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'Well, it's about time!' Renewing the lost art of musical timing in cartoon animation for contemporary animators, directors and composers

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Keywords: *animation; timing; cartoons; synchronisation; beats; tempo; rhythm; music.*

Figure 1: *Unstill Life* (© Mark Mason, 2023)

- UCLan Research and Enterprise Image Competition 2023: PGR Student Category Winner

- UCLan Post Graduate Research Conference 2023: Best Presentation (Greenbank Sessions) 2nd Place Winner

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Every film that deserves the name
must possess its individual rhythm which determines its form.
(London, 1936)

Background

The research is focussed on a narrow, technical aspect of traditional, drawn animation production specifically related to the roles of the Animation Director and Animator. It should be noted that animated short films produced in the period I'm researching (1928-c.1957) were almost always called Cartoons and are created frame by frame, unlike a live action film. Animation must be timed in units of frames, seconds and sometimes feet (16 frames = 1 foot of 35mm film). Each scene, action and movement are timed to ensure the correct pacing to clearly communicate the story, action and personality/mood of the characters.

My research focusses on two methods of timing animation which relate to music, beats and rhythm:

1. Timing to a pre-recorded audio or music track. Think of any film where characters sing or dance to existing music.

2. Timing with tempos and beats using a Bar Sheet, where the timing of the action is determined by the Animation Director using beats and tempos. The music is composed during or after animation production using the director's timings.

I have explored the first method in depth throughout my 38 years of work in the UK animation industry as Director, Animator, Storyboard Artist and Character Designer (submitted as Projects 1 and 2) when I conducted early experimentation around aspects of method 2. This has led me, via PhD by Portfolio, to Project 3, a deeper, more focussed, investigation into the technical use and impact of the second method.

After early experiments by the Fleischer Brothers in sound synchronisation, Wilfred Jackson, animator at the Walt Disney Studios made the link between beats per minute on a metronome and the recently standardised shooting and projection speeds required to enable accurate recording and playback of sound. Standardised to 90 feet per minute (24 frames per second) by Stanley Watkins, Bell Labs sound engineer seconded to Warner Brothers. As animators like Hugh Harmon, Rudolf Ising, Ub Iwerks, Friz Freleng 'the master of this arcane art' (Jones, 1990: 104) and music director, Carl Stalling moved from Disney to the Schlesinger Studios (later becoming the Warner Bros Cartoons) and MGM, knowledge of the method was disseminated, and the techniques were refined.

In 1937 Walt Disney clearly describes the entire process and how the 'layout bar sheet' prepared by the director is central to the entire production (Naumburg and Disney, 1937: 253-271). He suggests a separating of styles between 'fantasy' timing and 'realistic' timing, echoed in internal Disney memos (Jackson, 1939, published in Hahn, 2015: 192-207). For Disney, fantasy and realistic timing were stylistically incompatible. This conscious shift towards realism at the Disney Studios wasn't echoed at Warner Brothers and MGM where fantasy timing was about to be given Acme Rocket Booster Shoes. I have found no reference to Disney's essay in any published research. William Hanna (MGM Animation Director) believed that 'the primary element' of cartoons 'was the refinement of the directorial timing' and describes the 'partly mathematical, partly intuitive process' of timing a cartoon using bar sheets. 'the alignment of images with precisely coordinated rhythms', 'the precise beat of the ever-reliable metronome' (Hanna, 2000).

My current research indicates that timing to beats and tempos, despite being used in all the Tom and Jerry, MGM, Merrie Melodies and Looney Tunes cartoons, is now virtually unknown and unused in the animation industry. My research in Project 3 will rediscover and repurpose the method as a valid timing option for contemporary independent animators. I will also argue that as a result of the decline in use of this method, a greater loss has occurred in the way animation feels to the viewer, examining the question often put to me: *'why don't they make them like that anymore?'*. Humans are drawn to find and feel rhythms, from your own heartbeat to the success of popular music. I believe, based on my knowledge and experience that rhythms in timed animation stimulate, engage and maintain engagement in audiences, a vital factor in today's demanding media environment. The Synopsis of my Portfolio will bring together the research from Projects 1, 2 and 3 as a single body of research focussed on this narrow technical aspect of animation creation.

