Chapter 6
Lecture Jokes: Mocking and Reproducing Celebrated Subject Positions in Physics

Anders Johansson and Maria Berge

6.1 Introduction

> If I could tag the air molecules – this is Joe, Joe, what are you doing? Generally, Joe is just going back and forth.

This lecture joke about air molecules comes from a list of quotes collected by students and presented on the website of Professor Ramamurti Shankar, who is a respected lecturer in physics at Yale University. One of the primary functions of a joke is to make people happy and invite laughter, but another effect is to create or support intimacy through acknowledging the shared knowledge of an in-group (Cohen 1999). At least some of the students clearly get Shankar's joke and are in this way invited in as physics insiders to some extent. But what are the conditions for this intimacy? This chapter takes a critical look at lecture jokes in physics, focusing on how they may reproduce norms that structure the possibilities of students' identifications. We analyse jokes collected by the first author during participant observation of lectures, together with the list of Shankar's jokes. In what ways do his and other lecturers' jokes reflect the culture of physics and shape identities within that culture?

We draw inspiration from studies of the culture and discourse of physics, which have indicated that physicists are often expected to exhibit traits that are generally perceived as male, such as competitiveness and authentic intelligence (Gonsalves et al. 2016; Hasse and Trentemøller 2008; Traweek 1988). Recent research has

A. Johansson (✉)
Communication and Learning in Science, Engineering Education Research, Chalmers University of Technology, Göteborg, Sweden
e-mail: anders.l.johansson@chalmers.se

M. Berge
Department of Science and Mathematics Education, Umeå University, Umeå, Sweden
e-mail: maria.berge@umu.se

A. J. Gonsalves, A. T. Danielsson (eds.), *Physics Education and Gender*,
Cultural Studies of Science Education 19,
https://doi.org/10.1007/978-3-030-41933-2_6

pointed out how the discourse in physics classrooms may influence physics students, for example, by expressing limited ways of 'doing physics' (Danielsson 2009) in quantum mechanics courses (Johansson et al. 2018). Similar research in school science classrooms has shown that certain identities are attributed a 'celebrated' status, whereas others are regarded as secondary or even unintelligible (Archer et al. 2017a; Carlone et al. 2014). While some research has pointed to the role of jokes, humour and playfulness among physics students (Berge 2017; Hasse 2002, 2008), no attention has been paid to lecture jokes and how they, as part of the discourse in physics, may be part of shaping and reproducing physics culture. This chapter represents a first venture into analysing physics lecture jokes from an identity perspective. In particular, we aim to address questions about what values physics lecture jokes reflect, how this relates to gender and equity, and how it may structure students' possibilities for identification with physics and as physicists.

6.2 The Physics Community: Brimful of Humour

Part of talking scientifically is to be 'serious and dignified' all the time (Lemke 1990). In *Talking Science* (1990), Lemke elaborates on how scientific language has its own style and that 'scientific language' differs from 'everyday language'. The special style of scientific language is constituted by grammar, by word choice, by its use of idioms and metaphors, and 'largely by its avoidance of many stylistic devices that are freely used in other kinds of language' (p. 130). Nevertheless, the internet is full of humour related to science (Marsh 2016) and jokes are commonly used in science communication (Riesch 2015). Likewise, when students solve physics problems together, jokes account for a significant number of their interactions (Berge and Danielsson 2013; Due 2014; Scherr and Hammer 2009). Berge and Danielson (2013) also noticed that jokes among physics students can be an important way to demonstrate physics knowledge. In another study (Berge et al. 2012), which included both physics and bioengineering students, the physics students positioned themselves as insiders in relation to physics whereas the bioengineering students positioned themselves as outsiders, and this was partly done through jokes. The physics students made a joke about the formula $s = v{\cdot}t$ being an 'old classic', whereas the bioengineering students made ironic remarks about not being good enough, something that did not occur in the groups of physics students. A closer look at student laughter in physics problem solving (Berge 2017) revealed a more fine-grained pattern of physics humour. Humour and jokes contributed to a good working atmosphere (and thereby to the students' learning) but also interrelated with the disciplinary culture of physics. The students not only created and re-created humour that facilitated their social interactions, but through humour they also constructed local norms of science and engaged with the disciplinary discourse. In analysing physics problem solving among upper secondary school students, Due (2014) noticed a power dimension within the students' joking. Some jokes worked to exclude some students in the group, mainly by revealing their (lack of) physics knowledge. This is in line with Hasse's work (2002, 2008), which found several

students excluded by jokes referring to science fiction and particularly to the number 42, a reference to *The Hitchhiker's Guide to the Galaxy* (Adams 1979). Barthelemy et al. (2016) reported sexism as well as sexist jokes in graduate physics and astronomy programmes. In this context, women sometimes experienced jokes as a form of microaggression from their classmates, for example: 'You like chickens for their legs. Not their brains' (p. 7). Here, humour became part of larger structures of gender discrimination. To sum up, wherever you find physics students, you will find humour and jokes of many different kinds.

