Mathematics, Computer Science and Scottish Country Dancing

In 2018, I was interviewed by Radio New Zealand as consequence of receiving an award from the New Zealand Royal Society[1]. During this interview, I was asked why, as a mathematician, I was interested in Scottish Country Dancing[2]. Based on the interview, some members of the RSCDS asked me to write a short piece about SCD and patterns; and why I think SCD appeals to people in maths and sciences. So with some trepidation, here goes:

The SCD experience.
One of the things I love about SCD is that there are many different ways to enjoy it. There are people who only dance a little at a ceilidh and that's it, there are those who attend classes/club nights and love the social occasion, right up to those who regard the whole experience as their calling in life. I think this should always be kept in mind in any discussion of SCD. The following discussion simply reflects my experiences and views as a dancer, a teacher, and a deviser. These experiences are all intertwined as we see below.

Music and SCD
To me the music is the core of SCD. Many of those dances from the early books have fabulous tunes. I believe that is one of the reasons these dances and tunes lasted down through the centuries. Perhaps that is why they they were included in the first books. As a dancer I love a great set of tunes, and try to educate my class about SCD music, as best I can. I am so lucky to be in a club which as a database of nearly 4,000 tunes from modern back to digitized 78's. I must say I find myself using Jimmy Shand, Jim Macleod, Stan Hamilton, Alisdair Downie, Ron Gonella and others from that generation quite often in class, as their music has such clarity. As a teacher, I consider the musical structure of my programmes for social dances as a key element. As a dancer and teacher, there are many aspects we can try to master[3]. However, for me the single most important part of the dance is the interpretation of the music. Where should we be and when? How should we try to modify our phrasing to enable the dance for ourselves and others?

As a dancer, when dancing classic old dances like "The Braes of Tulliemet" or "Monymusk" it is very satisfying to be arriving at positions exactly at the end of the phrase so that it looks seamless. (Perhaps at my current age I should say, "I seem to recall".) As a teacher I emphasise the use of all the music, to arrive on "2,3" just in time to flow into the next formation. I try to get the group to understand, firstly, how most mistakes stem from inappropriate

[1] `https://www.radionz.co.nz/national/programmes/ourchangingworld/audio/2018667030/mathematician-wins-top-science-award`

[2] This was not the first time I had been asked about SCD and maths as the article `http://homepages.ecs.vuw.ac.nz/~downey/Oct06_6-8.pdf` will show.

[3] Such aspects include correctness of steps, especially in relation to enabling formations. For example having a good jeté in pas de Basque for Setting to Corner and Partner. Also trying to master formations and the like.

phrasing (especially if the choreography of the dance is one that enables flow), and, secondly, how the phrasing of one person in the group affects others (I say "It's a team sport.")

So what has this got to do with maths[4]*?*
SCD does seem to appeal to mathematicians/computer scientists/scientists. There have also been great devisers of SCD who have such a background: Hugh Foss and John Drewry are notable here, but there are many others such as Iain Boyd, Romaine Butterfield, Ian Brockbank, the Ibbotsons, Anselm Lingnau, and Sue McKinnell as a small sample.

I would like to explain what I do when I do mathematics. Often I am thinking about understanding some kind of "algorithmic process." This is some kind of programme where many agents are interacting and evolving with time. I try to visualize what will happen should certain interactions occur. For example, we might think of a triage nurse whose job is to assign patients into an ordering to see the doctors. But new patients are coming in all the time. How to ensure that someone gets seen in the appropriate order. Or maybe I am trying to model sequencing of lights to enable traffic flow. The key aspect of all of this is the visualisation of what is happening to objects as they evolve with time. From "The Chess Mind", by Gerald Abrahams:

> "the capacity of the mind for making a path through time and complexity, is the essence and moving edge of any intellectual process."

Devising
Thus for me a key aspect of dancing, and dance teaching is seeing this flow and how it relates to the music. As a deviser, I try and see a similar flow in time, how it interprets the tune, and how one figure flows into the next. Should I slow people down here, speed them up, what figures are appropriate? There are of course, other considerations. As a mathematician, I love symmetry. But this is certainly common in SCD, and perhaps this also appeals to scientists in general. While I devise simple dances for teaching, I also like seeing how to extend the SCD canon with new formations and also enjoy being able to devise complex and challenging dances with multiple interactions.

The many aspects of SCD.
I know there are many people who dislike the fact that there are so many new dances. I see SCD in several parts.

Social dancing.
I believe that there is a core of traditional dances which should be part of a shared vocabulary. When I am constructing a social programme, for example

[4] I don't want to try to explore the connection between maths and music as I don't know anything about that. Only that I feel a deep connection with the music.

for our annual dance, I try and make the programme just that: social. First I think about the musical structure of the programme with issues including how to begin, where the stirring reels should be, where to put pipe marches, balance in the styles of the strathspeys (which for me will mean mostly strong traditional tunes).

This musical structure will usually involves a significant portion of the programme from early Society books (say, below Book 36), and the original graded book and leaflets. Second, I think about balance of the programme, the formations, including a couple of recent dances, making sure new dancers are catered for, etc. Finally, I will include a couple of challenging dances (with warnings) because I know there are people who crave these things, and I like to challenge the more experienced dancers a wee bit. At this point I talk to the band about what they think. One little problem here is that many of the early book dances are quite vigorous, and my programmes have a bit of a reputation for being tiring; but hopefully satisfying. But I like to think that a social should be just that: social. We should not need to study up for most of the dances.

