ABSTRACT: In the field of science education, the current views of scientific language and scientific literacy are based on an epistemology that begins the presupposition of the identity of a thing with itself—both the phenomenon of representation (inscription) and the figure of the scientist as rational thinker and actor are premised on this identity. However, recent philosophical scholarship generally and the French philosophers of difference particularly—including Gilles Deleuze, Jacques Derrida, Didier Franck, Jean-Luc Nancy, and Paul Ricœur—take a very different perspective on the question of language. This perspective emphasizes the opposite, that is, the non-self-identity of a thing or person with it or him/herself, which is a conception more compatible with our experiential reality. This perspective also allows us to better theorize the learning of science and scientific literacy in the indeterminate manner in which it is actually experienced and observed. In this essay, I further develop an approach to science language and scientific literacy articulated in my recent writing, adding to the concept diaspora and its attendant concepts of bricolage, métissage, hybridization, heterogeneity, and hybridity (Roth, in press) a new concept: the mêlée. The purpose of this article is to exemplify and explicate the power of the mêlée in two contexts relevant to science education: science identity and (scientific) language. The mêlée gives us another advantage over other theories (Roth, 2007): a way of conceptualizing a forward looking, change-oriented theory of scientific literacy in particular and culture in general—a perspective required for understanding the constant and increasingly exponential changes literacy, culture, science, and language undergo. The perspective has
serious consequences for the way in which we think about learning and assessment of scientific knowledge and scientific literacy.

The subject of knowledge can only be someone, like everyone, of mixed blood. (Nancy, 2003, p. 279)

In a laboratory office of a midsize Canadian university, an Indian scientist (pseudonym Macarthur) and a Chinese graduate student (pseudonym Yi) have come together for an interview about the biography of the former. They speak (fluently) English, though for both it is the second language. In the course of their talk, they produce an (audiotaped) narrative, in which the plot of Macarthur’s life is a mixture of the forms that the autobiographies of people in Western societies can take: against the goals his parents have had for him, he chose his own field, went abroad to Canada to get his PhD, and eventually came to build and lead a world-renowned laboratory. In this life plot, the person Macarthur became a particular character, in part on his own, in part as a function of the plot. As a result—because the interview requires the collaboration of interviewer and interviewee—the topics covered, the characteristics talked about, the features of Macarthur the person, his character and life trajectory, came to be a mix, or, as I propose in this paper, a mêlée. I have taken this concept from an essay by the French philosopher Jean-Luc Nancy (1993), who uses it to theorize a number of phenomena such as culture, language, knowing, subject of knowing, and so forth. The concept of the mêlée highlights the processual nature of these terms and the things they denote as processes of mixing and mixes rather than purities; and I intend this process of mixing to be associated with all the connotations of the word including scramble, scrimmage, batter, and scrummage: “in a mêlée, there is opposition and encounter, there is what gathers itself and that which separates, that which makes contact and that which makes contract, that which concentrates and that which is spread out, that which identifies and
that which alters” (Nancy, 1993, p. 12). Thus, in the interview, which the two produce with the same kind of skills that jazz musicians improvise a jam session, neither the interviewer Yi nor interviewee Macarthur can be understood as self-identical unities (stable identities), but their identities, in a contradiction of terms, always and already have to be understood as mêlées. The language they use, English, also is a mêlée, a continual mixing of languages, even of the language with itself—and it therefore is in constant change, continually mixed and remixed in use. An upshot of this analysis is that we have to rethink scientific language and literacy and the forms of identity that students evolve relative to science as they participate in school science.

Jean-Luc Nancy had written his praise of the mêlée to articulate issues of culture, language, and identity in war-torn Sarajevo of the 1990s, though he generalized his comments to culture, language, and identity as such. The purpose of this article is to propose the mêlée as a concept for thinking such educational issues as scientific culture, language, literacy, and identity. I do so not to reproduce the concept in carbon-copy form but to develop an educationally relevant concept that has fractal similarity with the way in which the philosopher uses it for his quite different purposes (understanding the situation Sarajevo). This concept is built on the grounds of an ontology that theorizes difference to exist in and of itself. Any phenomenon (language, Self, culture) is taken to be non-identical with itself and therefore has difference as the core constituent of identity (a ≠ a). Difference at the core of the Self (same) is able to harbor the possibility of the impossible—for example, the attainment and learning of that which is absolutely foreign/strange and therefore lies beyond the horizon of the intelligible. Thus, scientific literacy and knowing and science identities already come to be possibilities at the very heart of what they are not: pre- and un-scientific literacy, non-scientific knowing, and non-science identities.
Introduction

