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MTO 21.2 Examples: Gotham, Meter Metrics

(Note: audio, video, and other interactive examples are only available online)
http://www.mtosmt.org/issues/mto.15.21.2/mto.15.21.2.gotham.php

Figure 1. A 'tree' structure representation of meter ((22)(23))

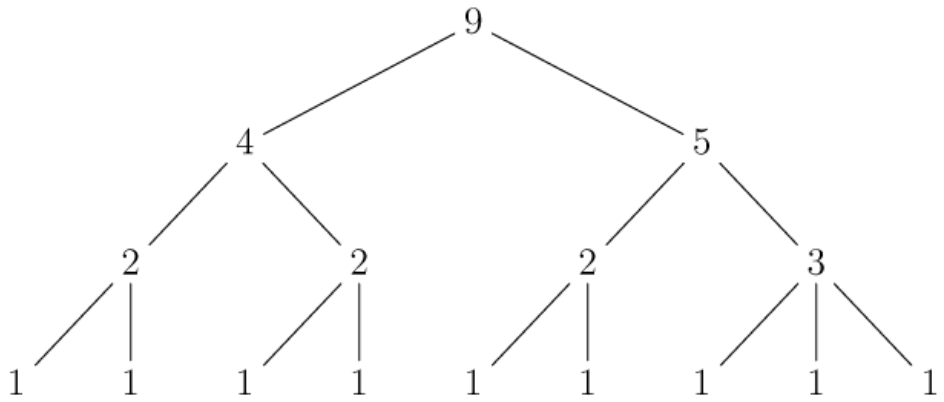

Figure 2. A recursive chart for metrical structures. Meters are ordered first by the number of pulse units, secondly by the number of beats, and finally (where applicable) by listing permutations of the same vector in a pattern employed throughout this paper and all of its figures

Vector	Example	Units			Order	
{1,0}	2/8	⟨2⟩			2	
{0,1}	3/8	⟨3⟩			3	
{2,0}	4/8	4	⟨2⟩		(2,2)	
{1,1}	5/8	⟨5⟩	2		(2,3)	
					(3,2)	
{0,2}	6/8	⟨6⟩	2		(3,3)	
{3,0}	3/4	6	⟨3⟩		(2,2,2)	
{2,1}	7/8	⟨7⟩	3		(2,2,3)	
					(2,3,2)	
					(3,2,2)	
{1,2}	8/8	⟨8⟩	3		(2,3,3)	
					(3,2,3)	
					(3,3,2)	
{4,0}	4/4	8	4	⟨2⟩	((2,2),(2,2))	
{0,3}	9/8	⟨9⟩	3		(3,3,3)	
{3,1}	9/8	⟨9	4⟩	2	((2,2),(2,3))	
					((2,2),(3,2))	
					((2,3),(2,2))	
					((3,2),(2,2))	
{2,2}	10/8	⟨10⟩	4	2	((2,2),(3,3))	
					((2,3),(2,3))	
					((2,3),(3,2))	
					((3,2),(2,3))	
					((3,2),(3,2))	
					((3,3),(2,2))	
{5,0}	5/4	10	⟨5⟩	2	((2,2),(2,2,2))	((2,2,2),(2,2))
{1,3}	11/8	⟨11	4⟩	2	((2,3),(3,3))	
					((3,2),(3,3))	
					((3,3),(2,3))	
					((3,3),(3,2))	
{4,1}	11/8	⟨11	5⟩	2	((2,2),(2,2,3))	((2,2,2),(2,3))
					((2,2),(2,3,2))	((2,2,2),(3,2))
					((2,2),(3,2,2))	((2,2,3),(2,2))
					((2,3),(2,2,2))	((2,3,2),(2,2))
					((3,2),(2,2,2))	((3,2,2),(2,2))
{0,4}	12/8	⟨12⟩	4	2	((3,3),(3,3))	
{3,2}	12/8	⟨12	5⟩	2	((2,2),(2,3,3))	((2,2,2),(3,3))
					((2,2),(3,2,3))	((2,2,3),(2,3))
					((2,2),(3,3,2))	((2,2,3),(3,2))
					((2,3),(2,2,3))	((2,3,2),(2,3))
					((2,3),(2,3,2))	((2,3,2),(3,2))
					((2,3),(3,2,2))	((2,3,3),(2,2))
					((3,2),(2,2,3))	((3,2,2),(2,3))
					((3,2),(2,3,2))	((3,2,2),(3,2))
					((3,2),(3,2,2))	((3,2,3),(2,2))
					((3,3)(2,2,2))	((3,3,2),(2,2))
{6,0}	6/4	12	⟨6⟩	2	((2,2,2),(2,2,2))	
	3/2	12	6	⟨3⟩	((2,2),(2,2),(2,2))	
etc.	etc.		etc.		etc.	

Figure 3. Corresponding extracts from the opening and recapitulation of the third movement of Martinů's *Les Fresques de Piero della Francesca*, showing the same musical material notated in different ways

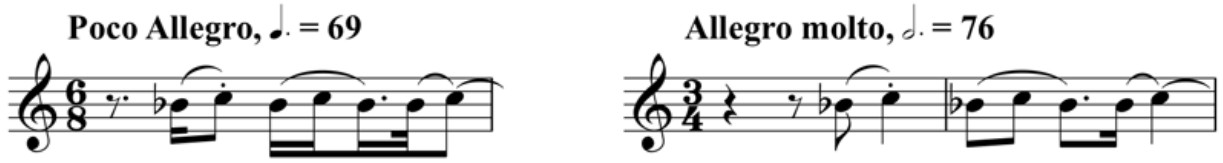

Figure 4. A reading of 'The Grudge' from Tool's album *Lateralus*, based on the migration of a single 5 level among binary groupings on other levels. This stands as an example of the equivalence relation without identity