24 FPS	Change FPS to find MM BPM and NOTE/REST durations in seconds & frames for each of the FRAMES PER BEAT	NOTE REST WHOLE		NOTE REST HALF		NOTE REST QUARTER		NOTE REST EIGHTH		NOTE REST SIXTEENTH		NOTE REST THIRTYSEC		NOTE REST HALF .		NOTE REST QUARTER .		NOTE REST EIGHTH .	
FRAMES PER BEAT	MM BPM	Seconds	Frames	Seconds	Frames	Seconds	Frames	Seconds	Frames	Seconds	Frames	Seconds	Frames	Seconds	Frames	Seconds	Frames	Seconds	Frames
6	240.00	1.00	24	0.50	12	0.25	6	0.13	3	0.06	1.5	0.03	0.8	0.75	18	0.38	9	0.19	4.5
7	205.71	1.17	28	0.58	14	0.29	7	0.15	3.5	0.07	1.8	0.04	0.9	0.88	21	0.44	10.5	0.22	5.3
8	180.00	1.33	32	0.67	16	0.33	8	0.17	4	0.08	2	0.04	1	1.00	24	0.50	12	0.25	6
9	160.00	1.50	36	0.75	18	0.38	9	0.19	4.5	0.09	2.3	0.05	1.1	1.13	27	0.56	13.5	0.28	6.8
10	144.00	1.67	40	0.83	20	0.42	10	0.21	5	0.10	2.5	0.05	1.3	1.25	30	0.63	15	0.31	7.5
11	130.91	1.83	44	0.92	22	0.46	11	0.23	5.5	0.11	2.8	0.06	1.4	1.38	33	0.69	16.5	0.34	8.3
12	120.00	2.00	48	1.00	24	0.50	12	0.25	6	0.13	3	0.06	1.5	1.50	36	0.75	18	0.38	9
13	110.77	2.17	52	1.08	26	0.54	13	0.27	6.5	0.14	3.3	0.07	1.6	1.63	39	0.81	19.5	0.41	9.8
14	102.86	2.33	56	1.17	28	0.58	14	0.29	7	0.15	3.5	0.07	1.8	1.75	42	0.88	21	0.44	10.5
15	96.00	2.50	60	1.25	30	0.63	15	0.31	7.5	0.16	3.8	0.08	1.9	1.88	45	0.94	22.5	0.47	11.3
16	90.00	2.67	64	1.33	32	0.67	16	0.33	8	0.17	4	0.08	2	2.00	48	1.00	24	0.50	12
18	80.00	3.00	72	1.50	36	0.75	18	0.38	9	0.19	4.5	0.09	2.3	2.25	54	1.13	27	0.56	13.5
20	72.00	3.33	80	1.67	40	0.83	20	0.42	10	0.21	5	0.10	2.5	2.50	60	1.25	30	0.63	15
22	65.45	3.67	88	1.83	44	0.92	22	0.46	11	0.23	5.5	0.11	2.8	2.75	66	1.38	33.0	0.69	16.5
24	60.00	4.00	96	2.00	48	1.00	24	0.50	12	0.25	6	0.13	3	3.00	72	1.50	36	0.75	18
25	57.60	4.17	100	2.08	50	1.04	25	0.52	12.5	0.26	6.3	0.13	3.1	3.13	75	1.56	37.5	0.78	18.8
26	55.38	4.33	104	2.17	52	1.08	26	0.54	13	0.27	6.5	0.14	3.3	3.25	78	1.63	39	0.81	19.5
28	51.43	4.67	112	2.33	56	1.17	28	0.58	14	0.29	7	0.15	3.5	3.50	84	1.75	42.0	0.88	21
30	48.00	5.00	120	2.50	60	1.25	30	0.63	15	0.31	7.5	0.16	3.8	3.75	90	1.88	45	0.94	22.5
32	45.00	5.33	128	2.67	64	1.33	32	0.67	16	0.33	8	0.17	4	4.00	96	2.00	48.0	1.00	24