Science educators are in trouble: There are a large number who posit that students talk about natural phenomena using a pre-instructional (mis-) conception-laden language without proposing a way that this language could change. In fact, conceptual change theorists have long realized that students’ ways of talking about natural phenomena resist instruction and few high school students ever develop the canonical ways of talking that scientists and science educators aim at achieving within students (Duit & Treagust, 1998). This conceptual change way of thinking is in trouble because it does not realize the inappropriate and insufficient nature of its own theoretical discourse for capturing the essence of learning.¹ Current theories suggest that students construct scientific knowledge, but they do not suggest how such a construction could succeed given that the tools and resources students use in this so-called construction are non-scientific! How can something scientific be built on the grounds of and with materials and tools that are all non-scientific? Similarly, allowing students to “construct” science identities is one of the core goals many science educators set themselves today without, nevertheless, providing a theory that could explain how science identities could emerge on the grounds of and with materials and tools that are utterly non-scientific (as denoted and defined in the pertinent literature). In the present essay, I propose a conceptualization of identity (Self), language, and culture consistent with present day cultural studies. This conceptualization is in terms of the mêlée, which embodies a contradictory nature that can and does account for the existence and emergence of something initially so utterly foreign/strange (scientific knowing) that it is beyond all grasp and intelligibility.²

Elsewhere, I already extend the possibility for rethinking science education and scientific literacy in new ways that are suitable to deal with the problems science

¹ From my perspective, “misconceptions” are to science educators what flogiston was to chemists preceding Antoine Lavoisier.
² Even the writing of the mêlée has to be mixed; it cannot be other wise.
education faces today (Roth, in press). One of these problems is posed by an ongoing
globalization, which leads to an increasing scattering of cultural groups into other cultural
groups where they, the latter, continue to be affiliated with one another thereby forming
diasporic, hybrid, and heterogeneous identities. Our Canadian identity, if there is such, is
a mêlée, a continual mixing of cultures, in themselves already mêlées. Diasporic
identities emerge from a process of cultural bricolage that leads to cultural métissage and
therefore hybridity and heterogeneity. To escape the hegemonies that arise from the
ontology of the same—which undergirds much of educational thought—I introduce to
(science) educators the concept of the mêlée.

The mêlée is rooted in an ontology of difference (e.g., Deleuze, 1968/1994), which
posits the non-self-identity of a thing with itself (e.g., a thing and its image are not the
same because “the thing is itself and is its image” [Levinas, 1948, p. 778]). Difference
and heterogeneity are the norm, the starting point, the originary condition that preceded
any Being not something less than sameness and purity (Levinas, 1978). This ontology
allows the framing of bricolage, métissage, hybridity, heterogeneity, and, the topic of this
paper, mêlée as positive concepts for theorizing the particular experiences of learning
science and identity not only as a consequence of cross-national migrations—such as,
Mexicans in the US, Asians and Europeans in Western Canada, Haitians in Québec, and
Africans in Europe (France)—but also the experience of native speakers who, in science
classrooms, find themselves (temporarily) at home away from home: they hear and are
required to learn a form of their native tongue that is not their own. (In contrast to others
who distinguish schools from “the real world,” I take all forms of science teaching, even
the worst, to constitute real world experiences for the students who are subjected to it.)

Speaking with a tongue half-way between what students speak at home and what science
teachers ultimately want them to speak, that is, speaking ever-changing forms of Sabir
(Roth, in press), no longer is a lesser form of language but a necessary form in the
transition between the two existing and desired forms, in themselves not purities but
mêlées. This then addresses a problem of understanding how I—any learner is an “I” with intention, and experiences of learning are in each case mine—can ever intend learning something without knowing what it is so that I am unable to use this something as the goal for my learning-related endeavors. How can I, a learner using Aristotelian talk to explain motion learn to speak in Newtonian ways, a talk so foreign as Chinese to the standard English speaker? In the history of science, such a shift that requires a scientific revolution, where new ways of thinking usually do not win over old ways but rather gain the upper hand because the old ways die out (Kuhn, 1970)? In my previous work, I conceptualized this problem in terms of an encounter with the unknown (itself receding at the very moment that it affects us), and this encounter mediates our short- and long-term emotional states (Hwang & Roth, in press).

**The Dispersion of the Scientific Self and Scientific Identity**

Immanuel Kant (and with him all constructivists) takes the Self as the starting point of a self-contained and self-constructive (autopoietic) process of knowledge production. But, building on the work of Edmund Husserl, dialectical phenomenological philosophers now recognize that “the oneself cannot form itself; it is already formed with absolute passivity” (Levinas, 1978, p. 165). It is a consequence of collective life on both phylogenetic and ontogenetic levels. The Other is not another Self in the sense of an alter ego, but rather, the Self emerges in the image of the Other at the same time as this Other. Who I am and can be therefore always is given as general possibility that exists in and constitutes my culture. I exemplify this idea in the following interview excerpt with the Indian scientist Macarthur, who is involved in one of our projects concerned with providing authentic science opportunities to high school students, including internships for First Nations students, who constitute a population all too often selected out of science programs and access to university science programs. To have a better understanding of the laboratory and its director (Macarthur), one of my graduate students
(Yi) conducted an interview concerning life and career of the lead scientist. The excerpt is taken from somewhere in the middle of the interview at a point where the two talk about the scientist’s good fortune of having been able to follow a particular educational trajectory and career path that led to his current position.