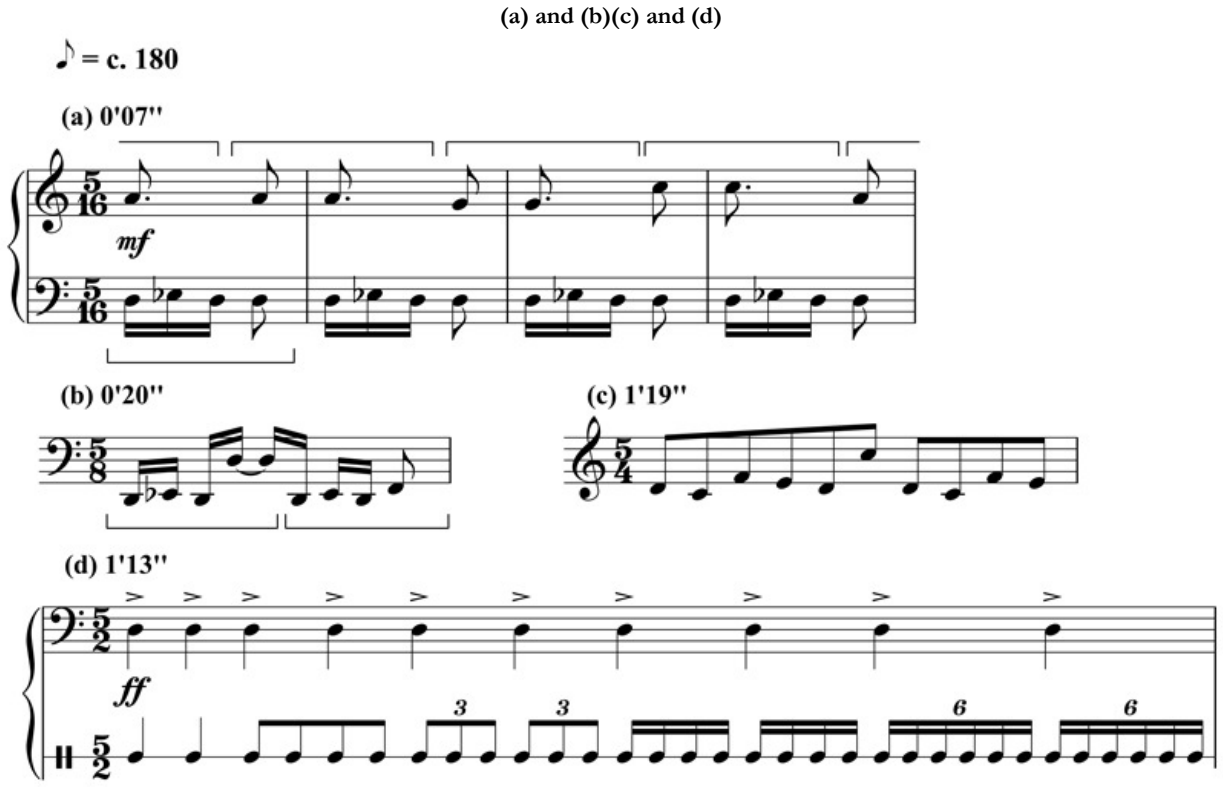

Figure 5. An extract from Copland's Appalachian Spring (reh. 11 and also 3 bars before reh. 14), in which the motivic correspondence between the two measures emphasizes their similar sub-tactus pulse cardinality

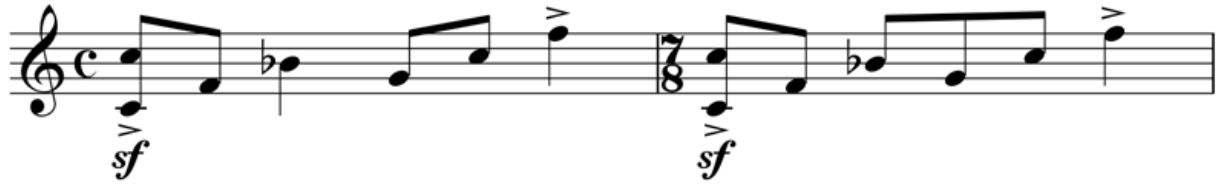

Figure 6. An illustration of the relevance of the B relation in an Hungarian folk song as transcribed by Bartók

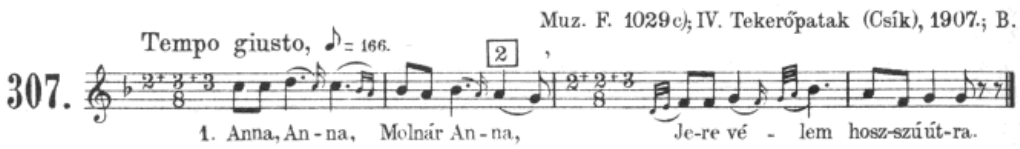

Figure 7. A vector space for the B and U relations. Beat equivalence holds between meters on the dotted-line diagonals, while the unordered subset and superset relations are shown by the vertical and horizontal solid-line arrows. The space sets out compound meters (those in the form {0,N}) in the leftmost column, duple meters (those in the form {N,0}) in the lowest row, and mixed meters in between

