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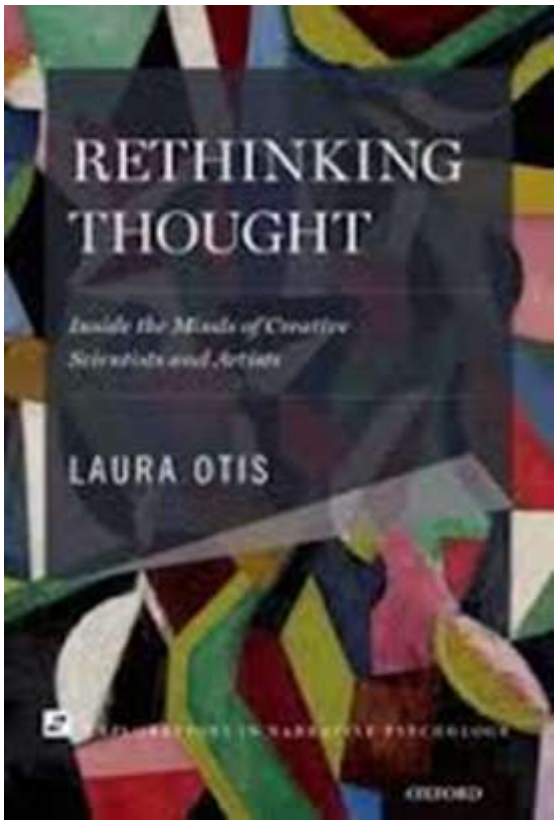

Laura Otis's *Rethinking thought: Inside the minds of creative scientists and artists* is not specifically about education, but it contains much that should interest educators. The book is a qualitative study resulting from Otis's interviews of 34 artists and scientists, varying from video game designers and artists to neuroscientists, asked to reflect on how they experience thought. The Interview questions, included in an appendix, asked participants to do such things as describe whether they see anything when a word is spoken, or which senses are most involved when they attempt to remember something. Otis organizes her chapters thematically, with each chapter highlighting a few of the interviewees who best represent that chapter's theme. Interspersed with a review of scholarly literature on that theme, as well as Otis's own reflections, her conclusions speak to the remarkable cognitive diversity in humans.

The first several chapters are organized around the difference between those who think primarily in words and those who think

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primarily in images. For example, a chapter on linguistic thinking brings up writings by behaviorists who were convinced that all thinking is linguistic, discounting other modes of thought as not thought at all or a mistaken report of thought that is actually linguistic. Later chapters go beyond the popular linguistic/visual dichotomy to include discussion of interviewees who don't experience their thought as visual or linguistic, but something else (chapter 5), those who see their thought as primarily the result of social interaction (chapter 6), how various interviewees experience creative thought (chapter 7), and interviewees who have been able to modify how they think (chapter 8).

Otis's results reveal an incredible diversity in approaches to thinking between just 34 participants, a diversity that is often missed or not fully accentuated in quantitative literature. Some, like animal scientist Temple Grandin, think primarily in visual images and must work to translate those images into words that never fully capture the richness of the images. Others, like literary theorist Jonathan Culler, report thinking predominantly in language, where it is easy to put one's thoughts into words but not in images. Still others, like complex systems scientist Nicholas Gessler or flamenco dancer Linda Richardson, report thinking in neither words nor images, or experience thought in a multisensory way that can't easily detach one modality from others, as reported by video game designer Jason Rohrer and painter Rigoberto Gonzalez.

However, Otis cautions us to resist the urge to categorize people too easily into "verbal," "visual," and "other" categories. Her interviews and reflections suggest that one individual often uses several modes of thought, often varying with context; when writing a lecture, thinking in words might become the appropriate strategy, and when working out a problem in the laboratory, another mode of thought may be utilized. Most interviewees report a combination of several modes of thought, and the variance comes less from whether they are "verbal" or "visual" (or "other") than in how heavily they rely on one mode than another.

