

Dragon Ball Z Project: R1 and R2J Dragon Boxes Merge

by **JySzE** and **Romao***
a Seed of Might Project



January 22, 2021

This project continues Seed of Might's trend of improving the raw footage from the Dragon Box DVD sets due to the lack of quality official releases (see [5]) by creating an innovative multi-sourced video track, getting the best out of both Dragon Ball Z Dragon Box releases: the Japanese (Region 2 - 2003) and the American one (Region 1 - 2011).

Acknowledgements

For the video, big thanks to **kratos** and **tm (theMaestro)** for first bringing to light the overall better dark details in R1 Dragon Box. Without their insight, this project probably would have not even been done.

For the audio, we thank **kei17** (and whoever helped him) for collecting the various broadcast audios, **AnimeMaakuo** and **HKB** for releasing them, **Team Mirolo** for carefully synchronizing all the audio files to R2J Dragon Box video, and **iKaos** for adding the Dragon Ball GT's first episode preview to the end of the final episode.

For the subtitles, we thank many people. **Marin888** for cleaning-up and converting Romao's OCR of R1's VOD subtitles to SRT with proper line breaks. **Team Mirolo** for further synchronizing them to video. **Evoshare** for the translation of Japanese signs during episodes. **corre** for formatting them with amazing custom titlecards and signs. **iKaos** for quality-checking and improving their formatting and styling. **dubadavid** for the opening credits. **SaiyaJedi** for song translations. Finally, **dubadavid**, **AnimeAjay**, and many others for helping with translations and the update on name adaptations.

For the chapters, we thank **gravitypriest** for adding an extra chapter to the titlecards.

We thank **tm** and **iKaos** again for reviewing and improving this very document.

1 Tracks

The Matroska file of each episode contains the following data:

Track	Type	Name	Format	Language
0	Video	Dragon Ball Z [SoM]	AVC	—
1	Audio	1989 Broadcast Audio [TeamMirolo]	FLAC	Japanese
2	Subtitles	Styled Subtitles [SoM]	ASS	English
3	Chapters	—	text/XML	English

Attachment	Type	Name	Format
0	cover	—	JPEG
1	font	Funimitation	TTF
2	font	Faxfont Tone	OTF
3	font	Oravetica	TTF
4,5	font	Josephs Brush (Regular, Italic)	TTF
6	font	Wolf Sans	TTF
7	font	Caballar	TTF
8	font	Tomorrow Comes Today	TTF
9	font	PP Handwriting	TTF

*a.k.a. John Rambo in Discord and other media platforms

2 Video

This is not a purist project. For those seeking this kind of release, there are already remuxes and encoded batches with less modifications to the image available for download ([4],[2]).

Purism is collectively understood as “you don’t fuck it up if you don’t touch it.” It is an important and safe attitude that keeps decent sources from disappearing and helps people get more critical of poorly made edits and filterings.

However, purism for the sake of purism can sometimes be limiting. With that in mind, the intention of this release was to improve upon the Dragon Boxes by not only reducing or eliminating flaws in the source material, but also combining the strengths of each release together in an attempt to make the video look more like the original Dragon Box masters. Rest assured that this will not be some blue-tinted *warpsharped* mess, but rather a pretty based release that is quite unlike anything you have ever seen before. 😊

Criticism is welcome, by the way!

2.1 Metadata

The video tracks of the episodes have the following properties.

Codec ID	FR ¹	DAR ²	PAR ³	Resolution	Bit depth	Planar format
V_MPEG4/ ISO/AVC	constant 24000/1001	4:3	160:177	708 × 480	8 bits	YUV420

Encoding settings					
cabac	1	ref	6	deblock	1:-3:-3
analyse	0x3:0x133	me	umh	subme	10
psy	1	psy_rd	1.00:0.25	mixed_ref	1
me_range	32	chroma_me	1	trellis	2
8x8dct	1	cqm	0	deadzone	6,6
fast_pskip	1	chroma_qp_offset	-4	threads	16
lookahead_threads	3	sliced_threads	0	nr	0
decimate	0	interlaced	0	bluray_compat	0
constrained_intra	0	bframes	16	b_pyramid	2
b_adapt	2	b_bias	0	direct	3
weightb	1	open_gop	0	weightp	2
keyint	250	keyint_min	23	scenecut	40
intra_refresh	0	rc	crf	mbtree	0
crf	13.0	qcomp	0.80	qpmin	0
qpmax	69	qpstep	4	ip_ratio	1.10
pb_ratio	1.10	aq	3:0.50	library	x264