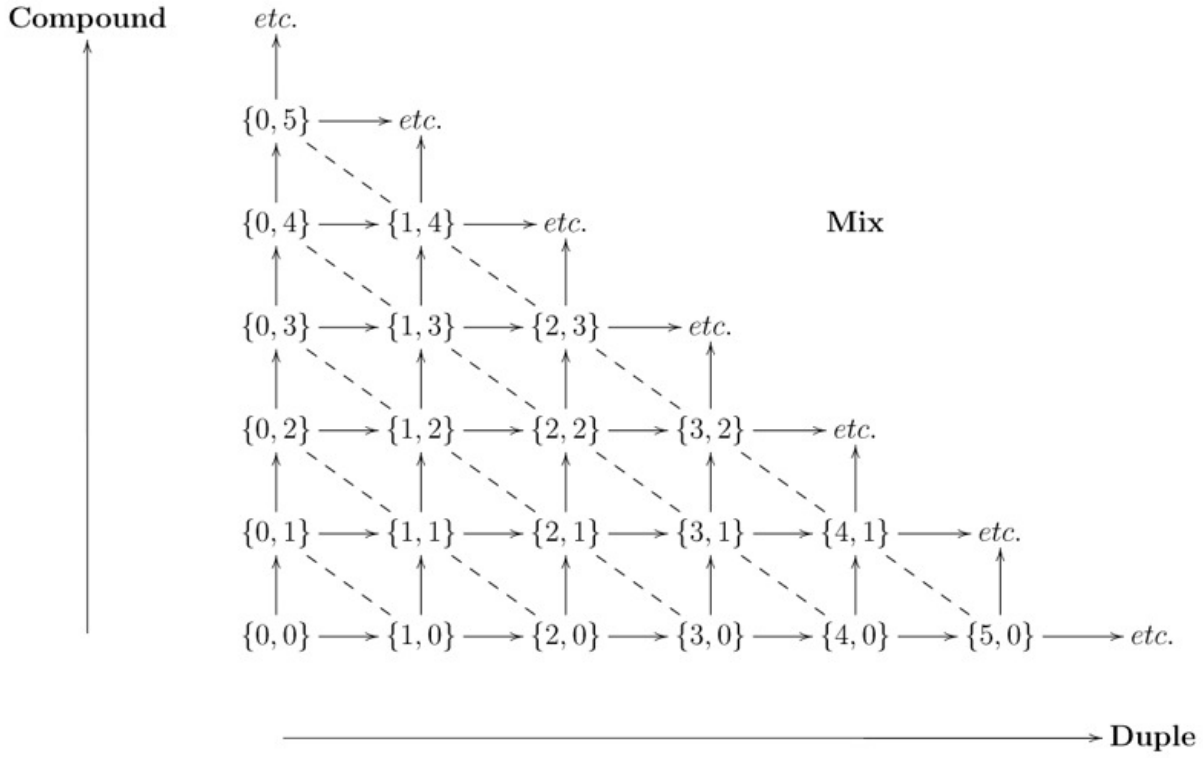

Figure 8. Measures 26–30 of Ralph Vaughan Williams's Fantasia on a Theme by Thomas Tallis, as an example of pulse (P) and beat (B) equivalences (shown by brackets below the staves), as well as the structural equivalence (E, shown above the staves)

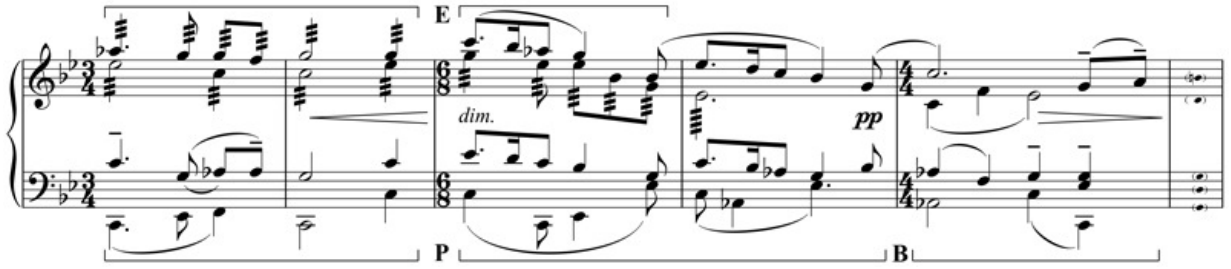

Figure 9. The number of unordered subsets for each meter, showing that meters with the most equal contribution of the two beat types are the most connected in this regard