Another reason Otis wants us to resist easy categorization is that even within those who think primarily in one domain (say, visual thinkers), there is seems to be much variation in what that means for each thinker. Some, like Temple Grandin or novelist Salman Rushdie, report seeing finely detailed images, where others, like evolutionary theorist Lynn Margulis, report seeing "big picture" images that are undetailed. When thinking visually, some attend mostly to the items in the representation (the chair and the table as separate items) while others attend mostly to the relationship between items being represented (the relationship between the chair and the table to the room they're in). The category of "visual thinker" often obscures these differences between people 'in" that category.

Another interesting theme of the book (maybe incidentally, as there is no chapter devoted to it) is an exploration of what happens when those most comfortable with one way of thinking must "translate" to another way of thinking. Translator Micheal Holquist (who, maybe counterintuitively, reports being a strongly visual thinker) was drawn to the act of translating between languages because, as he says it, all thought is translation, putting into language thought that, to him, is not originally encapsulated in language. Poet Nathasha Trethway conceives of poems by picturing images and struggling to find words that will communicate the richness of the image. Graphic designer Harriet Goren creates visual representations (such as advertisements) out of clients' verbal representations of their businesses. She must figure out what questions to ask clients that will give her enough verbal description to evoke visual images. Still others have been able, over time, to change the dominant modes of thought they employ. Literary scholar Mark Bauerlein reports having trouble understanding works of conceptual philosophy

until he learned to think less in concretes and become comfortable "translating" his thought into the more conceptual realm.

As mentioned, Olsen's work is not explicitly geared toward an audience of educators, but there are many points of interest for educators. One of these points comes from this idea of translating from one domain of thought to another, and the difficulty it can bring. Several interviewees who report strong visualization skills also report having trouble translating ideas into language, as others report thinking linguistically and having trouble creating images to represent their thoughts. This leads Olsen to wonder whether our insistence that every student learn to put thought into writing might deserve to be matched by an insistence that all students practice putting thought into other modes, like visual images. I think here of the increasing ubiquity of software to create pictures and video. Should we have students not only write papers, but represent their thoughts in video or other media? As Olsen says it, "students' struggles with the components leads compatible with their mental styles might benefit them the most" (p. 205).

A related area of potential interest for educators is Olsen's recommendation that we see modes of thought that may be foreign to us as legitimate, despite being different. It has often been the case - as when behaviorists denied that thought could be anything but linguistic - that scientists and others measure what counts and doesn't count as thought by their own experience of thought (which after all, is the only experience of thought anyone can experience directly). Behaviorists like John Watson insisted that thought could only occur in language, and it is likely that he was influenced by his own introspection.

The reader interested in education might wonder, for instance, how we can better educate those who do not think in the ways traditionally valued by conventional schools? This group may comprise those like Temple Grandin, who experience rich visualization skills but struggle to put those images into linguistic representation or to put verbal narratives into sequence because he/she cannot see an outline. It may also involve those like psychologist Gerd Gigerenzer who experiences his own thought as deeply social, ideas being mostly generated by continuing conversation with others. Educating those who struggle to put their thought into words might best entail opening up alternatives to written projects. Educating those who think best in social situations might include allowing more social (rather than individual) learning to take place in schools.

This, of course, cuts to the heart of discussions about learning and thinking styles that have gone on in educational literature for decades. Indeed, the likes of Howard Gardner and Robert Sternberg (who offer different iterations of ideas about multiple intelligences) are mentioned frequently. Olsen, though, is cautious about the scholarly fascination with learning and thinking styles because, despite their attempts to diversify how we think about though, they still tend to categorize thinkers in an overly broad way. "'Cognitive styles' is a troubling term, given that no one has a single, fixed mental way of operating. Over the courses of their lives and from one situation to another, individuals vary in the strategies with which they meet challenges" (p. 47). No one thinks only in images, words, or kinesthetic feelings, or thinks best in isolation or social situations; we all move from one to the other of these as needed over the course of our thought. And we can often learn to get better in one domain of thought when the need presents itself. Categorizing people as "visual" or "verbal" (or some other type of) thinker obscures the reality that the way any of us think will always transcend any one category.