Both R1 and R2J are 720 x 480 resolution, which you might think looks horizontally stretched, but they come with a flag that instructs the intended display to resize it to how it should actually look. This flag is something called a pixel aspect ratio, or PAR. It can be confusing to wrap your head around, but the basic idea is that it tells the display that each pixel in the 720 x 480 resolution should be taller than it is wide by a set amount. This will accurately resize the image and make it look as it should. This PAR transformation plus overscan from a CRT television (the intended display) yields a 4:3 picture (the display aspect ratio, or “DAR”).

¹Frame Rate (frames per second)

²Display Aspect Ratio

³Pixel Aspect Ratio

Today though, we don't use CRTs and so some decisions have to be made about how to resize accurately. One thing is clear: it is not possible to have a 4:3 DAR and the correct PAR without cropping. So we are left with 3 options.

1. Prioritize a 4:3 DAR at all costs without cropping. This leads to an incorrect PAR and so the image will look vertically stretched compared to what is intended.
2. Prioritize the correct PAR without cropping. This leads to a picture that looks correct but is wider than 4:3 and will sometimes show part of the image that is not meant to be shown (e.g. inconsistent and blurred black bars), since DVD authoring always predicts overscan by the old CRTs.
3. Prioritize the correct PAR and a 4:3 DAR, which is achieved by cropping away the over-scanned part. This results in resolutions such as 708 x 480 (which is resized to 708 x 531 on most players after the PAR transformation).

This project uses the third option.

2.2 Pixel aspect ratio

Non-square pixels were supposedly a smart choice at the time. The standard was analog display that could pack more information horizontally than vertically given any square sample of it. The industry had to optimize the data on DVDs for the consumer end, so this mathematical pixel concept that can only be approximated by modern players made sense in the past.

If you search right now for PAR correction on DVD footage, you will probably get to the ratio 10:11, both on simple and very detailed explanations on CRT analog-to-digital, signal-to-pixel conversions. But this is not the ratio we are using (160:177).

Another wrong PAR is 8:9, which comes from the resolution standard first set to DVDs fitted on a 4:3 DAR, which has nothing to do with how CRTs were using the converted signal to display a 4:3 footage. A couple of standards were written to fix the squeezed DVD footage. These standards were *digital* standards, to match the digital display of the video to what a well-calibrated CRT already would correctly display. Thus it is a conversion standard. From 8:9 to whatever gives the correct image. It is a complicated matter and the numbers get pretty ugly. Even the nice recommended 10:11 ratio is actually an approximation to 42651:38800 [1].

The 160:177 PAR standard comes from SMPTE RP 187-1995 [6] and supposedly solved the rectangle pixel issue for good. The industry ignores it nonetheless, because the numbers they came up with were awfully obnoxious and even the scaling process would be more hardware-expensive. This explains why this standard is not as well-known as the 10:11 one. But here in 2021, scaling video is not a problem, and your player will scale the footage like it is nothing.

We have tested it, and 160:177 looks best overall on Dragon Box. Meticulous comparisons using circle objects in the video (like the dragon ball at the very beginning of each episode) didn't give a huge edge to 160:177 over 10:11 because the film itself always has some form of warping. However, it is also better to be safe than sorry. Having a 4:3, 160:177 PAR footage leaves it with 4 extra pixel columns compared to a 4:3 with 10:11 PAR. You can still crop them away and set the PAR to 10:11 if you want, which is not possible to do the other way around.

We refer to *the lurker's guide to video* for more detail on pixel aspect ratio [3].

