

Aria Dice Statistics

by Mike Harvey

I wanted to evaluate the dice system used in Aria. What follows are some tables I generated (using a computer program). Any comments as to their accuracy and salience are welcomed.

First, I computed the straight chance to obtain any given result, given the ATC (adjusted trial chance). This table takes into account the rule of 1 and 10.

ATC	Mythic Success	Extraord. Success	Superior Success	Complete Success	Marginal Success
0	0.000000	0.000000	0.000010	0.000990	0.099000
1	0.000000	0.000010	0.000990	0.099000	9.900000
2	0.000080	0.003920	0.196000	9.800000	10.000000
3	0.000540	0.017460	0.582000	19.400000	10.000000
4	0.001920	0.046080	1.152000	28.800000	10.000000
5	0.005000	0.095000	1.900000	38.000000	10.000000
6	0.036000	0.564000	9.400000	40.000000	10.000000
7	0.098000	1.302000	18.600000	40.000000	10.000000
8	0.192000	2.208000	27.600000	40.000000	10.000000
9	0.324000	3.276000	36.400000	40.000000	10.000000
10	0.405000	4.095000	45.500000	40.000000	9.900000
11	0.900000	9.100000	50.000000	39.600000	0.396000
12	1.800000	18.200000	50.000000	29.700000	0.297000
13	2.700000	27.300000	50.000000	19.800000	0.198000
14	3.600000	36.400000	50.000000	9.900000	0.099000
15	4.500000	45.500000	49.500000	0.495000	0.004950
16	10.000000	50.000000	39.600000	0.396000	0.003960
17	20.000000	50.000000	29.700000	0.297000	0.002970
18	30.000000	50.000000	19.800000	0.198000	0.001980
19	40.000000	50.000000	9.900000	0.099000	0.000990
20	50.000000	49.500000	0.495000	0.004950	0.000050

ATC	Marginal Failure	Complete Failure	Serious Failure	Miserable Failure	Catastr. Failure
0	9.900000	30.000000	50.000000	9.100000	0.900000
1	10.000000	30.000000	45.500000	4.095000	0.405000
2	10.000000	30.000000	36.800000	2.944000	0.256000
3	10.000000	30.000000	27.900000	1.953000	0.147000
4	10.000000	30.000000	18.800000	1.128000	0.072000
5	10.000000	30.000000	9.500000	0.475000	0.025000
6	10.000000	28.800000	1.152000	0.046080	0.001920
7	10.000000	19.400000	0.582000	0.017460	0.000540
8	10.000000	9.800000	0.196000	0.003920	0.000080
9	9.900000	0.099000	0.000990	0.000010	0.000000

10	0.099000	0.000990	0.000010	0.000000	0.000000
11	0.003960	0.000040	0.000000	0.000000	0.000000
12	0.002970	0.000030	0.000000	0.000000	0.000000
13	0.001980	0.000020	0.000000	0.000000	0.000000
14	0.000990	0.000010	0.000000	0.000000	0.000000
15	0.000050	0.000000	0.000000	0.000000	0.000000
16	0.000040	0.000000	0.000000	0.000000	0.000000
17	0.000030	0.000000	0.000000	0.000000	0.000000
18	0.000020	0.000000	0.000000	0.000000	0.000000
19	0.000010	0.000000	0.000000	0.000000	0.000000
20	0.000000	0.000000	0.000000	0.000000	0.000000

Next, I computed cumulative chance to achieve a given result or better for a given ATC. This is much more interesting:

ATC	Mythic Success	Extraord. Success	Superior Success	Complete Success	Marginal Success
0	0.000000	0.000000	0.000010	0.001000	0.100000
1	0.000000	0.000010	0.001000	0.100000	10.000000
2	0.000080	0.004000	0.200000	10.000000	20.000000
3	0.000540	0.018000	0.600000	20.000000	30.000000
4	0.001920	0.048000	1.200000	30.000000	40.000000
5	0.005000	0.100000	2.000000	40.000000	50.000000
6	0.036000	0.600000	10.000000	50.000000	60.000000
7	0.098000	1.400000	20.000000	60.000000	70.000000
8	0.192000	2.400000	30.000000	70.000000	80.000000
9	0.324000	3.600000	40.000000	80.000000	90.000000
10	0.405000	4.500000	50.000000	90.000000	99.900000
11	0.900000	10.000000	60.000000	99.600000	99.996000
12	1.800000	20.000000	70.000000	99.700000	99.997000
13	2.700000	30.000000	80.000000	99.800000	99.998000
14	3.600000	40.000000	90.000000	99.900000	99.999000
15	4.500000	50.000000	99.500000	99.995000	99.999950
16	10.000000	60.000000	99.600000	99.996000	99.999960
17	20.000000	70.000000	99.700000	99.997000	99.999970
18	30.000000	80.000000	99.800000	99.998000	99.999980
19	40.000000	90.000000	99.900000	99.999000	99.999990
20	50.000000	99.500000	99.995000	99.999950	100.000000