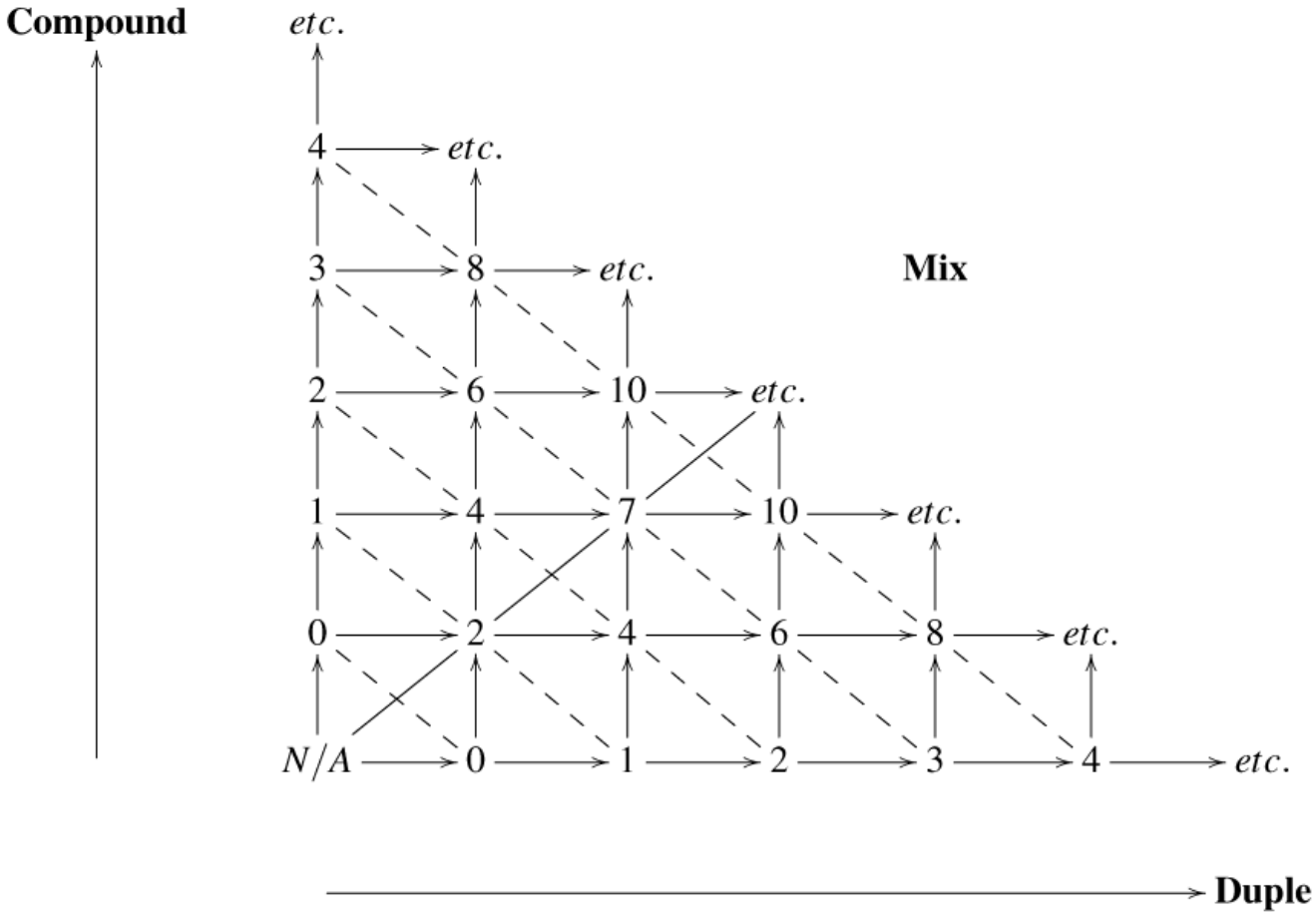

Figure 10. Saturation by multiplication of duple and triple groupings

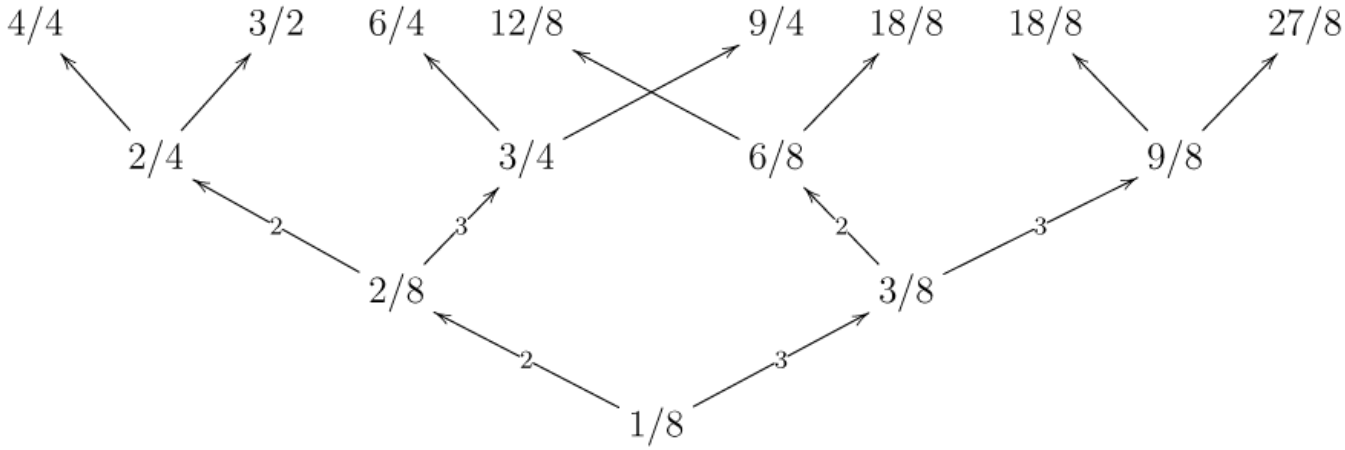

Figure 11. The Saturation relation in Copland's Symphony no. 3, movement 3, rehearsal number 72ff

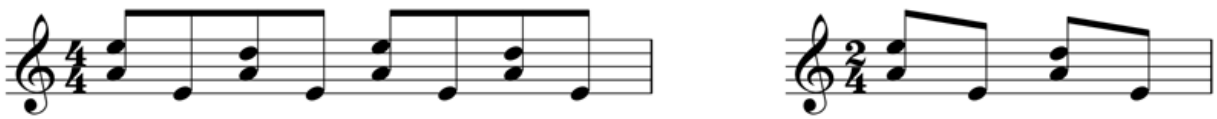

Figure 12. A 'tree' structure representing of the Saturation relation between two binary meters (such as 2/4 and 4/4)

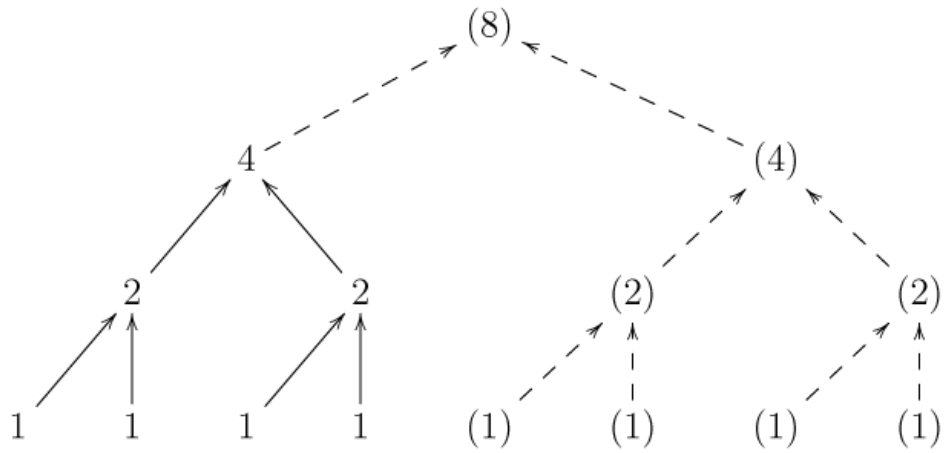

Figure 13. The family structure of entailments for the unordered (U), ordered (O), and saturation (S) relations. Double-line arrows stand for the entailments, while dashed lines serve as a reminder that the entailments do not go both ways

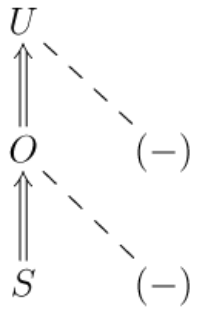

Figure 14. Ordered subset relations (including saturation) for meters {1,0} to {0,4}. Dotted lines show the Saturation relation (S), and solid lines show first-generation First (F) and Last (L) order relations. S, F, and L are labelled in the first instance only. The Within relation is necessarily not a first generation relation and is not shown by single arrows here