01 M: And I'm fortunate that I’ve been able to develop a career in something that I cherished from my childhood. So . . .
02 Y: Um, that's great. Your parents were supportive of you doing science rather than medicine?
03 M: Um there were a few arguments here and there. But I said, “I, this is what I will enjoy doing. Becoming a doctor and you know, it’s not something that I will enjoy doing . . . it, it,” you know.
04 Y: Were you the oldest son?
05 M: Nope, nope.
06 Y: Sometimes there are pressures on the oldest–
07 M: Yes, yes. I think all of my brothers actually, we all had, we all had the grades, and excellence in school to go into medicine or engineering. All of us chose actually to be in fundamental science.

In this excerpt, the interviewer and the interviewee together constitute a part of the biography of the latter in a particular way. Although neither interviewer nor interviewee was conscious of the fact (as my subsequent interviews with both revealed), each drew on an interpretive repertoire that almost invariantly comes to be used in such interviews or conversations about a scientist’s life: the mediating influence of parents, siblings, and other family members. That is, the recorded and written autobiography constructed as the outcome of this interview is not as singular as some readers might expect, but rather, both parties contribute to articulating a particular life in recognizable and therefore general ways. Autobiography therefore also is biography, which has led to the concept of auto/biography (Roth, 2005). That is, here is a plot whereby the life of a famous scientist—in other instances, a famous novelist, doctor, politician, or athlete—is recounted in terms of mediating influences during childhood. The very notion of auto/biography points us to the fact that each account of Self also is an account of the Other, realizing the possibility of a generic plot with a particular protagonist (character).
There are other auto/biographies of scientists that feature parents having certain career images for their children, who nevertheless decide to pursue something else and become famous. Macarthur comes to be in the image of a character in the biographical plot where a child or teenager establishes career goals separate from his or her parents and becomes successful. Telling Macarthur’s life in terms of such a plot contributes to who he comes to be in and as a result of this interview: It is his life story, but one that follows a particular form and has characteristics that are common to other scientists (novelists, doctors, politicians, or athletes) as well. His story also is the story of the Other; and the story line and characteristics of this auto/biography have come to Macarthur and Yi from the Other. This Other is at the very heart and the origin of the Self (here Macarthur’s) and our understanding of identity (Levinas, 1978).

Here again, not only the plot is intelligible, realizing a possible plot inherently intelligible to the mutual Other, but the scientist, when his life is recounted in the context of certain possible and plausible plots, becomes a character in a life narrative. A character is not singular but always has certain, common characteristics. The word derives from the Greek χαρακτέρ (character), an instrument for marking or engraving a distinctive mark or sign upon something. In present day figurative use, character denotes the aggregate of the distinctive features of a person. But the instrument connotes the reproducibility of the mark it leaves; the mark is reproduced over and over again and therefore is typical of a range of individuals. A character inherently is a collectively possible way of being in the world so that the features of the individual fall into certain possible patterns and therefore are not singular at all—despite the singularity of my individual life where nobody can take my place because there is no alibi to Being (Bakhtin, 1993). Self (Ipse), Jean-Luc Nancy (2003) would say, always is the singular distributed, always distributing, always disseminating and sharing what is never present as such, that is, in person. “Ipse ‘is’ its own dispersion” (p. 287). For Emmanuel Levinas (1978), therefore, I am only insofar as I am the Other at my very heart (core) and,
therefore, only insofar as I can be substituted for/by another (because of the reproducibility of the character); and this other is no one other than my self itself—or, in the words of the poet Arthur Rimbaud, “Je est un autre [I is another].” I, Self, and identity therefore have to be thought in terms of the mêlée. My *core Self*, the term some scholars use to denote those aspects of identity that are the most constant and lasting, is the Other.