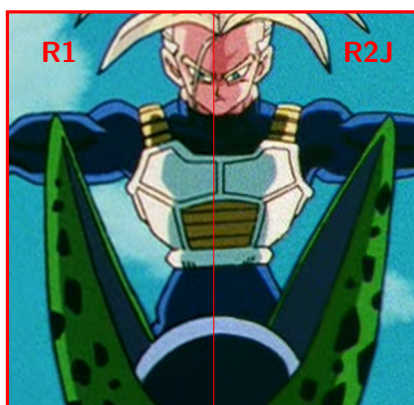
2.3 About the merging of the R1 and R2J footage

This merge of the two Dragon Boxes aims to get more detail at the boundary ranges of luma in order to obtain a higher dynamic range in a natural manner, without artificially warping/crushing the luma using sigmoid-esque functions. This is made possible due to the brightness difference between the North American NTSC and the Japanese NTSC-J standards and how the DVD compression codec (MPEG-2) handles this difference. Basically, MPEG-2 gives more

bitrate to brighter areas. Darker areas get less bitrate and so the image details there are blurrier and often destroyed. Fortunately for us, the North American NTSC standard has brighter blacks compared to NTSC-J, which means that MPEG-2 was able to allocate more bitrate to the dark areas on the R1 Dragon Box compared to the R2J, even though the latter has a higher overall bitrate. In addition to better dark details, the R1 Dragon Box also has more dark details. This is because DVDs have a limited luma range, and the brighter blacks on the R1 allowed more dark details to pass through that limited range. These same extra details missed the cut on R2J and were clipped away instead. So what does all this mean? It means that the R1 Dragon Box has better preserved dark details while the R2J Dragon Box has better preserved mid-and-bright details.

And now with the merge, we can combine the best of both worlds in order to obtain an image quality that is superior to either source on its own. We believe that this merged release is a much closer representation of what the Dragon Box masters look like. Get ready to experience a level of detail and dynamic range that has not been seen before from the Dragon Box.

One thing to note is that the detail difference between R1 and R2J can vary. This means that while some shots will show a profound improvement in the merge, others may only reveal a subtle difference. The figure below exemplifies the general differences between R1 and R2J with their mid tones matched. R2J is clearly sharper compared to R1, yet R1 has contours in dark areas which are not as evident in R2J.

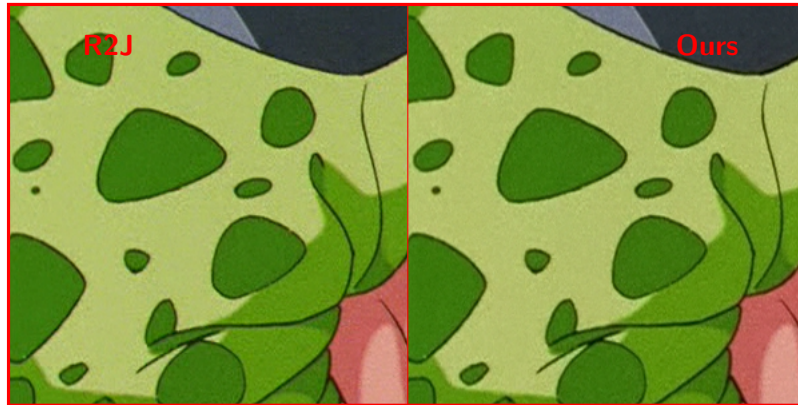


2.4 Blocking treatment

R2J has a lot of compression in its grain in the form of flat macroblocks with constant luma values, inside of which there is no relevant information whatsoever. In digital footage with little noise, smoothing away macroblocks blends well with the rest of the footage, but that is not the case with footage filled with film grain.

As a better approach to this type of video image, we filled these compressed areas with grain based on the grain of the footage to make it more uniform and pleasant to watch, again bringing the watching experience closer to what watching the SD masters would be. For the areas where there is already grain (with no significant compression) and detail, the image left untouched, thus preserving every bit of detail of the raw merged video.

Another important thing we did is to restrict the strength of the grain applied on the flat blocks in order to ensure that we are not *visually* destroying the existing detail. This prevents subtle details from being less perceptible when neighbored by noise with high variance. The result is a natural-looking, grain-preserving compression cleaning.