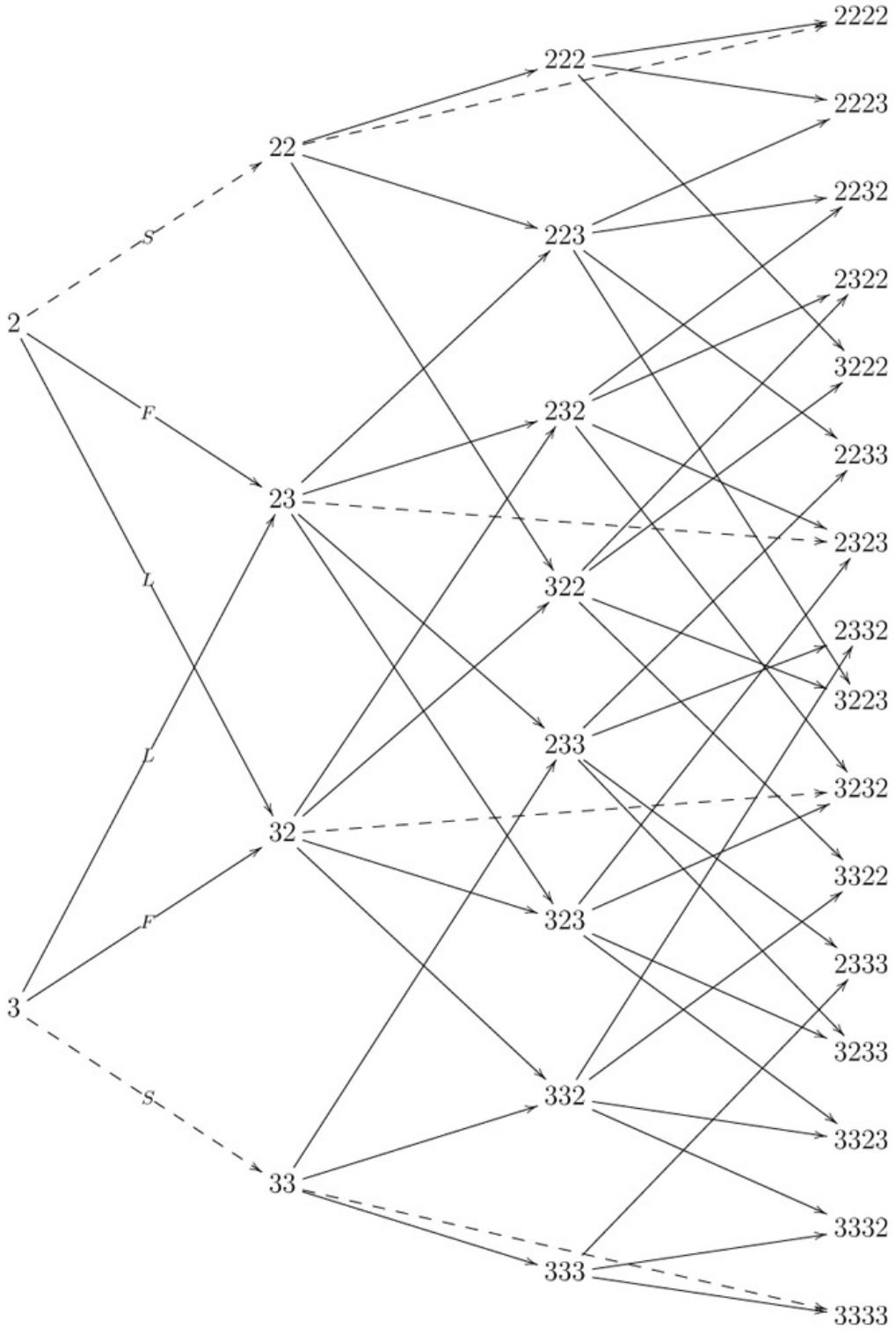

Figure 15. Further generations of F, L, and W relations

	2													
2	I	**3**												
3		I	**22**											
22	S		I	**23**										
23	F	L		I	**32**									
32	L	F			I	**33**								
33		S				I	**222**							
222	S		FL				I	**223**						
223	F	L	F	L				I	**232**					
232	FL	W		F	L				I	**233**				
233	F	L		F		L				I	**322**			
322	L	F	L		F						I	**323**		
323	W	FL		L	F							I	**332**	
332	L	F			L	F							I	**333**
333		S				FL								I

Figure 16. The L relation as manifest in Djoudjeff's transcription of a Bulgarian folk song, connecting '5/16' (23) and '9/16' (2223) meters (1931, 344)

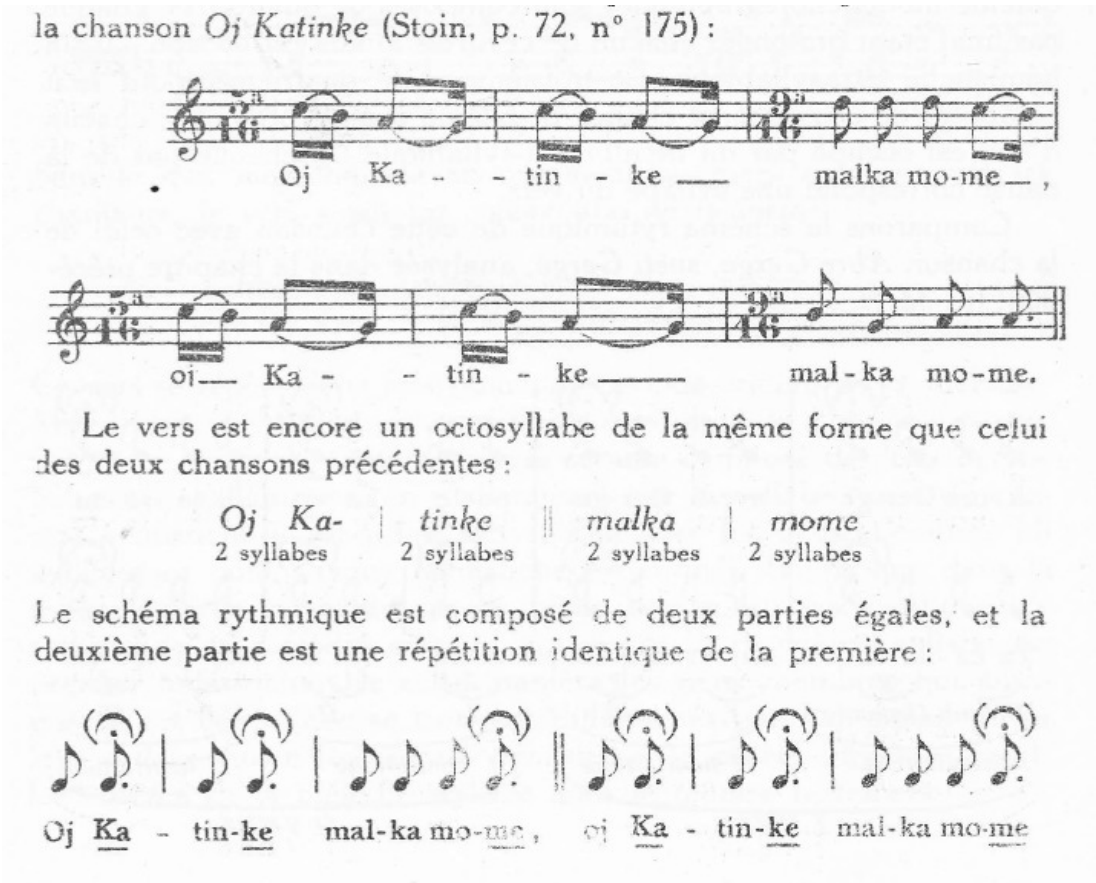

Figure 17. The nested L relation between the (2,3) and ((2,2),(2,3)) meters in Figure 16