Figure 2: Spreadsheet to calculate note duration as seconds and frames based on an adjustable frames per second (FPS) value (© Mark Mason, 2023)

Research Aims

1. To define and redevelop the musical timing method to be easily used by animators with no musical experience.
2. To demonstrate that the beat-based method is a valid tool in animation production, even when decoupled from musical synchronisation.
3. To expand the method beyond standard western rhythms.

Research Objectives

1. To review and analyse Project 1: TV Series and Specials and Project 2: TV Commercials, Title Sequences and other works (figure 3). Demonstrating the use of rhythmic or musical timing methods.
2. To synthesise and contextualise selected examples in Projects 1 and 2 within the research investigations and findings in Project 3.
3. To gather and synthesise technical information from fragmentary extant evidence of the original timing methods used in Hollywood Animation Studios between 1928 and c.1957, in order to produce a practical working methodology of the original system.
4. To create, through practise-based research, an animated documentary short film about beat-based timing using the original methodology discovered as a proof of principle.

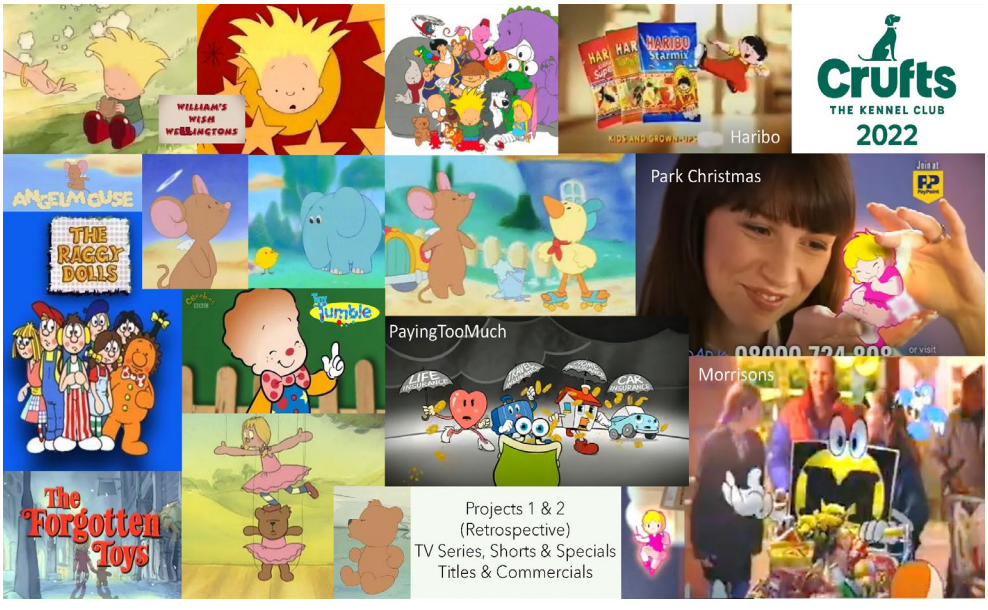

Figure 2: Examples of work from Projects 1 and 2 (© Mark Mason, 2023)

Research Activity: Project 3 (Live)

Part 1: Aim:

To define and record the characteristics of the original musical timing method. Drawing from documentation in autobiographies, interviews and other literature to identify technical elements of the method from its inception in 1928 and its development and refinement between 1937 and 1957. To define the method of beat-based timing, including standardisation of notation methods, an understanding of relevant basic music theory and the design and creation of any materials required (figure 2).