ATC	Marginal Failure	Complete Failure	Serious Failure	Miserable Failure	Catastr. Failure
0	10.000000	40.000000	90.000000	99.100000	100.000000
1	20.000000	50.000000	95.500000	99.595000	100.000000
2	30.000000	60.000000	96.800000	99.744000	100.000000
3	40.000000	70.000000	97.900000	99.853000	100.000000
4	50.000000	80.000000	98.800000	99.928000	100.000000

5	60.000000	90.000000	99.500000	99.975000	100.000000
6	70.000000	98.800000	99.952000	99.998080	100.000000
7	80.000000	99.400000	99.982000	99.999460	100.000000
8	90.000000	99.800000	99.996000	99.999920	100.000000
9	99.900000	99.999000	99.999990	100.000000	100.000000
10	99.999000	99.999990	100.000000	100.000000	100.000000
11	99.999960	100.000000	100.000000	100.000000	100.000000
12	99.999970	100.000000	100.000000	100.000000	100.000000
13	99.999980	100.000000	100.000000	100.000000	100.000000
14	99.999990	100.000000	100.000000	100.000000	100.000000
15	100.000000	100.000000	100.000000	100.000000	100.000000
16	100.000000	100.000000	100.000000	100.000000	100.000000
17	100.000000	100.000000	100.000000	100.000000	100.000000
18	100.000000	100.000000	100.000000	100.000000	100.000000
19	100.000000	100.000000	100.000000	100.000000	100.000000
20	100.000000	100.000000	100.000000	100.000000	100.000000

From this table it can be seen that any ATC of 10 or better is almost guaranteed to succeed. An ATC of 20 or better will always succeed. Similarly, an ATC of 0 is practically doomed to failure, most likely a Complete Failure. The reverse of the table shows how likely you are to fail, given ATC:

ATC	Mythic Success	Extraord. Success	Superior Success	Complete Success	Marginal Success
0	100.000000	100.000000	100.000000	99.999990	99.999000
1	100.000000	100.000000	99.999990	99.999000	99.900000
2	100.000000	99.999920	99.996000	99.800000	90.000000
3	100.000000	99.999460	99.982000	99.400000	80.000000
4	100.000000	99.998080	99.952000	98.800000	70.000000
5	100.000000	99.995000	99.900000	98.000000	60.000000
6	100.000000	99.964000	99.400000	90.000000	50.000000
7	100.000000	99.902000	98.600000	80.000000	40.000000
8	100.000000	99.808000	97.600000	70.000000	30.000000
9	100.000000	99.676000	96.400000	60.000000	20.000000
10	100.000000	99.595000	95.500000	50.000000	10.000000
11	100.000000	99.100000	90.000000	40.000000	0.400000
12	100.000000	98.200000	80.000000	30.000000	0.300000
13	100.000000	97.300000	70.000000	20.000000	0.200000
14	100.000000	96.400000	60.000000	10.000000	0.100000
15	100.000000	95.500000	50.000000	0.500000	0.005000
16	100.000000	90.000000	40.000000	0.400000	0.004000
17	100.000000	80.000000	30.000000	0.300000	0.003000
18	100.000000	70.000000	20.000000	0.200000	0.002000
19	100.000000	60.000000	10.000000	0.100000	0.001000
20	100.000000	50.000000	0.500000	0.005000	0.000050

Marginal Complete Serious Miserable Catastr.