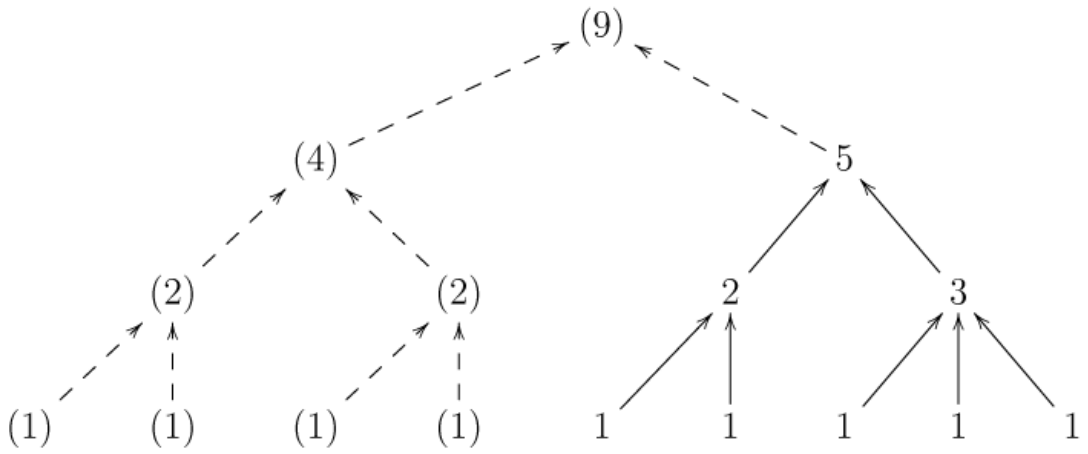

Figure 18. The (non-nested) L relation between (2,3) and (2,2,3) meters

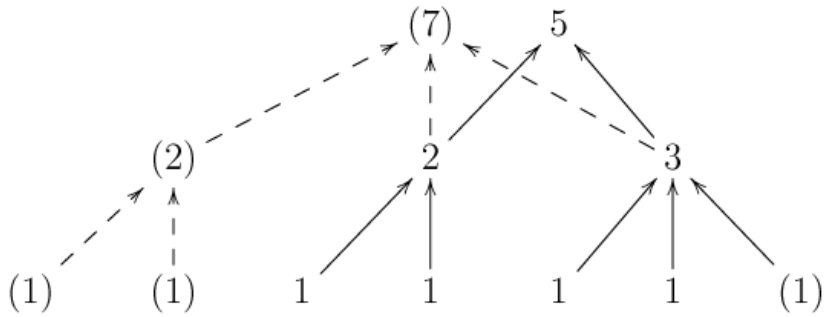

Figure 19. Hypermetrical ambiguity in Bartók's Concerto for Orchestra (movement IV, mm. 5–8 with anacrusis, oboe part). Two sets of brackets below the staff correspond to the alternative hypermetrical interpretations—a more stable 3222, and a less stable 2232—while the brackets above delimit the melodic phrase (2223)

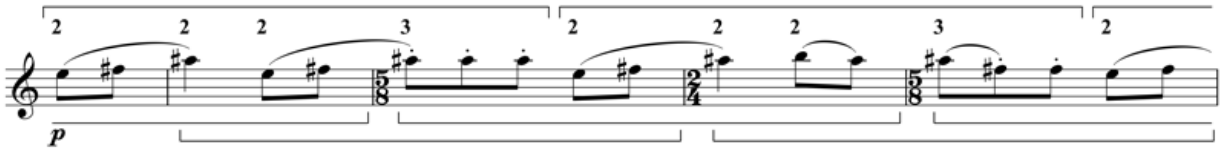

Figure 20. Symmetry in the metrical and motivic structure of Stravinsky's *Petrushka*, reh. 15 mm. 1–4, 1947 version

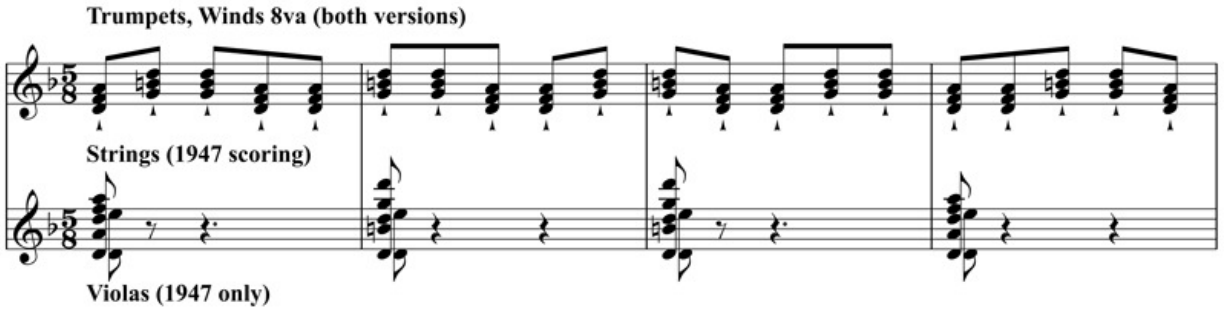

Figure 21. Metrical symmetry in the Tanz from Orff's *Carmina Burana*

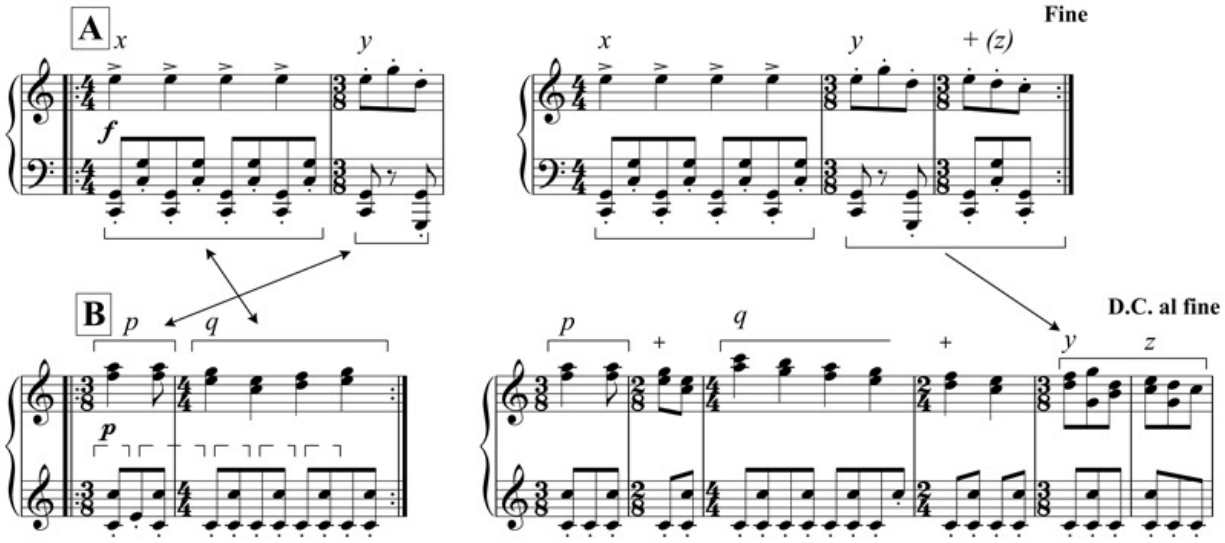

Figure 22. Complementation between meters in two passages from Britten's *Rejoice in the Lamb*