Part 2: Aim:

Test the Method. To generate new insights in the process and validity of the method. Data required: Secondary source animated films and extant detail/bar sheets gathered in Part 1. Data collection: Sequences will be time corrected to 24 frames per second. Vision and sound will be analysed frame by frame to identify beat, tempo and rhythmic patterns. This data collection will generate a visual data set of the rhythmic structure of the sequences. Bar sheets will be created to further understand the timing structure of the animation (figures 4 and 5).

Figure 4: Timing analysis with originated click-track metronomes (© Mark Mason, 2023)
Still from 'Little Red Riding Rabbit' Dir: Friz Freleng
(© Warner Brothers Inc., 1944)

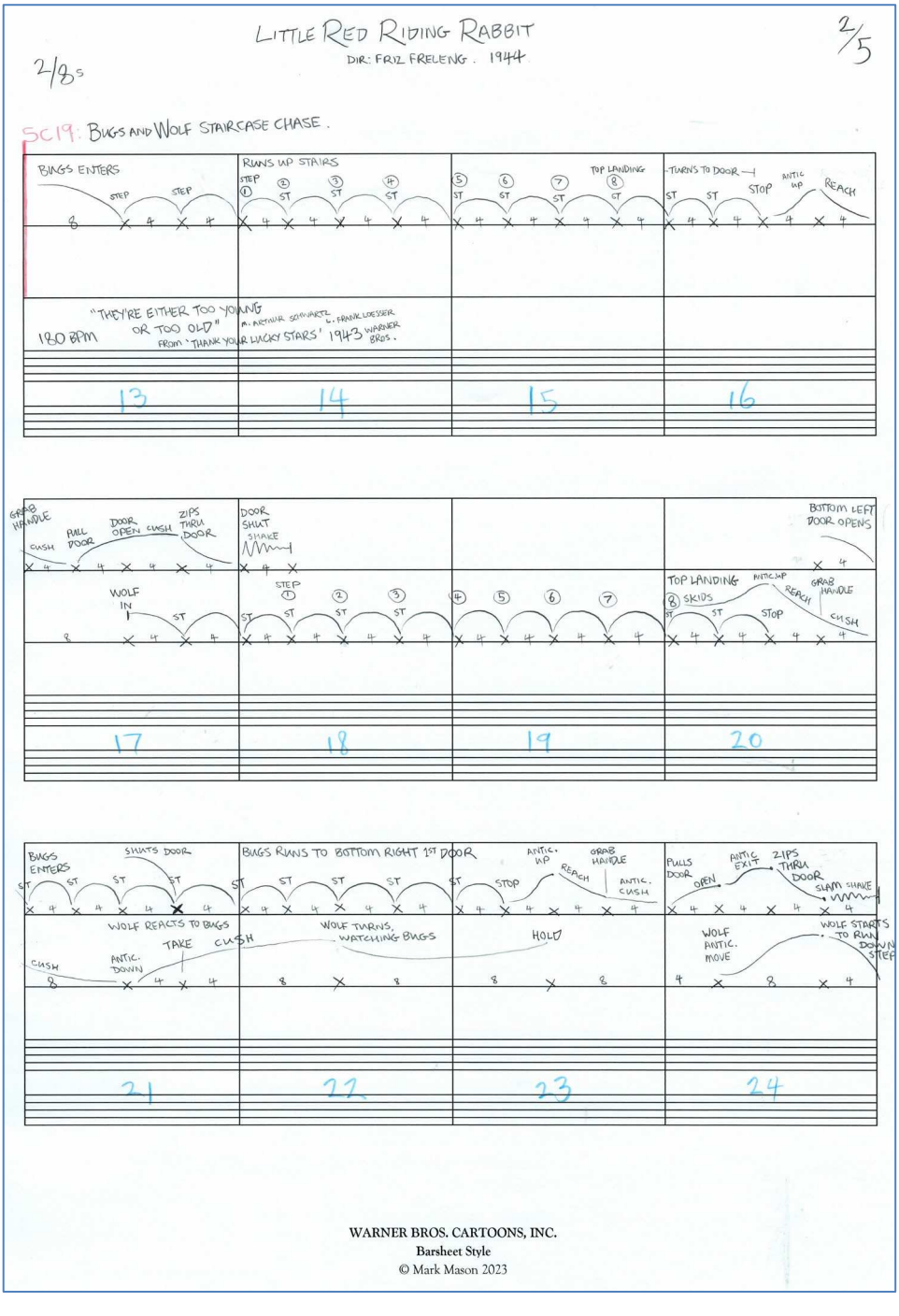

Figure 5: Page 2 of 5 bar sheets created on facsimile sheets from the click-track analysis shown in figure 4 (© Mark Mason, 2023)

Part 3: Aim:

Develop the Method. To demonstrate that the method a viable technique for timing animation in contemporary animation practice. Through practice research I will produce a short, animated documentary about the history, development and use of timing to beats and tempi. I will apply the method of beat-based timing revealed in my research as the primary production process.

Impacts:

An identified issue within current industry practice when scoring music for animation and film is that it can take the composer or music editor as long to establish the position of sync points and appropriate tempi than it takes to compose the score. 1. If directors worked to a beat when planning animation or shooting and editing film, the need for this time-consuming pre-composition processing is removed, allowing the composer to move straight into scoring. 2. The quality of animation is improved. 'Animating to beats forced animators to be more crisp in their thinking and better organised in their statements – no frills, no extras, get right to the point – valuable and necessary training' (Thomas and Johnson, 1981). 3. Beat-based timing can be applied to theatre, performance, stand-up and even conference presentations!

Intended Outputs and Intentions:

