more informed dialogue between fisheries biologists and hydrographers. I have been learning a lot about the science and practice of seafloor mapping since my arrival in February.

**Where are you originally from?**

I am originally from Cordova, Alaska—a small and stunningly beautiful coastal fishing community in Prince William Sound.

**What did you want to be when you grew up?**

When I was 5, I was convinced that I was destined to be a ballerina. At 10, I wanted to be a veterinarian. That soon changed to wanting to be a marine scientist.

**Favorite holiday and why?**

Any holiday that I get to be with my family.

**Favorite vacation spot?**

Costa Rica!

**A place in the world you’ve never visited but would like to see some day...**

Several. At the top of the list are the Arctic and Antarctica, and Bhutan and Nepal.

**Favorite ice cream flavor?**

Most anything chocolate.

**Favorite movie or TV show when you were a kid?**

The Little Mermaid, of course.
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CCOM Represents at Mapping Meeting

A number of CCOMers took part in the IOC-IOC-GEBCO sponsored Arctic-Antarctic Seafloor Mapping Meeting at the University of Stockholm, May 3-5, 2011.

Approximately fifty scientists and hydrographers from countries with interests in the polar regions met to present and discuss recent and future Arctic and Antarctic mapping activities, establish a coordination procedure for ship cruises conducting mapping in Arctic and Antarctic waters, coordinate and inspire contributions to polar bathymetric compilations, and exchange technical experiences from acquiring and compiling bathymetric data.

Sustainability Update

Maureen Claussen, Chase Sustainability Steward

The first year of our UNH Sustainability Stewardship Program concluded this past May. A lot of information about green initiatives for campus operations were shared that I hope you caught wind of through postings around the building: being more conscientious of energy consumption, recycling, alternative commuting options, and using the new filtered tap water rather than lugging plastic water jugs to the dispenser.

In June, we hosted a brown bag series with a presentation by Michele Chapman, Sustainability Special Projects Coordinator, titled “The Story of Bottled Water.” If you missed the presentation, the Annie Leonard video of the same name can be viewed on YouTube at http://www.youtube.com/watch?v=Se12y9hSOM0. This short video (less than 10 minutes) will change the way you think about bottled water.

Next year, I am hoping that the UNH’s composting program will be up and running again and we can take part in it. Please let me know if you are interested in helping with our own CCOM composting system, and feel free to contact me (Mau@ccom.unh.edu) if you have questions or suggestions for how CCOM can be more sustainable in its operations and culture.

I have created a sustainability page on the CCOM Wiki where you can find more information and links: http://wiki/index.php.Sustainability.

New Students

CCOM’s new students will be welcomed with a breakfast and orientation on August 26.

Our new graduate students are:
- Chris Englert, Earth Sciences
- Xiao Guo, Ocean Engineering
- Meghan Luke, Earth Sciences
- Giuseppe Masetti, Ocean Engineering
- Kittisak Nilrat, Earth Sciences
- Briana Welton (NOAA), Earth Sciences
- Matt Wilson (NOAA), Earth Sciences

Our new GEBCO students are:
- Mohammad Chowdhury, Bangladesh
- Prasadh Gunasinghage, Sri Lanka
- Norhizam Hassan, Malaysia
- Hiroki Minami, Japan
- Thanh Nguyen, Vietnam
- Saw Thein, Myanmar
Bring Your Kids to Work!

The second annual Chase Bring Your Kids to Work Day was held on April 13. The festivities included storytime with Larry, a knot-tying lesson with Captain Ben and Captain Emily, a VisLab demonstration with Tom Butkiewicz, a visit from the marine docents who brought a touch tank filled with sea creatures, and a rubber ducky race in the wave tank. The busy morning ended with a lunch featuring octopus-shaped sandwiches and a make-your-own-sundae buffet.

Clockwise from left: children and parents (some in touch with their inner child) pose for the annual group portrait; Larry’s storytime is a huge success; Trey drives the flying COCHECO in the VisLab’s panoramic display; Brittany leads a rousing game of Simon Says.

People News

Administrative Assistant Brittany Edgar left CCOM in June for the UNH Office of International Students and Scholars. We are happy that Brittany is still on campus and that we have a friend in an office we worked with so closely.

We are welcoming two new staff members this month. Dan Trefethen is our new Administrative Assistant. Tara Hicks Johnson, an Outreach Specialist, will coordinate tours of the building and events such as Know the Coast. She will also take on the role of editor of The Anchor. We thank Linda Prescott for her years of service as editor and are pleased that she will continue to contribute with her writing skills.

CCOMers Lester Peabody, Justin Charos and Carmen St. Jean graduated from UNH on May 21. Congratulations graduates!

Nikki Kuenzel successfully defended her Master’s thesis, “Quantitative Morphological Analysis of Submarine Canyon-Channel Systems on the U.S. Atlantic Continental Margin,” on June 30. She has moved to Louisiana where she is working at C&C Technologies.

Rachot Osiri presented his directed research, “Radiometric Calibration and Evaluation of Lidar Data for Coastal Science Applications,” on August 10. He will be returning to his life in Thailand where he serves in the Royal Navy.

We said goodbye to Brian O’Donnell in July as he left to complete his doctoral work in electrical engineering at Arizona State University in Phoenix.