There is a second and even more fundamental, irreducible moment in this episode: language. Both interviewer and interviewee (scientist) are seen to deploy (the English) language. For their talk to make sense at all, both have to presuppose the other to understand what he is saying, which means, neither the questions (even though the graduate student Yi may have very particular interests for pursuing the interview) nor the responses are singular (although the particular life is and has been led by but one person). Rather, each utterance is presupposed to make salient sense for the other person as well and therefore *reproduces* sense rather than producing completely novel sense. Even in the case that something were to be said for a very first time, as in poetry and other creative acts, the sense of the utterance *always and already* has to reproduce the possibility for a particular way of talking for others to be able to make sense. Or, to relate this back to identity, even the auto/biography of the most singular scientist has to have an intelligible plot line and character features for others to be able to make sense at all. This is so because an absolute, pure idiolect does not constitute a language at all (Wittgenstein, 1958); it could not mix with, be hybridized by, other languages. Idiolect is the impossible language itself, as “*it could no longer be translated so as to be the untranslatable that it is*” (Nancy, 2003, p. 285). It could not even be translated into itself, a process that occurs whenever we respond to “I don’t understand” or “Can you explain this again?”

At the very moment, therefore, that the scientist was articulating features of his lived experiences and life, he uses a language that is not his own. At the very moment one

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3 Of course, the question posed here is one of knowing whether any text could be *one*, a unity, and whether such a thing (a textual unit) could exists any more than a unicorn (Derrida, 1986).
might think him to produce a most singular account, the account cannot be singular at multiple levels, as he could not be understood if it were. Neither the language that the two use nor the character that they construct, nor the life plot they elaborate, nor the very interview situation that they realize in the process are singular but inherently realize concrete cultural possibilities. It precisely is in this way that the person, his life, his life trajectory, and his auto/biography come to be intelligible.

Finally, there is a third important aspect available in the episode, one almost never addressed in our field (education) despite the fact that the conversationalists presuppose their talk to be in, for, and constitutive of the interview. That is, the two participants in the interview realize something else in a concrete way, perhaps even without making this thematic: the interview as a particular, cultural-historical evolved form of activity. Here, the graduate student has invited the scientist to an interview about his life and work. They agreed on a time and place to meet, and when they were together and the audiotape recorder was turned on, they produced the interview event in real time, in an ongoing manner, without time out to sit back, reflect, and to be “metacognitive” about what they were doing. They realized the interview situation in and through talking the interview, which itself had a recorded (and subsequently transcribed) auto/biography as its result.

The interview continues to add (in nonlinear ways) to the production of Macarthur’s identity and Self. Thus, as in and through this interview, the scientist Macarthur is a mêlée, the result of a process of métissage; and he is so in many ways of looking at it. From a biological perspective, he is the outcome of a mixing of genes, a hybridization of gene stock, that since its evolutionary beginnings continuously has been agitated, transformed, remixed each time a sperm and egg cell united to form the mother cell for a new living being. From a phenomenological perspective, his language and the auto/biographical narratives he uses are from the Other, which therefore comes to be at the very heart of the individual Self of Macarthur. Each individual interacts with others even before being conscious (before Being proper). This, too, is immediately intelligible,
because we use the surname (the name of the family) to identify the scientist Macarthur. He is a member of a family, a constitutive member of a household (Lat. *familia*), rather than an absolute (solipsist) individual who does not belong to any class. If it were possible for me to be a solipsistic individual, I would not be able to understand myself, I would not have an identity, and would not have a character; as such an individual I would be incomprehensible, not be an individual at all, because as utter singularity, I would be totally inaccessible to the senses, even and especially my own. I would be foreign/strange to such an extent that I always would remain part of the foreign/strange, inherently withdrawing myself from any attempt to grasp and be grasped, inherently inaccessible, inherently beyond all horizons of interpretability and intelligibility. A pure identity therefore would be impossible to identify itself, it annuls itself: it is “solely identical to an itself that is identical to itself, and that thus goes around in a circle and never attains existence” (Nancy, 2003, p. 284).

Of interest to science educators concerned with bringing more students into the science is that which is scientific about Macarthur’s identity. Paraphrasing Nancy’s (1993) answer to the question of what makes a Frenchman French—what Macarthur has in common with other scientists precisely is what differentiates him from his peers. What Macarthur has in common with any other scientist is that he is not the same scientist as any other: his science-like nature therefore is nowhere to be found. (Elsewhere I explicate that this situation arises from the fact that Being is Being singular plural, that is, plurality is at the heart of singular Being [Roth, 2006].) Science-likeness is not and cannot ever be found, as there is no completed singular science, which can only exist in and as the plurality of the different ways in which it is realized. Thus, identity never is on its way: science students never develop science-like identities, because the mêlée that a(n) (scientific) identity constitutes is always already there, in all its non-scientific expressions. The mêlée, as Nancy says, is never accidental, never constructed, never the result of prior processes: it is originary, it is necessary, and never *is* but *always happens*. 
I introduce the mêlée because saying that someone is a hybrid or the result of métissage is problematic: nouns essentialize the nature of Being. We better should be saying mêlée, a verb denoting the process of mixing. Self and identity continuously are produced, in a process of mixing, overturning (brasser), agitating, and inter-connecting. Our Selves, the identities we produce and reproduce at any moment of our scientific lives, are the outcomes of processes that batter, mix, and scramble various cultural-historical resources for constituting and concretizing the Self, including the Self of the most outstanding and singular scientist that ever lived—Albert Einstein frequently is the first to take such a position. That is, any noun form of Self and identity always is the outcome of and abstracted from processes that I here denote and group by using the term mêlée.