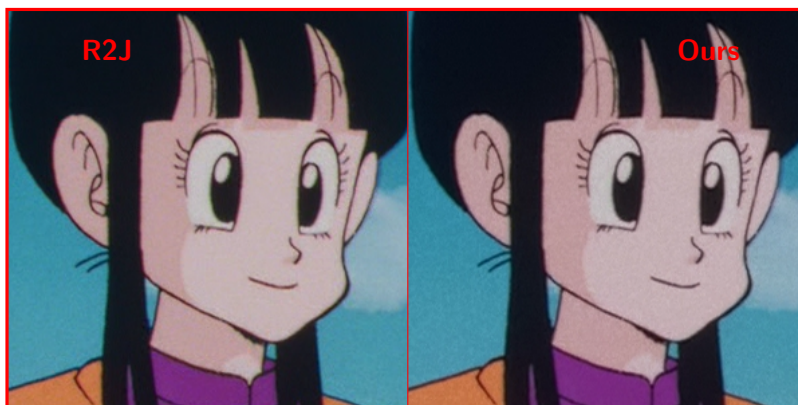


2.5 Chroma treatment

Sadly, we cannot give chroma the same noise treatment. The luma noise has a certain amount of detail allowing it to be kept and enhanced. The chroma channels, on the other hand, are half the resolution of luma and have far more compression. What would otherwise be fine color noise from the film is just broken phagocytized blobs of compression that only help in making the footage unappealing. They had to go.



Another major problem with the video source is chromatic aberration. It is pretty strong in some episodes. Regular filters usually do not work well in this case and most of them have unacceptable drawbacks. Our solution will clean it almost completely, but sometimes soften the chroma channels where chroma aberration is detected. We made sure to mitigate this issue by further improving condition masks and calibrating the strength of our script to balance the softness and aberration to our liking.



Finally, one might ask if there were changes in colors or any form of color-correction. We did not do any sort of color-correction for this release. Some of the episodes will look less tinted on this release compared to R2J, but there are two main reasons for this. Firstly, the clipped dark tones in R2J makes the dark tint relatively more visible even with the same chroma channels. Secondly, some R1 episodes just randomly have less of a tint, perhaps because Toei Animation messed up those episodes for the R2J, and chroma from R1 is used in this project. Anyone developing a scene-by-scene white-balance project for R2J should not worry though, since R1's occasional lower tint is probably on the whole episode or chapter. So R2J white-balance applied onto this project's video should give an image with constant amount of tint, which is easy to fix.

3 Audio

If you still do not know what the audio of the original broadcast of Dragon Ball Z is all about, just search for it, honestly.

The following table discriminates the audio source of the episodes. Tokai, Ishikawa and Fuji are the Japanese television channels through which the audio was first transmitted.

Source	Episodes
Tokai	009, 017, 019, 032-045, 100, 105, 107, 109, 114-141, 143-191, 198-211, 213-216, 218-225, 227-291
Ishikawa	006-008, 010-013, 015-016, 018, 020-030, 046-050, 052-057, 059-061, 064-094, 096-101, 104, 106, 108, 110-114, 212, 217, 226
Fuji	001, 003-005, 014, 031, 051, 058, 062-063, 095, 142, 192-197
Drama Cassette	002
Big Box CD	229, 237

Episodes 100 and 114 are both present in the Tokai and Ishikawa row, which indicates they are composed of both sources. There are also “next episode previews” (NEPs) missing from some of these broadcast audios. Team Mirolo used a filtered version of the Dragon Box audio to fill in these missing NEPs. These episodes are: 009, 037-039, 052-054, 079-081, 097-099, 128-130, 145-147, 175-176, 190-192, 218-220, 230-232, 256-258, 268-272, and 290.

3.1 Metadata

The single audio track of each episodes have the following properties.

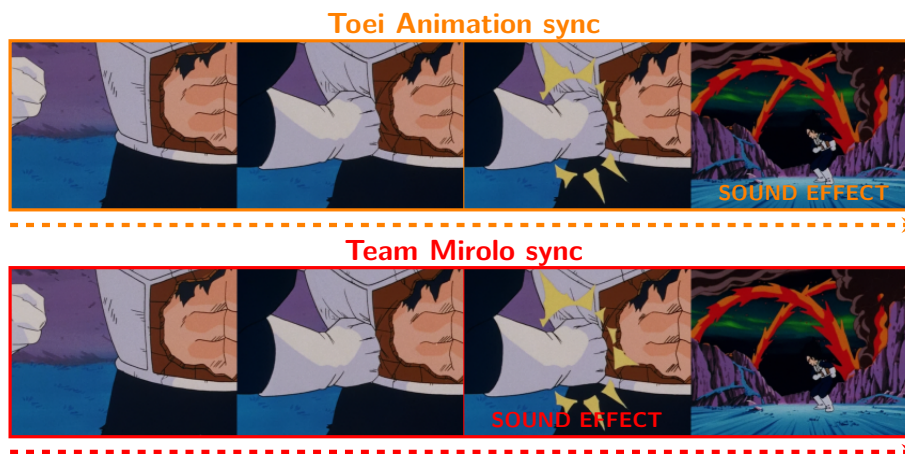
Codec ID	Sampling rate	Bit depth	Compression	Channel(s)	Library
A_FLAC	48 kHz	16 bits	Lossless	1	libFLAC