ATC	Failure	Failure	Failure	Failure	Failure	Failure
0	99.900000	90.000000	60.000000	10.000000	0.900000	
1	90.000000	80.000000	50.000000	4.500000	0.405000	
2	80.000000	70.000000	40.000000	3.200000	0.256000	
3	70.000000	60.000000	30.000000	2.100000	0.147000	
4	60.000000	50.000000	20.000000	1.200000	0.072000	
5	50.000000	40.000000	10.000000	0.500000	0.025000	
6	40.000000	30.000000	1.200000	0.048000	0.001920	
7	30.000000	20.000000	0.600000	0.018000	0.000540	
8	20.000000	10.000000	0.200000	0.004000	0.000080	
9	10.000000	0.100000	0.001000	0.000010	0.000000	
10	0.100000	0.001000	0.000010	0.000000	0.000000	
11	0.004000	0.000040	0.000000	0.000000	0.000000	
12	0.003000	0.000030	0.000000	0.000000	0.000000	
13	0.002000	0.000020	0.000000	0.000000	0.000000	
14	0.001000	0.000010	0.000000	0.000000	0.000000	
15	0.000050	0.000000	0.000000	0.000000	0.000000	
16	0.000040	0.000000	0.000000	0.000000	0.000000	
17	0.000030	0.000000	0.000000	0.000000	0.000000	
18	0.000020	0.000000	0.000000	0.000000	0.000000	
19	0.000010	0.000000	0.000000	0.000000	0.000000	
20	0.000000	0.000000	0.000000	0.000000	0.000000	

Thus it can be seen that with an ATC of 5, you have a 50% chance to achieve a marginal failure (or worse), while at ATC 10, you only have a 0.1% chance of the same result.

Next, I wanted to compute a table of the chance of success given Base, Rank, and Difficulty. As an intermediate step, here is a table showing the ATC for various combinations.

	0 none	1 init	2 versd	3 prof	4 pract	5 accom	6 exper	7 refin	8 exprrt	9 mastr	10 brill
0 routine	3	4	5	6	7	8	9	10	11	12	13
1 easy	2	3	4	5	6	7	8	9	10	11	12
2 stand.	1	2	3	4	5	6	7	8	9	10	11
3 engage.	0	1	2	3	4	5	6	7	8	9	10
4 chall.	0	0	1	2	3	4	5	6	7	8	9
5 diff.	0	0	0	1	2	3	4	5	6	7	8
6 formid.	0	0	0	0	1	2	3	4	5	6	7
7 stren.	0	0	0	0	0	1	2	3	4	5	6
8 arduous	0	0	0	0	0	0	1	2	3	4	5
9 hercul.	0	0	0	0	0	0	0	1	2	3	4
10 epic	0	0	0	0	0	0	0	0	1	2	3
11 mythic	0	0	0	0	0	0	0	0	0	1	2
12 mythic	0	0	0	0	0	0	0	0	0	0	1

Hope that's not too hard to read. In both this table and the next one, the Base is 3. This is a default base; adjusting this will shift the values in the table right

or left. As can be seen, the only way to achieve an ATC better than 13 is have an increased base, or modifiers for a very easy trial.

Armed with a table of ATCs and a table of cumulative chance for success, we can combine the two to show the percentage chance of success given Base, Rank, and Difficulty:

	0 none	1 init	2 versd	3 prof	4 pract	5 accom	6 exper	7 refin	8 exprrt	9 mastr	10 brill
0 routine	30.0	40.0	50.0	60.0	70.0	80.0	90.0	99.9	100.0	100.0	100.0
1 easy	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	99.9	100.0	100.0
2 stand.	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	99.9	100.0
3 engage.	0.1	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	99.9
4 chall.	0.1	0.1	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0
5 diff.	0.1	0.1	0.1	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0
6 formid.	0.1	0.1	0.1	0.1	10.0	20.0	30.0	40.0	50.0	60.0	70.0
7 stren.	0.1	0.1	0.1	0.1	0.1	10.0	20.0	30.0	40.0	50.0	60.0
8 arduous	0.1	0.1	0.1	0.1	0.1	0.1	10.0	20.0	30.0	40.0	50.0
9 hercul.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	10.0	20.0	30.0	40.0
10 epic	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	10.0	20.0	30.0
11 mythic	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	10.0	20.0
12 mythic	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	10.0

This table shows the percentage chance to achieve a marginal success or better, given the Base, Rank, and Difficulty shown.

Example: attribute trial vs. intelligence (5)

Base is 3, rank is 5, and lets set difficulty to "engaging" (5). The ATC is 3, and the chance of success is 30%. Referring to the previous tables, you have a 0.147% chance to get a Catastrophic Failure, and a 0.00054% chance to get a Mythic Success.

Any comments? Any glaring errors or miscalculations? The last table, IMO, provides a good tool for evaluating how "good" a particular attribute or expertise level is, as well as a tool for the MythGuide to set the difficulty of a task.

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Converted to HTML 27 February 1996 by Sixten Otto (sixten.otto@dartmouth.edu)