This brings us close to what is perhaps the book's strongest message, the idea that there may be as many unique ways of thinking as there are thinkers. Olsen puts the point most strongly in her introductory chapter:

> We need to develop the emerging science of "the" human brain into a science of human brains, because a body of knowledge restricted to what seven billion mental worlds share will create a severely limited, unrealistic picture of what human thinking involves (p. 5).

Categorizing types of thought (generally as the result of quantitative studies) surely has its uses, but this should not obscure a scientific appreciation for the diversity of cognition that exists within and beyond those categories. Those who tend to think linguistically do not all therefore think the same way and use non-linguistic modes of thought when appropriate. We may be able to categorize people by their preferred (or strongest) mode of thought, but the category only has validity if the categorization is recognized as a very broad approximation with fuzzy borders.

In this, Olsen's work aligns nicely with the emerging "science of the individual", which is devoted to the diversity of ways individuals develop that are often obscured by focusing on statistical aggregates (Rose et al., 2013). Olsen's qualitative work goes where quantitative work regarding cognition often can't go, going beyond what she calls the science of "the" human brain (as if there is an average human brain) into the science of human brains, showing how strongly even thinkers who prefer one domain of thought to others can vary in how they experience thought.

Olsen's work might add to another strand of thought, the study of neurodiversity, which Olsen mentions becoming aware of only during the writing of this book. For whatever reason, the study of neurodiversity has largely confined itself to the study of autism as contrasted to the neurotypical brain, arguing that autism is less a disability than a mode of thinking (Jaarasma & Welin 2011; Ortega 2009). Just like the study of cognitive styles, the study of neurodiversity adds to the scholarly appreciation of diversity, but risks simply replacing old categories with new ones that are more elastic but still inadequately representing the diversity of human thought. As with labels for cognitive styles, the labels of "autism" and "neurotypical" have their uses, but a book like Olsen's might give us appreciation for the neurodiversity that exists in human thought that goes beyond the two labels of "autistic" and "neurotypical."

As interesting and useful as Olsen's work is, I will end this review by noting a few concerns. First, Olsen limits herself to a fairly unique group of interviewees: scientists and artists. The benefits of this are that Olsen's interviews are with those who think and produce results of their thought for a living, and are therefore likely skilled in introspecting on and articulating how they experience their thought. However, Olsen's relatively select group of interviewees means that she is very limited in how generalizable she can make her claims. There is much opportunity to add onto Olsen's work by looking at whether this type of diversity is evident in other groups of people. For instance, are the same thinking styles evident in non-academic or artistic groups, from "white collar" office workers to those in "blue collar" trades (plumbers, wait staff, hair stylists), or other specialized groups like athletes? It would be interesting to see how populations of people outside of academia and the arts would garner qualitative results similar to those in Olsen's survey.

The second concern I have regards the difficulty of using of self-report data to depict one's thought accurately. That is, if one reports that they think primarily in one type of representation (images, words, processes, feelings), how accurately can we take that report? There always seems to be the possibility that one truly thinks in wordless, imageless "mentalese" (Fodor 1994), and attaches a "container" (words, images) to the thought when asked to report on what our thought feels like. In other words, when a person is asked what they "see" when they see

a bridge (one of Olsen's more widely written-about interview questions), maybe one does not so much think in words so much as recollect one's thought in words when one is expected to express the feeling of the thought. Additionally, many studies have highlighted the limits of introspection in giving accurate information about ourselves (For instance, see Lamme 2010; Pronin & Kugler 2007; Wilson & Dunn 2004). This may not be overly problematic for Olsen's project, as there is certainly value to exploring the difference in how people *experience* their own thought (even if it doesn't reflect the actual thought with complete fidelity). However, in a work like Olsen's that relies so heavily on introspective self-report as a descriptor of people's thought processes, she'd have done well to address these kinds of concerns.

Rethinking Thought is a fascinating and fruitful read for anyone interested in the literature on cognitive diversity. Whether one is an educator, neuroscientist, or just have an interest in exploring how others experience their own thought processes, Olsen provides a very well-written qualitative account that is circumspect and remarkably free of judgment; she readily confesses when she has trouble understanding an interviewee's description of their thought, but it doesn't stop her from taking it seriously as thought. This work will surely compliment both the existing qualitative and quantitative literature on cognitive diversity.

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