According to Hasse (2002, 2008) there are several distinguishable elements within the community of physics, and one of these elements is a form of play. In her anthropological work in a first-year Danish physics programme, Hasse (2002) noted specific themes of interaction that were significant within physics education: namely the use of science fiction terminology, playing with physics equipment, and telling specific physics jokes. However, these themes were not distributed equally in the students' interactions. One group of male students used different forms of playing when interacting, while a large group of male students and most female students did not. Hasse concludes that gender cannot be the only differentiator here. In her ethnography of particle physicists, Traweek (1988) describes several unexpected skills that are crucial for being successful in the field. These skills are: being an informed gossip, managing to exchange judgements about one's peers, persuading colleagues to support one's work, managing news, and, in addition, 'being a competent performer of combative, tendentious jokes' (p. 121). According to Traweek, these jokes should preferably use technical language from particle physics to describe human behaviour; for example, a physicist jokingly told her that the physicists' exchange of information with each other was like 'photons being exchanged among interacting particles' (p. 121). Studying an academic subject does not only entail learning the subject matter, but also becoming part of a community and negotiating an identity (Johansson 2018a; Traweek 1988). To become recognised as a competent and legitimate participant, you need to be able to act like one. Thus part of becoming a physicist is to learn and deal with physics jokes.

6.3 The Complexity of Humour

Humour is a form of common knowledge in every culture: what counts as good humour differs from group to group and from moment to moment. That is why jokes are always conditional and why telling the right joke at the right time requires considerable cultural knowledge (Kuipers 2006). Humour can therefore be used to identify fellow members of a community through their appreciation (or not) of a joke, since a joke can never be explained without losing some of its entertainment value (this is one reason why several of the jokes presented in this chapter will appear dull after our examination). According to Cohen (1999) this is the foundation of the intimacy of jokes: it is the 'shared sense of those in a community' (p. 28). A joke is a specific form of humour, often described as something that consists of a setup and a punch line, where the punch line suddenly shifts the meaning in an

unexpected way (Martin 2007). This form of joke is sometimes called a 'canned joke' since it is less conditional than other forms of humour and can work across different settings. But jokes and joking can also refer to informal jesting and witty quips. The quote from Shankar's homepage is an example of a mixture of a canned joke and informal humour. Jokes often deal with taboos and moral boundaries and at the same time mark social boundaries; to tag the air molecules and give them personal names is fun because it is irrelevant behaviour, and a form of play with a social boundary in physics education. Everyone who understands the joke is (more or less) pulled together automatically, but at the same time, those who do not understand it are shut out. Humour has many functions in social interaction. Kuipers (2006) points out that it can bring people together but also emphasise and augment differences in status; humour can shock, insult and hurt, and can consequently be used as an excuse for bad behaviour. This multiplicity of contradictory functions and meanings are at the core of humour – humour is and will always be contradictory. That is why humour also often touches upon social and moral boundaries; humour occurs in grey areas.

Although humour and jokes are often viewed as good, they must also be understood as based on and a part of the norms of any given social context, and they can thus be seen as having disciplining effects. Billig, in his critical evaluation of the role of humour in society criticizes both common-sense thinking and much academic research for sustaining an ideological positivism in relation to humour (Billig 2005). Rather, Billig argues, we must attend to the disciplinary role of humour, which through 'the possibility of ridicule ensures that members of society routinely comply with the customs and habits of their social milieu' (p. 2). Cohn's research (1987) on nuclear strategic thinking is an illustrative example of the disciplinary role of humour. She observed how the participants at a centre for defence technology and arms humorously talked about missiles without touching on the realities of nuclear holocaust that lay behind the words. For instance, the MX missile was called 'the Peacekeeper' and the bombs dropped over Hiroshima and Nagasaki were called 'Little Boy' and 'Fat Man'. This humoristic language limited what people working with nuclear weapons said and what it was possible to say, or even think, according to Cohn. In our treatment of lecture jokes, we aim to investigate the disciplining function of humour. With our poststructuralist understanding of social discourse, we also need to add that not only ridicule or demeaning jokes but also 'positive' or 'good-natured' jokes always represent a discursive structuring of what is funny, what is serious, what is possible to think and what is excluded from the social.

6.4 Jokes and Identity

In line with much research on gender and identity in science education, we use a feminist poststructuralist framework to conceptualize the social construction of identities. In particular we draw from the concept of *positioning* through discursive

practices, as outlined by Davies and Harré (1990). Here, 'a discourse is to be understood as an institutionalised use of language and language-like sign systems' and 'discursive practices' refer to 'all the ways in which people actively produce social and psychological realities' (Davies and Harré 1990, p. 45). In this framework, identity or selfhood is achieved by taking up or constructing subject positions. In the words of Davies and Harré, positioning is 'the discursive process whereby selves are located in conversations as observably and subjectively coherent participants in jointly produced story lines' (p. 48).

We view jokes as one form of discursive practice contributing to the construction of subject positions. Every discursive practice draws from already established discourses. While this may seem to imply a deterministic structuring of available positions, there is significant agency possible through the ambiguity of speech acts. Whether actors take up or resist given positions is always a more or less open question. Jokes represent particularly ambiguous speech acts, which may simultaneously make fun of and accentuate given positions. Nevertheless, we argue that pervasive patterns in the form and content of jokes made in physics may serve to limit the available subject positions. One way of conceptualising this limiting is to point out how certain subject positions get framed as more 'celebrated' than others, and how taking up these positions gives access to status and power (Archer et al. 2017a; Carlone et al. 2014). In this study we follow the way Berge and Danielsson use positioning, which includes how physics content is positioned within the conversation. This is an unorthodox use of positioning, which usually has a clear focus on how individuals are positioned, that is, on subject positions. We argue, however, that it is appropriate to broaden the analytical focus to include the physics content since scientific language often avoids personifications, personalities and reference to individuals (Lemke 1990), and since the understanding of what physics is, is a dominant theme in physics conversations (Berge and Danielsson 2013).