3.2 Team Mirolo's sync

From their own words:

The Japanese Dragon Box Z DVDs have their audio tracks badly synced. Sound effects appear later than they should. On average, sound effects appear 200 ms too late.

In order to video-sync, we had to calculate the gap in milliseconds between many video frames and their respective sound effects, for both part one and part two of each episode.



The [set of tables at the end of this document](#) shows the difference in milliseconds to get from the original dragon box audio (or any audio track in sync with it) to the video-sync. In that table, “Part A” refers to the first half of the episode, from the beginning to the end of the first eyecatch. “Part B” refers to the second half, which is everything after Part A. The “Diff” is simply Part B minus Part A, which is what needs to be change in Part B in case the fix for Part A is already applied to the entire episode.

Team Mirolo attaches an updated table with these time shifts to most of their releases. It is present in this document for the purpose of making it easy for people to update the synchronization in case Team Mirolo updates their sync.

4 Subtitles

As mentioned in the [Acknowledgements](#) section, subtitles in the opening, ending, and title cards are matching the Japanese *kanji* present in the Dragon Boxes.

Our subtitles are based on Steven J. Simmons' translation with some Herms reviews taken into account. These subtitles were missing translations of Japanese text displayed in the middle of the episodes. The episodes for which new subtitles were added to untranslated Japanese signs or other forms of text are the following: 013, 030, 049, 061, 089, 137, 144, 171-172, 186, 195-197, 208-209, 214-215, 218, 223, 243, 249, and 289-291

The changes in the names and special words took four major factors: consistency, adaptation, modern and updated *romaji*, and language origin of the word or the pun intended for the word.

Simmons	Ours
Anoyoichi Tournament	Anoyoichi Budokai
Artificial Human	Cyborg
Chaozu	Chiaotzu
Demon Clan	Mazoku
Demon Clansman	member of the Mazoku
Demon Clansmen	Mazoku soldier
Ghurd	Gurd
Great King Yama	Enma Daio
Gyallic Ho	Gallick Cannon
<i>Gyumao</i>	Gyumao
Kamehameha/Kamehame-Ha	<i>Kamehameha</i>
Kami-sama/Kami	God
katchinko (metal)	katchin (steel)
Kiai-Ho	Kiaiho
Kibit	Kibito
Kikouhou	Kikoho
Kiko-Ha	Kikoha
kili	kiri
<i>Kinto Un</i>	<i>Kinto'Un</i>
Madoushi	Warlock
Ma-Junior	Ma Junior
<i>Nyoi bou</i>	<i>Nyoi-bo</i>
Pafu	pafu
Polunga	Porunga
Pu-erh	Pu'er
ReaCoom	Reacoom
senzu (bean/s)	<i>senzu</i>
Shenlong	Shen Long
Shishin no ken	Shishin no Ken
Shu Saiaku	Shu Sai'aku
Taiyou-ken	Taiyo-ken
Tao Pai Pai	Tao Pai-Pai
Tenkaichi Tournament	Tenkaichi Budokai
The Makyo World	Planet Makyo
Yama	Enma
Yamucha	Yamcha