Mêlée is a theoretical term that allows us to remake culture and thought in ways so that they are “not crude, rubbish, like any thinking of purity; to remix lineages, paths, and skins, but also to describe their heterogeneous trajectories, their networks, which are at once crossed and distinct” (Nancy, 2003, p. 279). Mêlée is an important concept to use because it allows me to bridge between Self and Other, same and other, familiar and strange. Without mêlée, to paraphrase Didier Franck (1981), I could not identify the actions of another as scientific without initially adopting over my own action an external point of view, that is, from the Other him- or herself. This viewpoint is the sole requirement that allows me to understand a bodily manifestation of someone else as indicating science and scientific practice. This also means that my auto-presentation of my living body irreducibly is intertwined with and inseparable from a re-presentation; and this intertwined nature marks the impossibility of a pure presentation, that is, it marks the very presence of the Other at the heart of the Self.

**The Dispersion of Knowing, Speaking, Language**
A language is always a mêlée of languages, something halfway between the goal of total confusion of Babel and the immediate transparency of a glossalia. (Nancy, 2003, p. 285)

Everything in science classrooms is about language (the one called scientific and the concepts it uses) and happens in language (usually the one called non-scientific). How then is learning science possible if we cannot but build on, with, and in a language that is the anathema of the scientific language to be achieved? This question is like Zenon’s paradox: How can the scientifically speaking teacher ever catch up with students who do not speak anything else but the slow-poking mundane vernacular that is the incarnation of all that which is non-scientific? The answer I provide here goes like this: science teaching (Zenon) will catch up once we re-articulate the problem in a different way, that is, in terms of the mêlée. From this perspective, language is itself a mêlée, impure, non-identical with itself; and with it, knowledge or rather knowing, to remain within an ontology of the verb, is non-self-identical—or the impossibility of pure “ipseity, a ‘being-self-same’” (Nancy, 2003, p. 284). Both knowing and speaking constitute continual processes of mixing, hybridizing, métissage—they are processes that are subsumed under the mêlée.

To articulate, exemplify, and elaborate this point, I draw on a lesson in a second-grade mathematics class, where students participated in the classification of mystery objects. As a result of the lesson, all objects came to be classified in a manner consistent with geometrical properties—rather than the properties of color, size, and other (from a geometrical point of view irrelevant) aspects that can be attributed to objects. In the moments preceding the following excerpt as part of the task that required Conrad to place his object with an existing collection or, if it did not fit, begin a new collection, he had placed it on a sheet of its own (arrow in Figure 1a). Following the teacher’s request to check again and to compare his object with all others already on the floor, Conrad then placed it in a collection that had the label “cube, square” associated with it (arrow in
In praise of mêlée

Figure 1b). The following part of the episode begins when, right after Conrad has placed his object, the teacher asks him “what that group was about” while generally pointing to the collection of objects that now included the one Conrad has placed.4

46 T: em an ↑[what did we say that group was about ((points to the group of cubes))]
47 (1.00)
→ 48 C: «<p>what do you mean [like?] ((looks up to her, still pointing))
49 T: [WHAT] was the (0.15) WHAt did we put for the name of that group. ((still points))
50 (1.51) ((still points, then pulls hand back))
51 what's written on the card.
52 (0.83)
53 C: «<p>squares>
54 T: `square an::d?
55 (0.20)
56 Ch: ((has moved forward, points to the label)) cube
57 (0.25)
58 T: cube. does it meet the criteria of having the square or the cube? ((looks at Conrad sternly, nods while talking))
59 (0.25)
60 X: «<p>no>
61 (0.25)
62 T: do you think it does?
63 (0.84)
→ 64 C: like what do you mean?
65 (1.10)
66 T: does it match. We said THAT this group ((points)) was ‘squ::re (0.31) or cube (0.49) ((looks at Conrad, nods)) does it match that?
67 (0.41)
68 X: «<pp>yes.>
69 (0.48)
70 X: or:::
71 C: ((gazes at teacher)) yes.