Discourses may be institutionalised on many levels and around different topics (Davies and Harré 1990). For example, physics is commonly positioned as a difficult subject that requires a brilliant intellect, which is associated with masculinity (Francis et al. 2017). Persistent discourses about gender and physics serve to define the commonly imagined subject positions for physicists, and these may exclude many forms of femininity, meaning women have to perform as 'one of the boys' or craft other positions as competent physicists (Gonsalves et al. 2016). A feminist poststructuralist understanding of gender identity points to the discursive production of gender. A common way of conceptualizing this is to conceive of gender as produced through performative acts, discursive practices where subject positions are mostly reproduced in line with given patterns, but where a possibility of change lies in 'subversive' or 'wrong' repetitions of expected gender behaviour (Butler 1990). We consider jokes as performative speech acts that are part of constructing gendered subject positions. In our analysis, we focus on the construction of subject positions in lecture jokes. In particular we ask how physicists *and* physics are positioned in the jokes.

6.5 Getting the Jokes: Materials and Methods

The material for our analysis consists of two datasets. First, we use a list of jokes collected by students in the introductory physics classes taught by R. Shankar at Yale University, and then published on his website (Shankar 2015). Shankar has long taught physics, and we understand the long list of quotes to be a sign of admiration from his students. Second, we use field notes of utterances interpreted as jokes in observations of physics classes conducted by the first author[1] (see Table 6.1). The extracts used for this study are quotes from teachers noted more or less verbatim in the notes taken during observations.

In the case of Shankar's quotes, the students defined (and edited) what he said as humour. In our data based on observations, the first author picked out humorous sequences that caught his attention. In most cases this was determined by laughter from the students or the lecturer, a clear indication of humour being performed (Berge 2017). Most of the humour analysed here is therefore co-produced (Söderlund 2016) with the students in some way. In the case of Shankar, co-production occurs through the students' role as editors; in the fieldwork setting, by students laughing along with the lecturer. While aware that the quotes from Shankar and university lecturers are a mix of canned jokes and informal humour, we will, for convenience, label all analysed extracts 'jokes'. We are also aware of the fact that 'the same sentence can be used to perform several different speech acts' (Davies and Harré 1990, p. 50), which makes our analysis of Shankar's (edited) jokes more difficult since we do not have access to the whole context (much more context is available for the observations). The ambiguity of jokes makes analysis even more complicated. However, according to Davies and Harré, nobody can have full access to a conversation and all conversations can be perceived in several ways. What we have attempted to capture in our interpretation of the material is thus dominant constructions of subject positions as physicists, recognising that other interpretations are possible and that these positionings could be taken up in different ways in the participants' negotiations.

Table 6.1 The number of recorded jokes, courses, classes and teachers in all of the data sets

Material	Jokes	Courses	Classes	Teachers
List of quotes from R. Shankar	111	Unknown	Unknown	1
Observations of quantum physics classes at two Swedish universities	48	3	29	5
Observations of various classes at two Master's programmes in physics at two Scandinavian universities	13	5	7	5

[1] Johansson did ethnographic field work in physics classes to answer questions about identity and culture in physics education. Those projects also involved interviews with students, but the material analysed here is the notes from the observed physics classes. For further discussion of the methodology, see Johansson et al. (2018) and Johansson (2018b, c).

We employed an open coding procedure to analyse the jokes, with both authors initially coding parts of the material. In this process it was helpful that both authors have a background in physics. On the basis of this analysis, we developed a selection of codes characterizing how physics and physicists were positioned within the jokes. The refined coding scheme involved codes such as 'physics is rigorous/breaking the rules' and 'physics does not concern ordinary things'. Often a joke positioned both physics and physicists in some way. For example, a lecturer presenting the postulates of quantum mechanics said, 'It is a postulate – we don't know where it came from. And we don't care'. We interpreted this as positioning physics as abstract and concerned with very specific things, thus implying that physicists are 'narrow-minded' in some sense. After developing our coding scheme, we independently coded all the jokes according to it and discussed both our diverging and converging interpretations of the gist of the jokes and the positioning done in them. This second iteration led to our expanding the scheme as we could see that a few more positionings were being done. In this way we arrived at a consensus interpretation for most of the jokes and could summarise our interpretations in the three major themes presented in the following sections: Physics is serious and rule-bound; Physics is difficult and physicists are smart; Physics is interesting and physicists are nerdy and passionate.

During our analysis we found that the jokes differed in a few ways. For example, Shankar's jokes concerned college physics, whereas the university lecturers' jokes concerned upper-division university physics. However, we also noticed local details within the jokes, like references to being a Harvard student (Shankar is at Yale) or to a specific door that was difficult to close (Master's course). We also noticed that some jokes reappeared in quantum physics courses, almost like canned jokes. For instance when half of the students answered 'yes' and the other half 'no', two lecturers joked about making 'statistical averages', similar to quantum mechanics calculations. A category of jokes that occurred in both datasets concern the teaching situation, but we have chosen to not focus on these here. Shankar made several jokes about himself, positioning himself as the Einstein stereotype, both absent-minded and wise (not answering email but understanding the meaning of life). The lack of mean jokes was striking; we found no jokes directed towards any student to diminish her or him, as occurred in student-student interactions in Due's study (2014). Personal nouns were almost non-existent. In fact, in the list of Shankar jokes, a physicist is explicitly gendered only once: 'Let's say the physicist gets stuck while climbing, and you want to send him something. It may be food, or since it's a physicist, he might say "Send me my Wolfson and Pasachoff (our textbook)! I haven't read it in two days!"' Still, we did find consistent patterns of positionings of physicists, and it is to our presentations of these that we turn in the following three sections.