References

- [1] Die bedeutung der itu-r bt.601 für das par. <https://encodingwissen.de/hintergrund/videobild/anamorph/itu-r-bt601/>. Accessed: 2020-12-18.
- [2] ikaos multi-audio releases on nyaa. https://nyaa.si/?f=0&c=1_0&q=iKaos. Accessed: 2020-12-18.
- [3] The lurker's guide to video. <https://lurkertech.com/lg/video-systems/#pixelaspect>. Accessed: 2020-12-18.
- [4] Romao's dragon box z remix. <https://nyaa.si/view/1114198>. Accessed: 2020-12-18.
- [5] Seed of might releases on nyaa. https://nyaa.si/?f=0&c=0_0&q=%22%5BSoM%5D%22. Accessed: 2010-12-18.
- [6] SMPTE, RP. Rp 187-1995. *Center, Aspect Ratio and Blanking of Video Images*. doi: [10.5594/SMPTE.RP187.1995](https://doi.org/10.5594/SMPTE.RP187.1995).

Episode	Part A	Part B	Diff
001	-110	-90	20
002	-150	-150	0
003	-150	-150	0
004	-120	-120	0
005	-180	-150	30
006	-140	-140	0
007	-150	-150	0
008	-110	-110	0
009	-130	-130	0
010	-150	-180	-30
011	-160	-160	0
012	-110	-110	0
013	-130	-200	-70
014	-220	-160	60
015	-180	-150	30
016	-80	-80	0
017	-100	-100	0
018	-210	-150	60
019	-120	-180	-60
020	-200	-120	80
021	-120	-120	0
022	-110	-110	0
023	-50	-150	-100
024	-150	-180	-30
025	-180	-200	-20
026	-180	-180	0
027	-180	-200	-20
028	-130	-180	-50
029	-80	-120	-40
030	-160	-160	0
031	-170	0	170
032	-170	-170	0
033	-150	-150	0
034	-150	-150	0
035	-150	-150	0
036	-210	-150	60
037	-230	-210	20
038	-250	-180	70
039	-220	-100	120
040	-120	-220	-100
041	-190	-220	-30
042	-180	-210	-30
043	-180	-160	20
044	-190	-190	0
045	-270	-270	0
046	-210	-230	-20
047	-210	-230	-20
048	-150	-210	-60
049	-230	-230	0
050	-200	-210	-10

Episode	Part A	Part B	Diff
051	-200	-230	-30
052	-200	-250	-50
053	-210	-250	-40
054	-110	-180	-70
055	-200	-200	0
056	-220	-260	-40
057	-120	-190	-70
058	-200	-140	60
059	-170	-220	-50
060	-110	-90	20
061	-140	-160	-20
062	-180	-180	0
063	-190	-150	40
064	-170	-180	-10
065	-110	-290	-180
066	-150	-150	0
067	-170	-250	-80
068	-240	-90	150
069	-170	-160	10
070	-190	-150	40
071	-200	-230	-30
072	-200	-180	20
073	-180	-30	150
074	-210	-200	10
075	-210	-210	0
076	-130	-230	-100
077	-190	-170	20
078	-170	-170	0
079	-200	-220	-20
080	-140	-200	-60
081	-160	-160	0
082	-180	-210	-30
083	-240	-160	80
084	-90	-160	-70
085	-210	-210	0
086	-230	-230	0
087	-180	-180	0
088	-170	-230	-60
089	-180	-190	-10
090	-160	-90	70
091	-210	-210	0
092	-250	-250	0
093	-200	-200	0
094	-230	-180	50
095	0	-170	-170
096	-180	-210	-30
097	-230	-140	90
098	-160	-320	-160
099	-270	-140	130
100	-70	-100	-30

Episode	Part A	Part B	Diff
101	-220	-130	90
102	-200	-200	0
103	-210	-230	-20
104	-260	-240	20
105	-260	-260	0
106	-220	-220	0
107	-190	-190	0
108	-210	-260	-50
109	-240	-240	0
110	-230	-180	50
111	-160	-260	-100
112	-200	-240	-40
113	-180	-200	-20
114	-190	-220	-30
115	-200	-200	0
116	-200	-200	0
117	-190	-190	0
118	-250	-250	0
119	-220	-240	-20
120	-230	-230	0
121	-200	-190	10
122	-220	-210	10
123	-230	-250	-20
124	-180	-180	0
125	-170	-170	0
126	-230	-180	50
127	-150	-180	-30
128	-220	-220	0
129	-180	-240	-60
130	-140	-210	-70
131	-180	-200	-20
132	-210	-200	10
133	-230	-230	0
134	-200	-250	-50
135	-190	-150	40
136	-180	-180	0
137	0	-150	-150
138	-160	-240	-80
139	-180	-180	0
140	-200	-170	30
141	-260	-260	0
142	-150	-230	-80
143	-190	-190	0
144	-230	-200	30
145	-150	-180	-30
146	-230	-230	0
147	-190	-230	-40
148	-250	-250	0
149	-170	-200	-30
150	-160	-200	-40