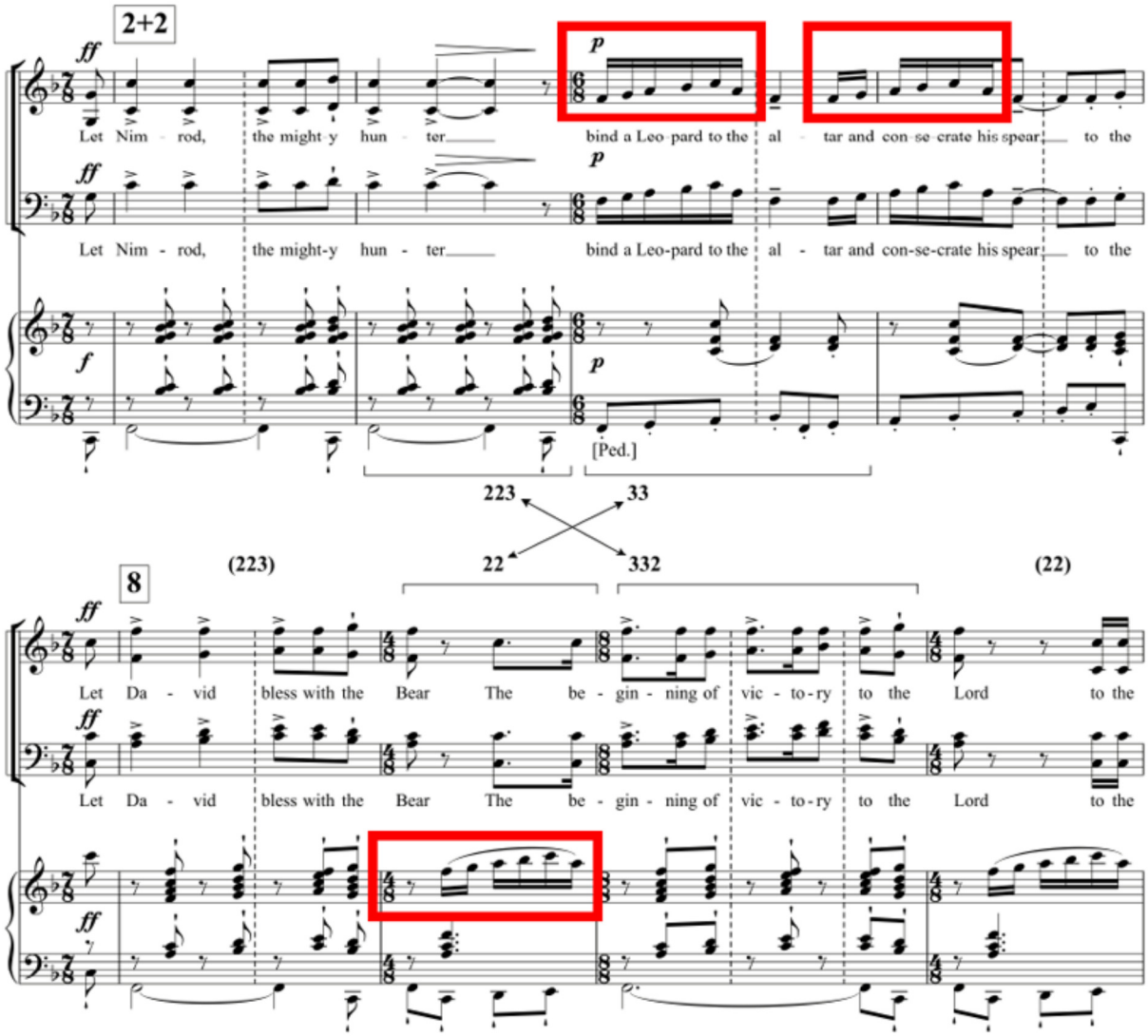

Figure 23. The family entailments among the B, V, C, R, and Sym relations. Double-line arrows stand for the entailments (such as V => B); single solid lines indicate the possible coexistence of relations which do not entail each other (such as V – C), and dashed lines serve to remind that the entailments do not go both ways (V and C both entail B, but B does not necessarily entail either V or C)

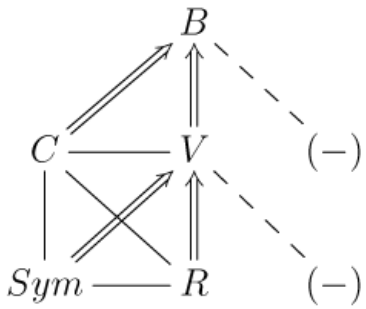

Table 1. V, R, Sym, C (and E) relations among meter vectors {4,0} and {0,4}

	2222	
2222	E	**3333**
3333	C	E

Table 2. V, R, Sym, C (and E) relations among orderings of meter vectors {3,1} and {1,3}

	2223								
2223	E	**2232**							
2232	R	E	**2322**						
2322	R	R,Sym	E	**3222**					
3222	R,Sym	R	R	E					
					2333				
2333	-	-	-	C	E	**3233**			
3233	-	-	C	-	R	E	**3323**		
3323	-	C	-	-	R	R,Sym	E	**3332**	
3332	C	-	-	-	R,Sym	R	R	E	**3333**

Table 3. V, R, Sym, C (and E) relations among orderings of meter vector {2,2}

	2233					
2233	E	**2323**				
2323	V	E	**2332**			
2332	R	V	E,Sym	**3223**		
3223	R	V	C,R	E,Sym	**3232**	
3232	V	C,R,Sym	V	V	E	**3322**
3322	C,R,Sym	V	R	R	V	E

Figure 24. The combined family structure of entailments for most of the metrical relations discussed. The figure shows that there are two separate sets of meter relations: between B-related and U-related meters respectively. Double-line arrows stand for entailments (such as V → B or O → U), single solid lines indicate the possible coexistence of relations which do not entail each other (such as V – C), and dashed lines serve to remind that the entailments do not go both ways (V and C both entail B, but B does not necessarily entail either V or C). To that effect, note that there are also pairs of meters for which neither B nor U hold.