6.6 'Never trust a log plot': Physics Jokes Are Serious Business

The majority of the jokes concerned the physics content itself, or the process of learning and doing physics. Geelan (2013) noticed that many high school physics teachers use 'dry humour' in year 11, and we could see a similar pattern here. Examples of dry humour are Shankar's description of the risk of trusting a log plot: 'Never trust a log plot. And especially never trust a log log plot' and a quantum mechanics lecturer's comment, 'I'm gonna do what I always like to do, give you a new operator.' We categorise these jokes as dry humour because although the content is serious and positions physics as closely related to mathematics, there is a subtle comedic delivery. Another form of humour in talking about physics content is the use of absurd scenarios and strange metaphors (Berge 2017). Shankar illustrated the Einstein equivalence principle by suggesting the idea of switching Earth for another planet:

> Say you're in an elevator. I could do two things to you and you wouldn't know the difference. I could pull the elevator up with a rope and you'd begin to feel heavy. Or, I could replace the planet beneath you with a bigger planet and you'd feel heavy. Now most likely I'll do the first one. But you can't tell the difference!

Or similarly, on the idea of eternal life, 'If you live 15 billion years, then you will be able to see the back of your head'. Common to both these examples is the fact that what is actually possible is not relevant, but the ideas are. Shankar is playing with variables while illuminating the physics he is lecturing about.

Physics at this level is often abstract, with few realistic contextualisations. Shankar, however, is able to joke about that too: 'Many people think that, since they're going to be doctors or something, they're never going to need to know about relativity. Well, what if one of your patients starts running away from you at the speed of light? Then you really need to know this.' Here Shankar manages to make light of the fact that the concept of speed of light is not applicable in everyday life while giving the students an absurd (and entertaining) picture of imaginary patients taking off at the speed of light. These absurd scenarios or strange metaphors are used as tools for contextualising physics and promoting learning.

The teachers also joked by breaking informal norms about scientific language, in the same way as the students in Berge's study (2017). As in our first example, the air molecule called 'Joe', this kind of humour is based on the informal norm that certain things (like personal names) are of no significance in physics discourse. Rather than playing with physics concepts, the teachers here play with physics norms, and often with what Lemke (1990) refers to as the stylistic norms of science. Lemke has summarised the common style of talking science into a list of nine norms that he describes as a 'recipe for a dull, alienating language' (p. 134). One of the norms on the list is to be 'serious and dignified' when talking science, something Shankar does not seem to care too much about judging from the analysed quotes. Shankar also violates other norms on Lemke's list, like the norm of avoiding the use of personifications and dramatic accounts. This is clear when he talks about the mass of

the Earth: 'The Earth's whole mass – you, me, China – everything is pulling it down', and also when he describes the trajectory of a rocket:

> Say you're firing a rocket launcher. What angle should you fire it at for maximum range? Say you fire it straight up. The good news is that it's going to be up in the air for a very long time. The bad news is that it's going to land on your head.

Similarly, one quantum mechanics lecturer talked about the 'violent name' of an operator (the annihilation operator), and the students laughed. This kind of humour intrudes upon the norm of avoiding metaphorical and figurative language when talking science, and especially avoiding emotional, colourful, or value-laden words (Lemke 1990, p. 133). Likewise, when a lecturer says that 'But that's when we talk about space-like, separation, distance. Now it's time-like […] When this gets bigger, this gets smaller, that is the hand-waving explanation' this intrudes on the norm of being as verbally explicit and universal as possible. By making jokes like this, these norms become strengthened; the laughter reinforces the point that we are not, in this context, supposed to talk this way. Thus, humour is a way to make a norm or an implicit rule explicit in the conversation. Likewise, this kind of humour can be a way to teach the students awareness of these norms, since humour is one way to make a norm or an implicit rule explicit (Berge 2017).

We know from previous research that students pick up on these examples of physics humour. When they solve physics problems together, they use absurd scenarios both in order to be funny and to clarify what they mean in order to be able to solve the task (Berge 2017). Making an accurate joke about physics content can even be a way for students to display their knowledge to their teachers: being able to make the 'right joke' implies that you have the 'right physics knowledge' (Berge and Danielsson 2013). Within the jokes described above, physics is positioned as a subject that has certain rules and norms and a special style that is not to be neglected; everyday words like 'violent' and 'China' become funny in this context. The physicist, on the other hand, is positioned as someone who appreciates this kind of somewhat dry humour. This may work to exclude students who are not necessarily used to joking in this way (Hasse 2002).

6.7 'It's Not Fun, It's Not Easy, But It's in the Notes': Hard Physics, Smart Physicists

Another theme in many of the analysed jokes was that physics is hard and difficult. This was sometimes explicitly stated, as by Shankar when he talked about a new topic in physics: 'This is very different from a graduate quantum course which I could teach in my sleep and which you could listen to in your sleep. Here, everyone needs to be awake – this causes some added difficulty.' Here Shankar specifically mentions that even he needs to concentrate, implying that this is not easy for anyone. Similarly, the university lecturers made jokes about how difficult physics can be: 'You stick it in here, you do the integral; it's not fun, it's not easy, but it's in the

notes'. On one occasion, a lecturer presented a homework task, saying, 'It's more difficult than the last one.' This statement was met with laughter from the students and the lecturer continued, 'I realize it's more than a little harder,' making the first description an understatement. This is the core of the fun in many of these jokes: physics is so difficult that calling it easy must clearly be a joke. Statements like 'this feels easier'[2] and 'this is a standard problem'[3] are followed by laughter. A quantum physics lecturer joked on the same theme when talking about Einstein's derivation of the photoelectric effect: 'So, this was pretty easy. For this simple derivation he received the Nobel Prize in 1921 … No, there were some other things as well.'

