ABSTRACT

Title of Dissertation: **ANALOGIES AS CATEGORIZATION PHENOMENA: STUDIES FROM SCIENTIFIC DISCOURSE**

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Studies on the role of analogies in science classrooms have tended to focus on analogies that come from the teacher or curriculum, and not the analogies that students generate. Such studies are derivative of an educational system that values content knowledge over scientific creativity, and derivative of a model of teaching in which the teacher's role is to convey content knowledge. This dissertation begins with the contention that science classrooms should encourage scientific thinking and one role of the teacher is to model that behavior and identify and encourage it in her students. One element of scientific thinking is analogy. This dissertation focuses on student-generated analogies in science, and offers a model for understanding these. I provide evidence that generated analogies are assertions of categorization, and the base of an analogy is the constructed prototype of an ad hoc category. Drawing from research on categorization, I argue that generated analogies are based in schemas and cognitive models. This model allows for a clear distinction between analogy and literal similarity; prior to this research analogy has been considered to exist on a

spectrum of similarity, differing from literal similarity to the degree that structural relations hold but features do not. I argue for a definition in which generated analogies are an assertion of an unexpected categorization: that is, they are asserted as contradictions to an expected schema.

ANALOGIES AS CATEGORIZATION PHENOMENA: STUDIES FROM SCIENTIFIC DISCOURSE

By

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Dedication

For women in physics.

…As I say, I can speak only for myself,
but as soon as I got here the rules became different.
They didn't apply to me any more, or to anyone else except a distant runt,
almost invisible in its litter. So how was
I to know who to stand up to, when to turn abrasive, when all things
nestled,
equidistant, all hearts were charming, and it was good to be natural and
sincere?…

School was over,
not just for that day but forever and for seasons to come.
The reason was that the truth was just average
on the iniquity scale, and nobody wanted to get involved…

You see we all thought the ride would be lovely
and worth the trip, which it was, but now we cannot go anywhere
having already been everywhere. No, do you
understand how realistic it all is?…

And so we faced the new day
like a pilgrim who sees the end of his journey
deferred forever.
Who could predict where we would be led, to what
extremes of aloneness? Yet the horizon is civil.

-Ashbery, *Girls on the Run*

Acknowledgements

The idea behind this thesis is that the theories we develop with our *science* are analogies to the stories that we tell with our *lives*. And so this dissertation holds a mirror to my life and reflects its stories – the stories that have brought me here and brought about this work. And those stories have as much to do with community and friendship as they do physics and education. I would like to acknowledge all of my friends, in particular Dorothy, Kathryn, Noam and Sam, for conversation about the things that matter, and my Seattle roommates – especially Amber, Laura, Manu and Sam – for creating a true home. I would like to thank Jerry Seidler, in whose lab I discovered that I did not want to do experimental physics and I was given the freedom and support to decide that. I thank Stamatis Vokos, the deus ex machina of my story, and Joe Redish, both of whom took risks for me and I am grateful for and buoyed by their trust. Graduate students Matty, Paul and Rosemary provided hours of critique and conversation in helping me hone the details of this thesis and kept me smiling through the massive frustrations. And friends outside of graduate school, Wendy and Anne in particular, reminded me of life beyond academia, while the Elliott family gave me hope that academia could be everything I wanted it to be. Were it not for my education at the Governor's School of North Carolina, both as a student and a teacher, I would never have seen myself as someone with a story to tell or a theory to share. The work that happens there is incredible and profound. Thank you to Mrs. Liz Woolard, my brilliant high school physics teacher. And to Janet Coffey who is going to be an amazing professor and advisor and was so encouraging – especially in the final stretch. The teachers from SIPS

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