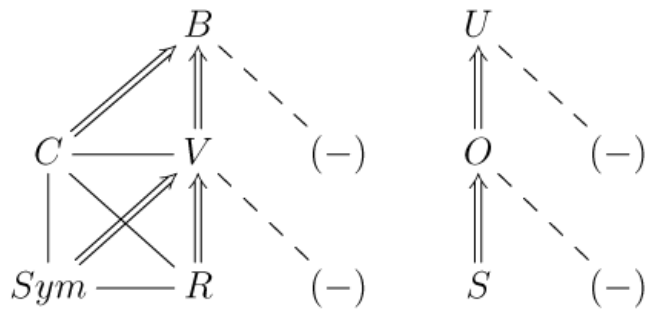

Table 4. Summary of relations among meters {1,0} to{0,3} including B, P, S, O, U, R, Sym, and C. Where multiple relations are present, the most restricted form(s) are given (cf. the structure of entailments in Figure 24). For instance, V does not appear, as all V-related pairs are accounted for by more restricted relations (R, C, and Sym) for these meters. All relations have been restricted to exact equivalences (including P). Notice the diagonal axes of C and Sym relations, as well as the clusters of R blocks (as shown earlier in Tables 1, 2, and 3 at the end of the section on vector identity).

	2													
2	E	**3**												
3	C	E	**22**											
22	S	-	E	**23**										
23	F	L	B	E	**32**									
32	L	F	B	Sym, C	E	**33**								
33	-	S	C	B	B	E	**222**							
222	S	E	F, L	-	-	P	E	**223**						
223	F, W	L	F	L	U	-	B	E	**232**					
232	F, L	W	U	F	L	-	B	R	E, Sym	**322**				
322	L, W	F	L	U	F	-	B	R, Sym	R	E	**233**			
233	F	L, W	-	F	U	L	B	B	B	C	E	**323**		
323	W	F, L	-	L	F	U	B	B	C	B	R	E, Sym	**332**	
332	L	F, W	-	U	L	F	B	C	B	B	R, Sym	R	E	**333**
333	-	S	-	-	-	F, L	C	B	B	B	B	B	B	E

Figure 25. A connected, summative three-dimensional space for meters and metrical relations

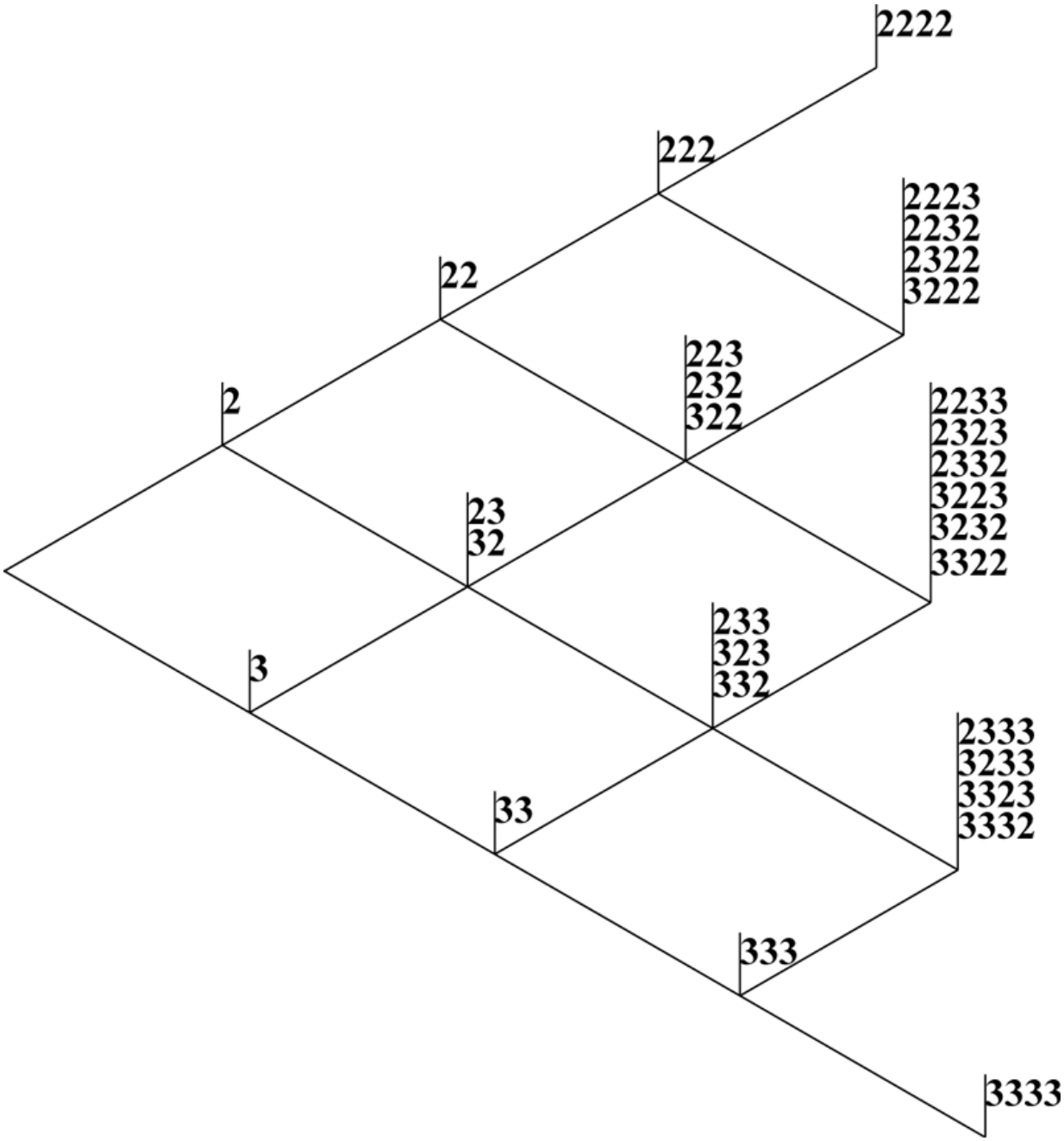

Figure 26. An example using the space set out in Figure 25 for meter 2233, and the relations it shares with other meters of cardinality 1–4 (in red)