Physics, like mathematics, has a certain status because it is seen as difficult (Archer et. al 2017b; Francis et al. 2017; Gonsalves and Seiler 2012). Anyone who studies these subjects is assumed to gain some of this status, as one of Shankar's jokes illustrates:

> Mathematicians are always ahead of physicists, and physicists are always a little bit ahead of engineers, although that difference is not always clear anymore. It's because it takes so much time for our president to catch up with everything. He says 'How many barrels of oil will we save by you studying quantum mechanics?' and then we say 'Well, zero barrels' and he gets confused. So either you find this quantum stuff very useful or just use it to scare the hell out of everyone else.

In this joke, mathematicians have higher status than physicists and engineers (the opposite is illustrated in other jokes), but the main message is that studying quantum physics is a way to improve your position in society, even in relation to the president. Studying physics means you are already doing something difficult so that, ironically, it is often less important for physics students to gain the highest grades in examinations at university level (compared to other prestigious programmes like law and medicine). For engineering physics students, failing examinations is not considered extraordinary; simply passing can be considered success (Nyström et al. 2019). This acceptance of difficulty can be recognized in the American college context as well. Shankar guessed that some of his students had not got everything in his physics lesson and told them that he accepted this: 'It's okay if you don't get it, because if you all do get it, then I'm out of a job. I rely on you guys not getting it.' On another occasion Shankar acknowledged (and legitimised) that some students could not follow everything in class 'We're going to go over this again, as part of our No Child Left Behind program. Some children were left behind Wednesday; I know, because I saw lots of puzzled faces.' The point is that as long as you learn this difficult subject, you will at least be better than other people, who have not studied physics at all: 'There is one congressman who knows physics, and he's just bullying everybody around, because when he writes an equation down, none of the rest of them know what to do!' By positioning physics as difficult you simultaneously

[2] After writing the simplified Schrödinger equation with the given substitutions, the lecturer says 'ok … this feels easier, doesn't it?' and laughs a little. The equation is still fairly long. None of the students respond.

[3] The lecturer says that the third homework problem is available and that 'this is a standard problem' (compared to the earlier very tricky one). Several students laugh.

position physicists as smart. In fact, in these discursive positionings, anyone who manages to study physics is smarter than anyone else.

Even though students can be positioned as smarter than the rest of the world by studying physics, the university lecturers struggled to get them to ask questions. When one of the lecturers demonstrated an example on the blackboard and called for questions, the lecturer couldn't resist joking about the silence from the class: 'I'm gonna take that as meaning I was extremely clear and you understood everything.' This statement was met with laughter because the silence obviously did not indicate understanding. This lecturer also joked about the students' silence, saying, 'the floodgates are open so …' implying that the students seldom asked questions, and also that 'I will not be mean if you answer incorrectly.' Clearly the students were afraid to ask stupid questions.[4] Maybe being implicitly positioned as clever (just by being present in a physics classroom) makes it even harder to risk being perceived as stupid, since the fall is higher. This does affect the possibilities for learning within these classrooms at university level, since exposed confusion can be a valuable resource for learning physics (Dowd et al. 2015).

6.8 'It's Fun, and If You're Lucky, You Might Actually Get Paid!': Interest, Nerdiness, and Devotion

Physics is not only positioned as hard and physicists as smart, but the jokes also often played with notions of the engaging nature of physics and the engaged, or even nerdy, interest of physicists. In our analysis, we found that physics was positioned as a subject for interested and engaged students. Every teacher naturally wants to make their subject as engaging and interesting as possible for students. In physics, this can be done by engaging demonstrations. For example, a graduate level quantum mechanics lecturer used balloons to illustrate wave function collapse. After 'collapsing' a balloon, the lecturer commented that 'this wasn't meant to be a real analogy, though; this was just for fun', which generated some laughs from students, supposedly in part about the physics idea of 'fun'. But the serious business of physics cannot necessarily be learned through such 'engaging' demonstrations, and physics teachers may have to convey what fun physics is in other ways. Shankar told the students outright: 'That's why I'm telling you all to go do physics for the rest of your lives. It's fun, and if you're lucky, you might actually get paid!' This joke reflects the possibly fierce competition for jobs in the academy, but in particular it positions physicists as dedicated people. They may do physics their whole lives because it is fun; it is more important than money.

[4] This topic was brought up in several of the interviews that were part of the projects conducted by the first author. The interviewed students said that they often found avoiding asking stupid questions to be important in the physics classroom.

Other jokes positioned physics as the only really important thing in the world. A typical joke from Shankar exemplifies this: 'This is a very important day. You can forget your birthday, forget anniversaries, but you need to remember this day, because this is the day that you will learn Newton's Laws.' While this is an explicit instruction about how students should relate to physics, Shankar also conveys this message by telling (hyperbolic) anecdotes from his own life: 'I forgot what my life was like before quantum mechanics. I know I was playing in a sandbox and someone was trying to beat me up, but I don't remember when that was.' This same pattern can be seen in jokes about 'physicists in general'. For example, Shankar joked about physicists' hobbies: 'This problem in your book says that a physicist is hiking up the Alps. You know that's a joke, right?' The joke here lies in pointing out the irony of a hiking physicist, positioning interests other than physics as unthinkable for physicists.[5] Some jokes indicate that some areas of physics are seen as particularly interesting or sexy, which is not necessarily mirrored in students' experiences of learning them (Johansson 2018a; Johansson et al. 2018). For example, in one of the quantum mechanics courses the students were asked if they felt 'psyched up' for the subject in the first lecture, to which several of the students responded positively (see Johansson et al. 2018 for further discussion of this). In pointing out how interesting his current class is, Shankar says: 'Relativity and quantum didn't used to be taught in this class, which is a shame, because they are two of the sexiest topics in all of physics.'