4 In transcribing, I have used the following conventions: (0.14) – time without talk in seconds; (.) – pause of less than 0.10 seconds; ((turns)) – transcribers comments; Kenya::: – colons indicate lengthening of phoneme, about 1/10th of a second per colon; […] – square brackets in consecutive lines indicate overlap; «<p> its» – piano, lower than normal speech volume; «<pp> yea» – pianissimo, very low volume, almost inaudible; (??) – question marks in parentheses indicate inaudible words; –?:: – punctuation is used to mark movement of pitch toward end of utterance, flat, slightly and strongly upward, and slightly and strongly downward, respectively; = – phonemes of different words are not clearly separated; ‘^’ – movement of pitch within the word that follows.
The episode features the teacher in the attempt to elicit from Conrad a statement about the special properties that characterize the members of the collection (family). There are two moments that are of particular interest at this point, surrounding turns 48 and 64, respectively (marked by arrows). In both turns, Conrad utters “[like] what do you mean [like]?” and thereby requests the previously speaking teacher to provide an elaboration, explication, re-articulation, or repetition of what she meant by saying what she said.

Figure 1. Conrad initially began a new collection with his mystery object (a) before, after the teacher’s request, reconsidering and changing its placement (b) (arrow).

In the first instance, the teacher has uttered “What did we say that group was about?” (turn 46). By asking, “What do you mean like?” Conrad marks the previous utterance as unclear with respect to its sense. Although spoken in plain English, Conrad does not understand, does not find a coherent structure in the setting that we denote by sense. With her next utterance (“What did we put for the name of that group?”), the teacher can be heard as responding to Conrad (turn 49). The sentence is different but contains some of

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5 He uses the utterance “what” and his inflection rises at the end (see question mark), both of which are recurrent features of everyday conversations that children learn to recognize as markers of questions even if the speaker does not say, “this is a question” or “a question is marked in this way.”
the same words that had been present in the initial utterance ("what," "did," "we," "that group"): we thereby can understand the topic to be continued. Economy and consistency rules of everyday conversations, which are used by competent speakers from the early ages, hold that the new utterance, despite its difference, pertains to the same topic and things when the categories are repeated (Hester & Eglin, 1997). That is, Conrad’s utterance following and preceding those of the teacher, have occasioned a repetition of sense, by using a form of language that is inherently different but also the same. The two senses, despite the apparent and obvious differences of the two utterances, are assumed to be reducible to the same sense. That is, there is heterogeneity in language with respect to what it is about. The teacher produces two different ways of talking intended to say the same thing though they say (and say so) differently. It is precisely through saying differently that the teacher’s words provide resources to Conrad to access sense that the first utterance did not achieve.

But it is a little more complicated than that. Here we (those overhearing) are confronted not only with two utterances, but also with a process of translation. This translation is hidden when we think in terms of the teacher having said the same; the perspective changes when we begin with the apparent difference between the two utterances so that the sameness of sense must be the outcome of a (constructive) process, a translation that makes the two utterances say the same. The term translation has its root in the Latin verb transfer-re (to bear, carry, bring) and means carrying something from one place to another. In the process of linguistic translation, two different situations are said to be the same: the English bee becomes the French abeille or the German Biene, and vice versa, when it refers to a particular animal; it is not the same when, for example, bee is used in the sense of spelling bee (Fr. réunion de competition d’orthographe, dictée) or meeting of neighbors to collaborate on tasks (Fr. corvée). I not only need to understand the literal sense of the word but also all the intended and unintended connotations to make sense in and of conversations. Thus, I showed in a careful analysis of the semantic
field of the two words that bee is not the same as abeille, because they constitute different
figure–ground configurations, with different allusions, associations (Ercikan & Roth,
2006). Translation therefore betrays, which the Italians have known about for a long time
coining the expression tradutore, tradittore (translating is betraying). The same is true for
science words, many of which also are used in everyday language but there are
connotations and senses that are different in the two forms of language (here, English).

A similar situation occurs just moments later, when the teacher asks Conrad whether
his mystery object “meet[s] the criteria of having the square or the cube” (turn 58). When
Conrad does not respond, the teacher reiterates her request to receive a response, which
Conrad follows by saying, “Like what do you mean?” Again, Conrad thereby makes
available publicly that he does not understand what the teacher has said in plain language.
He thereby asks for more, for a different statement, to understand what she really meant
to say with the words and sentence she just has uttered. That is, by asking the teacher for
the meaning of her talk, Conrad also suggests that she has not said what she really has
meant to say, or not said it in an intelligible way. The teacher says, “We said THAT this
group was square or cube. Does it match that?,” which another student (turn 68) and then
Conrad follow up by saying “yes” (turn 71). That is, now, after uttering a different
sentence, the student(s) understand what she is saying and what she has meant to say by
saying something differently. That is, having said differently (words, sentence structure)
and having heard differently (Conrad does not understand the first utterance, but does
understand the second), she has, and is heard to have, said the same.

