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A2 6 Pixel-Perfect: Analysis into Character Information in Mario Kart Wii

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Abstract

We present the first dataset of character information for *Mario Kart Wii*, derived from pixel measurements, BMI calculations, and comparisons to analogous animals. Although refinement of character mass estimates may be possible, this dataset represents a foundational step, enabling in-depth calculations and experiments to explore the physics of the game.

Introduction

Mario Kart Wii offers the ability to do indepth physics calculations, however, the limited availability of game data has restricted such investigations. In this study, we address this gap by generating a dataset of character attributes.

Theory and Results

Character dimensions (heights and widths) were determined using pixel measurements from reference images [2, 3, 4], using Mario's known height of 1.55 m as a baseline for comparison [1]. Measurement errors were calculated using a ± 2 pixel margin to account for uncertainties in the scaling process.

Only Mario and Wario have quoted masses in the game; for other characters, assumptions were required. For most humanoids mass m was calculated using BMI (Body Mass Index):

$$m = BMI \cdot h^2 \tag{1}$$

where h is the characters height. Where animal comparisons were available, they were used. The masses of Dry Bowser and Dry Bones were estimated by comparing bone mass percentages to their analogous counterparts, Bowser and Koopa Troopa. Bowser Jr's mass was found by scaling him against Bowser via the square-cube law which accounts for surface area not scaling proportional to mass. For the BMI calculations, the character's BMI was assumed to correspond to the median of the healthy range for their age [5, 8], with the uncertainty defined as the symmetric interval extending above and below this median value (see table). For Waluigi we assumed him to be at the minimum point for the range due to his slender figure. When animals were considered, the error reflects an estimated uncertainty based on the assumption that the true mass lies within the specified range, with the central value chosen proportionally to the height.

All of these results are detailed below in table 1. King Boo was excluded from the dataset due to insufficient reference images and data.

Discussion and Conclusion

We have presented our research into the masses and dimensions of characters in *Mario Kart Wii*. The measurement processes likely yield dimensions close to the actual values. However, although the masses presented are reason-

Character	Class	Mass (Kg)	Note/Source	Height (m)	Width (m)	Source
Baby Mario	Light	13.3 ± 1.2	$BMI = 15.5 \pm 0.4$ [5]	0.926 ± 0.042	$0.303\ {\pm}0.036$	[2]
Baby Luigi	Light	14.3 ± 1.3	$BMI=15.5\pm0.4$ [5]	$0.926{\pm}0.042$	$0.285 {\pm} 0.035$	[2]
Baby Peach	Light	$13.8 {\pm} 1.2$	$BMI = 15.5 \pm 0.1$ [5]	$0.944{\pm}0.042$	$0.294{\pm}0.036$	[2]
Baby Daisy	Light	$13.8 {\pm} 1.2$	$BMI=15.5\pm0.1$ [5]	$0.944{\pm}0.042$	$0.294{\pm}0.036$	[2]
Toad	Light	17.1 ± 1.5	$BMI=15.5\pm0.4$ [5]	$1.05 {\pm} 0.04$	$0.303 {\pm} 0.036$	[2]
Toadette	Light	17.1 ± 1.4	$BMI=15.5\pm0.1$ [5]	$1.05 {\pm} 0.04$	$0.356 {\pm} 0.037$	[2]
Koopa Troopa	Light	170 ± 20	Green Sea Turtle [6]	$1.23 {\pm} 0.05$	$0.445 {\pm} 0.037$	[2]
Dry Bones	Light	$8.5 {\pm} 1.0$	Scaled against Koopa Troopa [7]	$1.25 {\pm} 0.05$	$0.481 {\pm} 0.037$	[2]
Mario	Medium	89	Official [1]	1.55	$0.481 {\pm} 0.037$	Official [1]
Luigi	Medium	89	Same as Mario	$1.73 {\pm} 0.05$	$0.339 {\pm} 0.036$	[2]
Peach	Medium	78.9 ± 12.5	$BMI=21.7\pm3.2$ [8]	$1.91 {\pm} 0.06$	$0.445 {\pm} 0.037$	[2]
Daisy	Medium	71.7 ± 11.4	$BMI=21.7\pm3.2$ [8]	$1.82 {\pm} 0.06$	$0.445 {\pm} 0.037$	[2]
Yoshi	Medium	$90{\pm}10$	Deinonychus [9]	$1.73 {\pm} 0.05$	$0.499 {\pm} 0.037$	[2]
Birdo	Medium	95 ± 10	Deinonychus [9]	$1.92 {\pm} 0.06$	$0.624{\pm}0.038$	[2]
Diddy Kong	Medium	60 ± 10	Chimpanzee [10]	$1.23 {\pm} 0.05$	$0.606 {\pm} 0.038$	[2]
Bowser Jr	Medium	560.5	Scaled against Bowser	$1.10 {\pm} 0.04$	$0.552{\pm}0.038$	[2]
Wario	Heavy	140	Official [11]	$1.69 {\pm} 0.05$	$1.02 {\pm} 0.04$	[2]
Waluigi	Heavy	83.2 ± 15.1	$BMI = 18.5 \pm 3.2 [8]$	$2.12 {\pm} 0.06$	$0.374{\pm}0.037$	[2]
Donkey Kong	Heavy	160 ± 10	Western Gorilla [12]	$1.84{\pm}0.06$	$1.41 {\pm} 0.05$	[2]
Bowser	Heavy	9611	[13]	$2.53 {\pm} 0.07$	$1.60 {\pm} 0.05$	[2]
King Boo	Heavy	-	-	-	-	-
Rosalina	Heavy	$136 {\pm} 20.4$	$BMI=21.7\pm3.2$ [8]	$2.51{\pm}0.03$	$0.402{\pm}0.042$	[3]
Funky Kong	Heavy	160 ± 10	Western Gorilla [12]	$1.96 {\pm} 0.06$	$1.25 {\pm} 0.05$	[4]
Dry Bowser	Heavy	480.6	Scaled against Bowser [7]	$2.53 {\pm} 0.07$	$1.60 {\pm} 0.05$	Same as Bowser

Table 1: Mass, height and width values for characters in *Mario Kart Wii*, with associated assumptions stated. King Boo has no data due to limited information on his dimensions and make-up.

able the nature of the assumptions used makes space for improvements to be made. Therefore, these values should be considered preliminary, with opportunities for refinement through more advanced methodologies. However, this dataset provides a foundation for future, more detailed studies of *Mario Kart Wii* physics.

References

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