When the only interest of physicists is physics, that is also where they find their joy. If physics is simultaneously perceived as dry and difficult, such enjoyment positions the physicists as nerdy in some way for finding pleasure in narrowly focused interests. An example of this is how Shankar describes his own pleasure in drawing ray diagrams:

> When I was a student I used to just draw two rays and be done with it, but now that I am nearing retirement I am so excited to draw all these different rays and see that they all hit the same spot. You guys don't know how much pleasure this gives me.

Similar positioning was done, albeit in a more low-key way, by a tutorial teacher in quantum mechanics. After having spent some time on the derivation of a complicated expression that many students may have had trouble following, this teacher says that it would be easy to come up with a more specific solution for the problem at hand but that, 'for fun, I have showed you the general expression.'

These examples indicate how physicists and physics students are expected to have a very deep engagement and enjoyment of physics. At the same time, the narrowly defined physics is positioned as very important, nothing else matters. This is evident in how Shankar describes 'the beauty of physics':

> In this first problem, there is a car driving along a cliff, and the car just jumps off. This person has decided to end it all. Now, we want to know at what time the car hits the ground.

[5] This does not match our personal experiences of cultural attitudes to outdoor life among physicists in Sweden. It is not that uncommon for physicists to be outdoor enthusiasts.

> This is the beauty of physics, because if this were a psychology class we'd want to know why the person was jumping, but we are simply concerned with how long it takes.

In positioning physics and physicists as unconcerned with complicated things like human emotions, Shankar reflects the spirit that Traweek describes as promoted by physics textbooks: Care about the fundamental things and ignore things like '"cute" and/or irritating creatures, from nude females to fleas' (Traweek 1988, p. 80). Several of the lecturers also emphasized that the more pure, fundamental, or theoretical a statement is, the more beautiful it is. Shankar: 'I just love this problem, because it has no numbers! I mean, here's mu, here's B, and everybody's happy!' A quantum mechanics lecturer: 'Theoretical physicists have a solution for all these $\hbar$. They put them to one [laugh from students]. But I try to keep them around in class.'

When physics is constructed as concerned with only the most fundamental things, this gives physicists licence to be bad at the things ordinary people manage, such as social interactions (see Willey and Subramaniam 2017). One example is drawing 'nice' pictures. Shankar joked about his abilities after drawing a stick figure of a 'ballerina': 'I guess it's better to try and fail than not to try at all.' Similar positioning was done by a quantum mechanics lecturer, who after failing to draw a circle on the blackboard using a compass, drew one by hand and said: 'Well, technology … it doesn't matter that much how it looks, really.' Students also participate in these discourses. In one of the quantum mechanics classes the lecturer asked a question, but halted in mid-sentence to reflect upon the phrasing, which sounded weird. The lecturer then asked, 'Is this how you say it?' A short discussion among the students was ended by one of the students saying, 'We are physicists, don't bother about that; you can go and study languages or something in that case,' whereupon many students laughed.

6.9 The Punch Line: Discussion and Conclusions

In our analysis of lecture jokes, we have seen how conventional discourses about physics and physicists are largely reproduced, at the same time as they are joked about. The expressed jokes display a language full of absurd analogies, abstractions and (sometimes intentionally bent) rules on how to speak. The language is often straightforward; we found no euphemisms, and in contrast to the studies of Cohn (1987) and Barthelemy et al. (2016), gender was almost never made explicit in our data or even alluded to. The relative 'formality' or 'dryness' of the joking in physics lectures points to how physics discourse and physics culture is conceived of as value-free, supporting the notion of physics as a 'culture of no culture' (Traweek 1988, p. 162). Nevertheless, as Traweek and others have emphasized, this culture *does* have values and expectations that may be excluding many people. In the context of physics lectures, we claim that the discursive positionings of physics and physicists we have outlined in this chapter are part of structuring the possibilities for

students' identifications in physics, even though the signals are not as strong as might be the case in more sexist discourses (Barthelemy et al. 2016; Cohn 1987).

Another result of our analysis, which is in line with previous research, is that physics is positioned as difficult and the physicist as smart (Francis et al. 2017; Gonsalves and Seiler 2012; Traweek 1988) with a narrowly-focused passion for physics and nothing else. The physicist is also positioned as someone who appreciates a specific kind of humour (which we know can be a gendered position, see Hasse 2002). Again, the jokes in this study are both including and excluding: at the same time as the jokes legitimise a passion for physics, they implicitly exclude students with a more moderate love for the subject. Likewise, although everyone in the room may feel part of the physics community, insider jokes differentiate the students from those who do not understand them. We note a risk here that physics jokes may, like science comedy, fall into ridiculing people who do not like or understand science 'playing on the superiority aspect of humour' (Riesch 2015, p. 773). The celebrated subject position is in other words narrow, sharing many similarities with the position of the nerd or geek (Johansson 2018c; Willey and Subramaniam 2017).