The exchange could have continued for a while without leading Conrad to understand
what he is asked; potentially, this even could go on for an infinite amount of time. We
can easily imagine instances (and every science and mathematics teacher is familiar with
such) in which the student asks, “But what do you mean?” but, when she does not
understand what the teacher is saying the second time, asks the same question again, as
recounted in the following example from my research in an Australian twelfth-grade physics classroom:

I don’t know, Mr. Sparks is just one of those people that are very intelligent and that sort of puts you off a bit sometimes because he’ll sit there and explain a question or something and you’ll say you don’t understand it and he’ll sit there and explain it again but in exactly the same way, and you sort of say “I don’t understand” but you can’t sort of say, “Teach it a different way I don’t know what you are talking about,” ’cause he gets really annoyed and says, “This is the way I’m supposed to teach.” (Roth & McRobbie, 1999, p. 513)

In this situation, the student hears the teacher to be explaining what she did not understand “in exactly the same way,” although the videotapes reveal that the teacher Mr. Sparks has changed his expressions. Rona solicits another explanation and yet hears the same unintelligible explanation again. In fact, Rona here charges her teacher with monolingualism, not being able to say in so many words what he really means and thereby being caught in another language, his, a monolanguage. In the case of Conrad, however, the meaning of the utterance was revealed (little by little), which requires that the different utterances really mean the same in saying different. That two different utterances can be taken to be the same arises from the fact that each time a person opens his or her mouth, he or she also makes promises (Derrida, 1998). In speaking, the teacher promises the intelligibility of her utterances to Conrad, even if it turns out not to be the case as here. Conrad promises commitment to understanding and to the conversational situation, as he asks the teacher to state and restate what she really means. And the teacher in turn is committed to assist her student by rearticulating what she means without having so said: In responding, she implicitly promises Conrad to provide an intelligible response to his request, “what do you mean like?”

The upshot of this analysis is that language, as identity, is a mêlée, just as Nancy says in my introductory quote. Language therefore means the same by saying differently (the
different ways in which Nina articulates the same sense), and it means differently by saying the same (bee, the animal, bee, the busy person, bee, the spelling bee)—as we know from the different ways in which the same utterance can be understood, the different forms of sense it marks and remarks, the different ways in which it addresses the senses. That something is different and yet means or is meant to mean the same is the outcome of a process, a construction, for it needs to ascertain that difference is the same, difference is at the very center of the same, that the same is difference at the same time, the same cannot be understood without being different within itself. What the other means by saying the same differently itself requires our understanding of the other, empathy; and I can know the Other only because it is already integral to my Self (Franck, 1981).

**Scientific Literacy and Science Identity as Mêlée**

Thinking of language as a mêlée in the way articulated here, as continual process of mixing, has important implications for theorizing and enacting science in the classroom. The language students are to learn—the one that characterizes them as scientifically literate in the eyes of science educators and scientists—has to be acquired in the form of translations from the language that they currently speak, a language many science educators have come to characterize as embodying misconceptions, alternative frameworks, preconceptions, and other deficit phenomena. Whatever the teacher says in a scientifically correct and consistent way can be made intelligible only through a translation into the vernacular, which is different in its structures, timbres, and voices but, in the course of instruction, assumed to be the same. It is the same English or French, but also a different English or French. It is the same and different simultaneously, for when the teacher uses it, it is scientific, and when students use it, it is characteristic of misconceptions and alternative ways of speaking. It is English (French), but it is a different English (French): the English (French) language is not identical with itself.
There are as many forms of English as there are speakers speaking it. Yet these different ways of speaking are the very (fertile) ground on and from which scientific ways of speaking emerge in and evolve by means of translations that mean the same although any two expressions that are made to correspond are different. Any single language therefore already is a mêlée of languages (see Nancy’s quote introducing this section), and one of these other languages is the language itself (Derrida, 1998). Translation therefore “translates itself in an internal . . . translation by playing with the non-identity with itself of all language” (p. 65).

The concept of mêlée, because it is built on and consists of difference, allows for individual styles, tones, voices, genres, and so on to exist and emerge within a culture; but it also allows for the styles, tones, voices, genres, and so on that are required for the original to be heard, understood, and interpreted. Thus the sciences constitute particular styles, tones, voices, and genres; but these arose on a phylogenetic level, and, on an ontogenetic level, continuously arise, from everyday ways of talking that pre-existed and pre-exist them. This is an important step in theorizing learning, for in science classrooms common life comes face to face with the practices of particular communities, cultures within a culture, with practices (if we follow the distinction between scientific and pre-scientific and non-scientific) that are different from the remainder of the culture. Some scholars have begun to speak of third space, as if two pure cultures (the scientific and the root culture) come to be resources in another space, which is not here nor there, somewhere else, allowing students and teachers to return home after the days job is done, i.e., the production and reproduction of science lessons.

