As the saying goes, a little knowledge is a dangerous thing. This applies to music notation software as much as to anything else. The articles on this topic in this and the previous two issues of Computer Music Journal make it clear that notation programs can no longer be thought of as the toys that we believed them to be only a few years ago. Now that score preparation programs are growing up—perhaps this is even evidence that they are growing up—they’re suffering from one of the typical problems of adolescence; they act as if they know everything.

Why is this true, considering how much today’s better programs know about rhythm, complex chords, instrumentation, and so on? The reason is that all this knowledge isn’t much compared to what there is to know about common-practice Western music notation (CMN). This is a very complicated subject with many exceptions and subtleties. Lacking the space for an extended discussion, I’ll have to rely on a few dramatic examples to make this point.

Shown in Figures 1–4 are examples of cases in which famous composers of the classic-romantic period flagrantly violated important rules of music notation and yet produced results that are easily readable (playable) by most musicians. These examples are taken from my Ph.D. dissertation [Byrd 1984], which includes many more examples and a detailed discussion. In Figure 1, Johann Sebastian Bach changed time signature in the middle of a measure (from the Goldberg Variations)! Figure 2 shows a measure with no less than four horizontal positions for notes that are all on the same downbeat (taken from Johannes Brahms’s Intermezzo op. 117, no. 1). The notes in the dotted quarter chords occupy three different positions; the first eighth note on each staff, in yet a fourth position, is also on the downbeat. Finally, Figures 3 and 4 are two very different ways of having two clefs in effect on a staff at the same time.

The first is bizarrely obvious [from Claude Debussy’s La Danse de Puck]. The other—in the fourth measure on the lower staff—is so subtle that one really has to think about the 3/8 meter here (obvious everywhere else in the example) to see that the bass and treble clefs are both in effect throughout the entire measure (from Maurice Ravel’s Scarbo from Gaspard de la Nuit).

Why do these peculiar pieces of notation arise in the music of these highly respectable composers? The interesting thing is that there is really nothing very strange going on in any of these examples. In fact, it is easy to imagine someone playing through Figure 2 or 4 without even noticing anything unusual—and a listener to any of these examples would surely not notice anything unusual. Bach could have written the first example without a change of time signature at all, but it would have required tuplets and would probably have been harder to read. All of the other examples could have been written without any unusual notation simply by adding a third staff, but then the music would have required more paper (expensive for the publisher) and perhaps page turning (annoying for the performer). The point is that the supposed rules of CMN are not independent; they interact, and when the situation makes them interact strongly enough, something has to give way. It is tempting to assume that the rules of such an elaborate and successful system as CMN must be self-consistent. A problem with this idea is that so many of the “rules” are, necessarily, very nebulous. Every book on CMN is full of vague statements illustrated by examples that often fail to make the rule clear, but if you try to make every rule as precise as possible, what you get is certainly not self-consistent.

Software designers are well-intentioned people, and they tend to think they can best help their users by having their programs do things automatically. This is true if the software knows enough that it can do the right thing almost all of the time. SMUT, my first notation program, made many assumptions that
Figure 1. Example from the Goldberg Variations of J. S. Bach, demonstrating a change of time signature in mid-measure.

Figure 2. Example from Johannes Brahms's Intermezzo op. 117, no. 1, in which notes to be played on the same beat have four different horizontal positions.

Figure 3. Example from La Danse de Puck by Claude Debussy, showing two different clefs in effect in the same staff at the same time.

Figure 4. Example from the Scarbo from Gaspard de la Nuit by Maurice Ravel in which two different clefs are in effect in the same staff at the same time for an entire measure (the fourth in the lower staff).
are not always true (for example, that every voice in
the score stays permanently on one staff). After
working for years on it, I realized that it would have
been more useful if it had not made so many as-
sumptions, even though it would have been less au-
tomatic, and therefore less useful, when those
assumptions were true. (Of course, best of all would
have been a way to tell the program what it could as-
sume; then users would not have to give up any-
thing.)

Matters are made much worse by the fact that,
these days, most notation programs attempt to con-
vert CMN to performance—and vice versa—and
therefore have to understand to some extent what
the notation “means.” If the software wasn’t trying
to play from notation, it could behave to the user’s
satisfaction with a lot less domain knowledge. A
simple proof of the overwhelming difficulty of trans-
lating in only one direction—CMN to performance—
is that instrumental and voice teachers in every
music school spend a great deal of time teaching
their students how to interpret CMN, and not all of
this time is spent on subtle aspects that users
wouldn’t mind the computer overlooking. For ex-
ample, in jazz and related styles as well as some ba-
roque music, patterns of even eighth notes may
correspond to very uneven played values—or they
may not, depending on the tempo. The “interpreter”
is supposed to know how they are to be played from
his or her knowledge of the style.

Severo Ornstein, coauthor of the legendary (but
never commercially available) program Mockingbird,
has pointed out one of the worst offenses of many
programs (1991):

Right from the outset [most existing systems]
assume the existence of a defined rhythmic
structure [barlines, meter] as part of the staffing,
onto which input is mapped (I would say
forced).... [T]here is a ... serious problem that
follows when music is represented in a
rhythmically structured way. In working with a
score on the screen, entering and removing
material, all actions require the consequent
material to fit somehow into the predetermined
rhythmic structure. The consequences of
actions that would tend to violate this structure
must be forced into it in one way or another,
and the resultant side effects may well be at
variance with the user’s intentions.... When the
user puts a note down, he doesn’t want it to be
moved somewhere else just because the
program thinks it understands where it fits into
the structure. And he doesn’t want it to cause
anything else to move around either. He just
wants the note to go where he put it. And when
he deletes a note, that’s all he wants to
happen.... He may well plan to use the space
thus freed up for something else. It’s disturbing
to have things moved into space you just tried
to clear, things that don’t belong there and
which then lose their alignment with the
things they do belong with.

Conclusion

In my dissertation, I compared music notation to
Chinese writing and to mathematical notation and
argued that CMN is vastly more complex than Chi-
inese. Chinese has a very large character set, but al-
mast all you do with the characters is arrange them
in rows and columns and start new lines and pages as
needed, much as in any other language. In music,
layout is a major graphics problem, and there is no
fixed character set, no matter how large—consider
beams and especially slurs (and what about
accidentals, articulation marks, and augmentation
dots: are they independent characters, or are they
parts of some single character along with the note to
which they belong?). Mathematics is a more worthy
opponent, but music almost certainly is still more
complex.

I concluded, “Much music exists whose correct
formatting requires considerable intelligence (well
beyond the state of the art of artificial intelligence),
and some music exists whose correct formatting
probably requires full human intelligence.” In my
dissertation, I argued “the nonfeasibility of fully-au-
tomatic high-quality music notation [FAHQMN]”;
this position was inspired by Bar-Hillel’s famous
(1960) paper on “the nonfeasibility of fully-automatic
high-quality translation” (referring to natural-lan-

Byrd
guage translation). Bar-Hillel wrote in the face of widespread over-optimism about the tractability of the problem he discussed. The situation is somewhat similar with music notation, though an approximation that is good enough to be useful is probably easier than the equivalent for translating natural language. I see no reason to change these statements today. Transcribing and playing from notation, as most programs on the market today do, is much more demanding than just correct formatting. CMN is too difficult to handle automatically—at least until computers get a great deal smarter. In the meantime, any music notation program that thinks it can tell what its users really want is going to do them a lot of favors they would have been better off without. I'm not saying we need programs that know less, just ones that know how much they don't know.

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References