Episode	Part A	Part B	Diff
151	-170	-200	-30
152	-190	-190	0
153	-240	-180	60
154	-240	-190	50
155	-220	-260	-40
156	-230	-230	0
157	-200	-200	0
158	-190	-190	0
159	-230	-180	50
160	-210	-210	0
161	-220	-220	0
162	-210	-260	-50
163	-220	-250	-30
164	-240	-180	60
165	-260	-260	0
166	-230	-150	80
167	-180	-190	-10
168	-220	-180	40
169	-240	-130	110
170	-200	-160	40
171	-250	-200	50
172	-240	-150	90
173	-240	-130	110
174	-230	-210	20
175	-190	-210	-20
176	-190	-210	-20
177	-180	-180	0
178	-200	-180	20
179	-240	-200	40
180	-230	-170	60
181	-220	-230	-10
182	-200	-200	0
183	-230	-260	-30
184	-180	-120	60
185	-180	-220	-40
186	-220	-160	60
187	-190	-200	-10
188	-220	-160	60
189	-210	-170	40
190	-200	-160	40
191	-170	-130	40
192	-240	-200	40
193	-170	-210	-40
194	-220	-150	70
195	-210	-170	40
196	-210	-180	30
197	-190	-170	20
198	-260	-240	20
199	-200	-130	70
200	-240	-100	140

Episode	Part A	Part B	Diff
201	-140	-150	-10
202	-200	-160	40
203	-170	-150	20
204	-190	-150	40
205	-190	-170	20
206	-190	-210	-20
207	-200	-160	40
208	-180	-180	0
209	-250	-250	0
210	-210	-250	-40
211	-180	-250	-70
212	-190	-220	-30
213	-210	-230	-20
214	-180	-200	-20
215	-190	-170	20
216	-190	-190	0
217	-210	-170	40
218	-140	-100	40
219	-210	-170	40
220	-110	-220	-110
221	-180	-250	-70
222	-190	-190	0
223	-150	-130	20
224	-190	-210	-20
225	-200	-180	20
226	-200	-180	20
227	-180	-210	-30
228	-200	-200	0
229	-130	-200	-70
230	-180	-200	-20
231	-210	-210	0
232	-180	-220	-40
233	-200	-200	0
234	-210	-180	30
235	-170	-210	-40
236	-180	-180	0
237	-260	-260	0
238	-190	-190	0
239	-190	-170	20
240	-90	-50	40
241	-160	-120	40
242	-200	-160	40
243	-220	-180	40
244	-180	-140	40
245	-200	-170	30
246	-200	-100	100
247	-200	-140	60
248	-190	-150	40
249	-210	-170	40
250	-150	-190	-40

Episode	Part A	Part B	Diff
251	-240	-180	60
252	-220	-180	40
253	-180	-160	20
254	-160	-150	10
255	-240	-170	70
256	-190	-150	40
257	-220	-190	30
258	-260	-200	60
259	-250	-170	80
260	-150	-170	-20
261	-190	-190	0
262	-210	-210	0
263	-230	-190	40
264	-210	-170	40
265	-190	-190	0
266	-250	-190	60
267	-250	-140	110
268	-230	-190	40
269	-250	-210	40
270	-200	-190	10
271	-180	-190	-10
272	-230	-230	0
273	-200	-180	20
274	-250	-180	70
275	-240	-200	40
276	-240	-220	20
277	-220	-230	-10
278	-220	-180	40
279	-240	-200	40
280	-230	-190	40
281	-250	-210	40
282	-220	-240	-20
283	-220	-180	40
284	-240	-170	70
285	-180	-250	-70
286	-260	-270	-10
287	-200	-200	0
288	-210	-170	40
289	-210	-170	40
290	-240	-170	70
291	-240	-200	40