In a similar way: science educators nowadays talk and write a lot about the identities school science is supposed to support and build, or the resources school science is supposed to provide to construct “science (-like) identities” (some examples can be found in Roth and Tobin, 2007). Science identities, I suggest here, are not singular, are not entities that can be summarized under subjectivism and solipsism. Identities are cultural-
historical possibilities of Being, which always is realized in concrete singular cases. But despite the passivity involved, identities are not forced upon students either, as a way of “enculturating” or “acculturating” them into the community of science. Rather, we need to think of identity and identity formation in science as processes in which real, embodied, and singular Being comes to be articulated to cultural-historically possible narrative plots and characters; and this articulation occurs in, with, and through language, itself at once always mine and not-mine simultaneously, always from the other, for the other, and returning to the Other (Derrida, 1998). The starting point and end results of such processes always also are the mêlée.

Individuals are constitutive of cultures, which provide an orientation for individuals to be. Like identities and language, cultures (including science cultures) are not pure; and they do not add up when they encounter one another. They mix with each other, and in mixing, hybridize and alter one another, each contributing to the reconfiguration of the other. This is so too when laboratory science and everyday culture come face to face with each other in public and policy discourses, such as I observed in a study of the struggle over access to save drinking water in one Canadian community (Lee & Roth, 2003). The word culture comes from the Latin cultivare, to till, to take care of. It therefore comes as no surprise when Jean-Luc Nancy (1993) proposes the metaphor of cultures cultivating each other, clearing one another’s ground, irrigating, fertilizing, and draining each other. They also plow each other, culture being the cultivator, the tool for breaking the ground; and cultures graft themselves on each other—for example, to the dismay of purists in Québec and France, who want to translate English special terms rather than accepting it as part of a lingua franca (e.g., “chien chaud” to translate the English “hot dog”). Every culture therefore is a mêlée, is itself multicultural. This is the case because of previous enculturations and acculturations so that there is no pure provenance. But more importantly, every culture is multicultural because “the gesture of culture is itself a
gesture of mêlée: of confrontation, transformation, deviation, development, recomposition, combination, cobbbling together” (Nancy, 2003, p. 283).

We understand the exponential explosive changes that we observe in science and technology today precisely because the mêlée makes us think scientific language, literacy, identity, and culture as processes of continual mixing and remixing of heterogeneous culture—which occurs in and with every act a member of culture makes, scientist, science teacher, or science student. Students do not have to go “back to the basics” and restart at the beginning (from first actions and principles), but they are brought up and develop in respect to the present day mêlée, contributing to further mixing elaborations of the mêlée, further hybridization, fertilization, and plowing of the ground (Roth, 2007). Mathematics students do not really have to learn long-hand division prior to using the calculator to learn how to divide and to develop a number sense much in the same way that scientists do not have to return to programming their computers in machine language to get their experiments done but, as geneticists today, use high-level programs for the visualizations of genes, proteins, and other complex molecules, again without knowing about the Coulomb or van der Waals forces that are used to explain such molecules and how these forces depend on distance. If we were requiring all science students to go back over all the basics, science culture would not be where it is today—as this is the case of oral cultures where all forms of knowing have to be reproduced orally, taxing any human being’s capability of knowing. In fact, science and mathematics as they exist today are possible only because of writing and the inherent build up of complex concepts without having to reproduce the entire history of concepts that the field historically has undergone (Husserl, 1939). ⁶ Precisely because any already hybridized practice comes to be further hybridized, fertilized, amplified, and transformed can

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⁶ It took James Clerk Maxwell an entire book to develop and articulate four equations that in present day physics books take up but for short lines: (a) $\nabla \cdot \mathbf{D} = \rho$; (a) $\nabla \cdot \mathbf{B} = \rho$; (a) $\nabla \times \mathbf{E} = - \frac{\partial \mathbf{B}}{\partial t}$; and (d) $\nabla \times \mathbf{B} = \mathbf{J} + \frac{\partial \mathbf{D}}{\partial t}$. 
anything like “scientific progress” and industrialized society become a possibility that does not exist in oral cultures.

In this article, I articulate a praise of the mêlée. In closing, however, I feel compelled to articulate one caution: We must not take hybridization and métissage as thing, they are not essences, which would be a contradictory notion: the hybrid (métis) “gives a punctuation, a singular configuration to the without-essence of hybridization” (Nancy, 2003, p. 281). Mixture, writes Nancy, is not but it happens and emerges: Like languages and identities, always in the making, but always also reproducing themselves (in new ways) at the same time as they renew themselves. That is, in and with this paper I am calling for a process approach to science identity and language, which requires us to use verbs (Being, knowing, learning) rather than the noun forms that constitute ontologies of things (individual, knowledge, acquisition).

References