To create an accessible published manual and history of beat-based timing, a short, animated documentary explaining the method by using the method, with supporting hardware, software and video, giving new and established animators, directors and composers the tools to incorporate and further develop beat-based timing within their own practice. The intention is to continue to research the subject area as more archive material is found and, through practice research, apply the method to non-standard and non-western musical rhythms, leading to further publications and practice based video works. Output currently in progress: A chapter on beat-based timing in relation to early animation sound design in the forthcoming 'Routledge Companion to Animation Studies'.

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Ethics statement: This research was conducted with ethical approval from UCLan.

JQRSS Author Profiles

Mark Mason[1] is an animation director, animator, storyboard and layout artist and character designer, active in the UK animation industry since 1985. His work includes TV commercials including Haribo, British Gas, Morrisons, Blackpool Illuminations and Marks & Spencer and many TV series and specials for all the major UK terrestrial broadcasters. He achieved MA (Distinction) in Animation in 2016 and currently teaches animation at the University of Central Lancashire while continuing his professional practice. In 2022 he commenced postgraduate studies on a PhD by Portfolio registered at UCLan. IMDB link: https://www.imdb.com/name/nm0556842/ Email: MAMason1@uclan.ac.uk

- UCLan Research and Enterprise Image Competition 2023: PGR Student: Category Winner
- UCLan PGR Conference 2023: Best Presentation (Greenbank Sessions) 2nd Place Winner

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Collegial Review

This project resonates on so many levels, with layers of interest throughout the work. From a historical and conservation perspective it is fascinating to observe the rediscovery of a lost art, but not simply for 'old times' sake' as there is clearly a contemporary application for these methods in addition to the potential productivity benefits for composers. The musical layer itself offers an opportunity for obsessively pausing and rewinding the 'Little Red Riding Rabbit' scene, reading along with the bar sheets, and attempting to appreciate the attention to detail paid by the animators. As a percussionist myself, this project resounds with the comforting tick of the metronome and a well-executed performance where every beat is where it should be. I am particularly excited to see the results of this work at is explores musical timings outside of standard western rhythms. This conjures images of rich polyrhythms with unusual time signatures, perhaps scored to abstract animations or narratives of indigenous cultures.