The material analysed in this chapter does represent jokes in the rather formal context of lectures, where civility is presupposed. Therefore, our material represents not only a limited number of physics jokes, but a very specific sample of them. However, although this study represents a first attempt to investigate the role of lecture jokes in physics education, it has been striking to note the commonalities of physics joking across several courses, lecturers, universities and countries. This is something that we take as pointing to a shared physics culture. We do believe that the positionings enacted through the discourse of jokes contribute to students' identifications as physicists. One piece of evidence for the effect of these discourses lies in the uptake of these forms of joking and subject positions among students. For instance, we have acknowledgement of the rules of science by joking dryly around them (Berge 2017), but also the discourse of 'physicists don't need to care about other stuff'. Continued research could shed more light on the role of jokes in teaching and learning physics, and how this aspect of the disciplinary culture restricts or opens possibilities for various positionings. Interesting lines of inquiry would be to look in more detail at how jokes are both delivered and received, as has been done with conversation analysis of video-recorded science lessons by Roth et al. (2011), or to compare joking in different disciplines or stages of education.

Lecture jokes have both benefits and drawbacks. We know that teachers' use of humour and laughter is associated with learning (Banas et al. 2011; Roth et al. 2011). Nevertheless, our study also illustrates a pattern where the teacher may, with the very best intentions, be excluding some students without being aware of it. Shankar's joke about physicists who never hike can be interpreted as an example of that. Another drawback of the jokes analysed is that jokes that position students as smart may increase the risk of students feeling like frauds, the 'impostor syndrome' which has been shown to influence women in physics (and other subjects) more than men (Ivie et al. 2016). The jokes based on the lack of students' questions in our data are evidence of these feelings in the classrooms. However, in our ethnographic data we saw how humour could also have a positive effect in a classroom and change

the atmosphere for the better. For example, when a lecturer made a joke by confessing that a physics problem needed extra attention and that even the lecturer would need to look stuff up, this was followed by students' laughter and less silence in the classroom. In another situation, the same lecturer, while waiting for answers from the students, explained that the question was difficult. A student responded to this by bursting out 'this [the physics] is starting to get weird' and everyone laughed again. This time, a student's humour became an icebreaker that opened up the interaction in the classroom. Both these instances are examples of the valuable role that humour can have in increasing closeness and involvement in classrooms (Banas et al. 2011).

Humour is an ambiguous form of communication, which can have both positive and negative effects on the classroom, and is also an efficient way to make norms or implicit rules explicit in the conversation. Thus we cannot make general recommendations about the use of joking and humour in physics lectures. However, as teachers we should reflect on the power of humour when we use jokes in the classroom, and on what discursive positionings the jokes we tell enact. In that way we can take small steps to remove potential barriers to making physics open to all.

References

Adams, D. (1979). *The Hitchhiker's guide to the galaxy*. London: Pan Books.

Archer, L., Dawson, E., DeWitt, J., Godec, S., King, H., Mau, A., et al. (2017a). Killing curiosity? An analysis of celebrated identity performances among teachers and students in nine London secondary science classrooms. *Science Education, 101*(5), 741–764. doi: 10/gctkbf.

Archer, L., Moote, J., Francis, B., DeWitt, J., & Yeomans, L. (2017b). The "exceptional" physics girl: A sociological analysis of multimethod data from young women aged 10–16 to explore gendered patterns of post-16 participation. *American Educational Research Journal*, 54(1), 88–126. doi: 10/gctkdj

Banas, J. A., Dunbar, N., Rodriguez, D., & Liu, S.-J. (2011). A review of humor in educational settings: Four decades of research. *Communication Education, 60*(1), 115–144. doi: 10/fr95jf.

Barthelemy, R. S., McCormick, M., & Henderson, C. (2016). Gender discrimination in physics and astronomy: Graduate student experiences of sexism and gender microaggressions. *Physical Review Physics Education Research, 12*(2), 020119. doi: 10/gctkc7.

Berge, M. (2017). The role of humor in learning physics: A study of undergraduate students. *Research in Science Education, 47*(2), 427–450. doi: 10/f3pdvv.

Berge, M., & Danielsson, A. T. (2013). Characterising learning interactions: A study of university students solving physics problems in groups. *Research in Science Education, 43*(3), 1177–1196. doi: 10/f2z3vm.

Berge, M., Danielsson, A. T., & Ingerman, Å. (2012). Different stories of group work: Exploring problem solving in engineering education. *Nordic Studies in Science Education, 8*(1), 3–16. doi: 10/gd4s2p.

Billig, M. (2005). *Laughter and ridicule: Towards a social critique of humor*. London/Thousand Oaks: Sage.

Butler, J. (1990). *Gender trouble: Feminism and the subversion of identity*. New York: Routledge.

Carlone, H. B., Scott, C. M., & Lowder, C. (2014). Becoming (less) scientific: A longitudinal study of students' identity work from elementary to middle school science. *Journal of Research in Science Teaching, 51*(7), 836–869. doi: 10/f6dgcr.

Cohen, T. (1999). *Jokes: Philosophical thoughts on joking matters*. Chicago: University of Chicago Press.

Cohn, C. (1987). Sex and death in the rational world of defense intellectuals. *Signs, 12*, 687–718. doi: 10/cvbz3v

Danielsson, A. T. (2009). *Doing physics – doing gender: An exploration of physics students' identity constitution in the context of laboratory work*. PhD thesis. Uppsala University. http://urn.kb.se/resolve?urn=urn:nbn:se:uu:diva-98907.