The core.
One issue here is that when other groups concentrate on more recent dances, what is regarded as "core" or "well-known" is eroded. The Johnsonville Club (where I am tutor) recently had a 50th anniversary dance where I put many old dances from the past. Many of our recently joined members asked about such "unusual" dances! (These were The Montgomeries' Rant, The Duchess Tree, Sugar Candie, etc.) I have a huge amount of sympathy for those who don't want to be constantly learning all of the "most recent" dances for a social programme[5]. It's anti-social in my view. How do we find a balance?

I also think that the focus on learning new dances for upcoming programmes affects recruitment and retention unless we are lucky. So many groups I have danced withfocus on "upcoming programmes" and when some poor beginner stumbles in he or she will be thrown from torubillon to spurtle. It is true that if you survive this then you'll thrive but I wonder who we lose. As a teacher, at least for the beginning of the year, and because we don't have separate new dancers classes (except for the first month), I concentrate on teaching dancing, rather than dances, in a slow structures programme for the new dances, and on few formations for the experienced. There are lots of really interesting dances based araound only a few formations, if you look around.

Novelty.
On the other hand, it is also great to dance new dances. There are lots of clever devisers out there. We can return to the same delight we had when we first

[5]After reading a recent article in the magazine, I made a point of looking at programmes in Scotland online. At least for the sample I saw, these seemed really quite difficult and varied (particularly with no briefings) and with few of the old dances; much more so than we would have here in Wellington. I wonder if this is an example of the Diaspora preserving old forms?

mastered "A trip to Bavaria" early on thinking it was "so hard." I just don't believe that such novel dances should dominate a social programme.

But there are many ways to like SCD.
Social programmes are one aspect of SCD, but there are many other ways to experience it. I ran a little class for a group that loved complex dances needing real scope in the dancing, flow and teamwork. This group loved Hugh Foss dances, Barry Priddey's, Iain Brockbank's and others. Here we see mathematical minds devising clever complex dances, not for social programmes, but to explore the dance form. It is so satisfying to have a team dance "The Waterfall", or "Wing the Wind" or "The Palindrome" really well. Or to master the delicate phrasing of the "Celtic Brooch" sets.

This group also grappled with some the the Society's dances which don't flow in the least, but can be made to. Here I am thinking of dances "Fiddle Faddle", "Faulkland Beauty," "Marchioness of Blandford's Reel,"or "Loch Leven Castle" where the goal is to make the dance work with any semblance of flow[6]. Back to Johnsonville group, the more experienced dancers like dances of the former kind (complicated, but not too hard), such as "Rob Roy", or "The Bishop of Columbus" or the like. These I might consider on a Tartan night, or as the hard part of the social programme. People like to solve puzzles, and this is a great attraction to SCD for many. They just don't want to do it all night.

My own dances.
In my own devising, I have basically two kinds of dances.

Teaching dances.
The first group evolved when I started teaching. For example: I needed a simple dance for set to and turn corners and one that has no other phrasing or connection problems to solve. So I devised "Jeanette's Hornpipe"(1C down the middle and up, finish facing first corners, set to and turn corners finishing between them, all advance and retire, 1C turn RH one and a half times, 6 hands round and back) choosing the most excellent Victoria Hornpipe as lead tune. The "Daisy Chain" devised for a simple dance with ladies chain in strathspey time with with Bonnie Flowers o'er the Muir as the lead tune[7]. There are many other quite basic dances I devised for this purpose: simple dances for teaching specific formations with straightforward transitions.

Novel dances.
Almost all of the other dances I devise I try and include some novelty, because I believe that good dances should have their own distinctive feature, especially if they are new. As a dancer the novelty of "set and link for 3" was a great joy the first time I saw it. I remember how we all struggled when Book 36 came out.

[6]Dances providing fodder for advanced technique classes, and not danced elsewhere.

[7]Strangely, this was my teaching formation for the preliminary certificate, when, at the time there was no RSCDS dance with this formation.

Now this formation is regarded as "easy"; similarly "corners pass and turn", now apparently a beginners formation.

Since the beginning, this delight in novelty has involved devising new progressions such as the rose, la spirale, various novel poussettes such as hello goodbye, Borders and gay Gordons, pass right progression and others, as well as new formations such as corners pass and turn in tandem, setting to corner and partner in tandem, hello goodbye chase, and others; always trying to keep in the spirit of traditional SCD. I also use unusual formations I have learned from others like Terry Glasspool's isobirl, and John Drewrey's wheelie chain, or unusual dance forms like fugues and rotating dances. This is because I love the exploration of new knowledge. I am attracted to problems in my research because I see something which my intuition tells me looks interesting intellectually. My curiosity is piqued. Perhaps this is part of it all, and part of science, the wonder of trying to understand the world.

My novel dances don't need to be hard, and I have tried to write some easy ceilidh style dances (some of which turned out to be harder than I thought), like "The Maypole Dance," "Room One" (for children), or "The Kitchen Faerie". But some dances I simply wrote to challenge others and myself. Often I will hear a bit of music and think, what kind of dance will work to that? Some of the early dances I would probably not write now, as I don't like some of the transitions, but hopefully some will remain and be danced.

Online Publishing
I publish all my dances online on my home page `http://homepages.ecs.vuw.ac.nz/~downey/dances` in the same way that I publish my mathematics online. In maths, people freely access information from others using their homepages or various online archives. I think in this world of electronically available information, it is imperative that our community engages in such electronic publishing. For my own dances, my earnest hope is that people dance them and like some of them.

Finally, I have found SCD a fascinating and rewarding hobby. My wife and I did some ballroom dancing when we were young, but when we found the SCD community, we found a community which was welcoming worldwide. It is also danced in the same way everywhere, a tribute to the RSCDS. And a delightful dance form with some superb music. I hope the tradition survives for centuries to come.

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