Davies, B., & Harré, R. (1990). Positioning: The discursive production of selves. *Journal for the Theory of Social Behaviour, 20*(1), 43–63. doi: 10/fxdfdt.

Dowd, J. E., Araujo, I., & Mazur, E. (2015). Making sense of confusion: Relating performance, confidence, and self-efficacy to expressions of confusion in an introductory physics class. *Physical Review Special Topics – Physics Education Research, 11*(1), 010107. doi: 10/gc5s8c.

Due, K. (2014). Who is the competent physics student? A study of students' positions and social interaction in small-group discussions. *Cultural Studies of Science Education, 9*(2), 441–459. doi: 10/f25bmc.

Francis, B., Archer, L., Moote, J., DeWitt, J., MacLeod, E., & Yeomans, L. (2017). The construction of physics as a quintessentially masculine subject: Young people's perceptions of gender issues in access to physics. *Sex Roles, 76*(3–4), 156–174. doi: 10/f9nnjt.

Geelan, D. (2013). Teacher explanation of physics concepts: A video study. *Research in Science Education, 43*(5), 1751–1762. doi: 10/gd4tnh.

Gonsalves, A. J., & Seiler, G. (2012). Recognizing "smart super-physicists": Gendering competence in doctoral physics. In M. Varelas (Ed.), *Identity construction and science education research* (pp. 157–172). Rotterdam: Sense Publishers. doi: 10/cs4t.

Gonsalves, A. J., Danielsson, A., & Pettersson, H. (2016). Masculinities and experimental practices in physics: The view from three case studies. *Physical Review Physics Education Research, 12*(2), 020120. doi: 10/f3rnhx.

Hasse, C. (2002). Gender diversity in play with physics: The problem of premises for participation in activities. *Mind, Culture, and Activity, 9*(4), 250–269. doi: 10/dsr9f3.

Hasse, C. (2008). Learning and transition in a culture of playful physicists. *European Journal of Psychology of Education, 23*(2), 149–164. doi: 10/cxg4zs.

Hasse, C., & Trentemøller, S. (2008). *Break the pattern!: A critical enquiry into three scientific workplace cultures: Hercules, Caretakers and Worker Bees*. Tartu: Tartu University Press. https://cordis.europa.eu/publication/rcn/10449_en.html.

Ivie, R., White, S., & Chu, R. Y. (2016). Women's and men's career choices in astronomy and astrophysics. *Physical Review Physics Education Research, 12*(2), 020109. doi: 10/gc5vqt.

Johansson, A. (2018a). Undergraduate quantum mechanics: Lost opportunities for engaging motivated students? *European Journal of Physics, 39*(2), 025705. doi: 10/gctj9n.

Johansson, A. (2018b). *The formation of successful physics students: Discourse and identity perspectives on university physics.* PhD thesis. Uppsala University. http://urn.kb.se/resolve?urn=urn:nbn:se:uu:diva-357341

Johansson, A. (2018c). Negotiating intelligence, nerdiness, and status in physics master's studies. *Research in Science Education*. doi: 10/gfjxxr

Johansson, A., Andersson, S., Salminen-Karlsson, M., & Elmgren, M. (2018). "Shut up and calculate": The available discursive positions in quantum physics courses. *Cultural Studies of Science Education, 13*(1), 205–226. doi: 10/f3rq2b.

Kuipers, G. (2006). *Good humor, bad taste: A sociology of the joke*. Berlin: Mouton de Gruyter.

Lemke, J. L. (1990). *Talking science: Language, learning, and values*. Norwood: Praeger.

Marsh, O. (2016). 'People seem to really enjoy the mix of humour and intelligence': Science humour in online settings. *Journal of Science Communication, 15*(02). doi: 10/gd22z4.

Martin, R. A. (2007). *The psychology of humor: An integrative approach*. Burlington: Elsevier Academic Press.

Nyström, A.-S., Jackson, C., & Karlsson, M. S. (2019). What counts as success? Constructions of achievement in prestigious higher education programmes. *Research Papers in Education*, 34(4), 465–482. doi: 10/gc8vmx.

Riesch, H. (2015). Why did the proton cross the road? Humour and science communication. *Public Understanding of Science, 24*(7), 768–775. doi: 10/gd23sr.

Roth, W.-M., Ritchie, S. M., Hudson, P., & Mergard, V. (2011). A study of laughter in science lessons. *Journal of Research in Science Teaching, 48*(5), 437–458. doi: 10/fh7z7v.

Scherr, R. E., & Hammer, D. (2009). Student behavior and epistemological framing: Examples from collaborative active-learning activities in physics. *Cognition and Instruction, 27*(2), 147–174. doi: 10/ckc7qw.

Shankar, R. (2015). *Physics 200 – Professor Shankar*. https://campuspress.yale.edu/rshankar/files/2015/09/shankarquotes-1ufgofr.doc. Accessed 4 Jan 2017.

Söderlund, H. (2016). *"Jättekul att det är så många tjejer här ikväll": En interaktionell studie om humor och kön i tv-programmet Parlamentet*. PhD thesis. Umeå University. http://urn.kb.se/resolve?urn=urn:nbn:se:umu:diva-120169.

Traweek, S. (1988). *Beamtimes and lifetimes: The world of high energy physicists*. Cambridge, MA: Harvard University Press.

Willey, A., & Subramaniam, B. (2017). Inside the social world of asocials: White nerd masculinity, science, and the politics of reverent disdain. *Feminist Studies, 43*(1), 13–41. doi: 10/gctj9r.