

Fallout: Shelter

A Game Mechanics Analysis

Aron Rindstedt Max Block

August 12, 2015

Introduction

- Postapocalyptic mobile game
- You control a shelter full of dwellers
- One thing dwellers can do is scout
- Scouts retrieve bottlecaps and items
- Scouts face deadly challenges

Character Stats



- SPECIAL stats
($\in 1..10 + \text{bonus}$)
 - ▶ Strength
 - ▶ Perception
 - ▶ Endurance
 - ▶ Charisma
 - ▶ Intelligence
 - ▶ Agility
 - ▶ Luck
 - ▶ Bonus from armour (blue)
- Level (assumed to be discrete)
- Happiness (assumed to be insignificant)
- Weapon damage

Goal

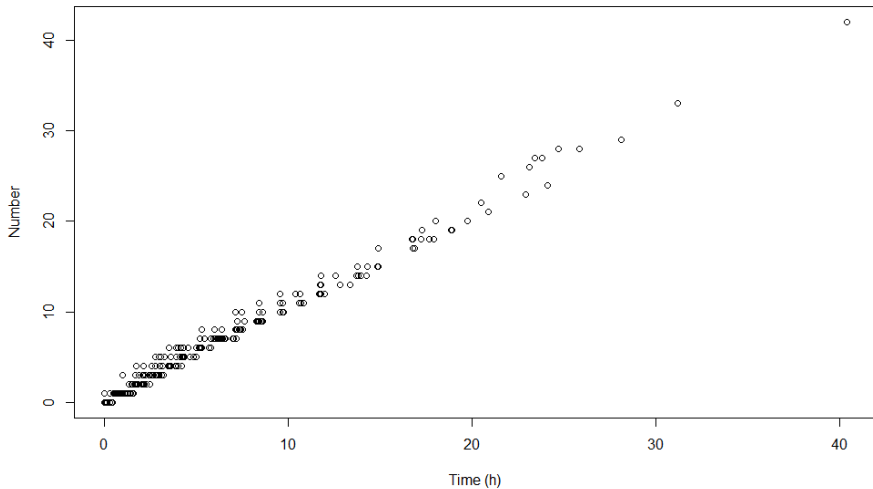
- We wanted to know what determined how fast a scout found items and bottlecaps
- We performed a linear analysis and looked at the p-values
- The goal is to figure out if some dwellers are better scouts than others

Items Per Hour

Table: Number of items per hour

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	1.290960	0.771921	1.672	0.0959
level	-0.021353	0.017178	-1.243	0.2152
dmg	-0.060882	0.057463	-1.059	0.2906
s	-0.003986	0.055532	-0.072	0.9428
p	-0.079242	0.095350	-0.831	0.4069
e	0.031539	0.070731	0.446	0.6561
c	-0.057148	0.091382	-0.625	0.5324
i	0.324587	0.335993	0.966	0.3351
a	0.214665	0.133610	1.607	0.1096
l	0.042945	0.073570	0.584	0.5600

Items Per Hour



Caps Per Hour

Table: Average number of caps per hour

	Estimate	t value	Pr(> t)	
(Intercept)	83.81787937	11.63356	<2e-16	***
s	-0.21649106	-0.43309	0.665802	
p	0.61211724	0.91113	0.364235	
e	-0.88781188	-1.67151	0.097489	.
c	-0.18453188	-0.31035	0.756888	
i	0.19836365	0.35132	0.726024	
a	-0.04815488	-0.08799	0.930043	
l	13.48815469	26.55579	<2e-16	***
start.level	-0.68088744	-4.25171	0.00004495	***
start.damage	-1.56703535	-1.97083	0.051278	.
level.increase	-3.44085855	-1.97599	0.050683	.
death.damage	0.30906873	0.88693	0.377067	

Conclusions

- Difficult to determine what affects items found. Two p-values stand out, but are still bad.
 - ▶ Intercept has p-value 0.096
 - ▶ Agility has p-value 0.11

Conclusions

- Difficult to determine what affects items found. Two p-values stand out, but are still bad.
 - ▶ Intercept has p-value 0.096
 - ▶ Agility has p-value 0.11
 - ▶ Probably constant, but we need more data to be sure.

Conclusions

- Difficult to determine what affects items found. Two p-values stand out, but are still bad.
 - ▶ Intercept has p-value 0.096
 - ▶ Agility has p-value 0.11
 - ▶ Probably constant, but we need more data to be sure.
- Caps found determined by Luck (p-value $<$ machine ϵ). There's also a base value (intercept).
 - ▶ Also a small but clearly negative correlation with level, hard to tell why this is.

- Scouts face a variety of threats.
- Threats can deal damage both as lost hit points and radiation, too much of either results in death.
- Death is nonpermanent but expensive.
- By calculating the expected time of death for a scout we can choose how long we dare to let our scouts roam.

Summary: Survival Time

Table: Survival time

	t value	Pr(> t)	
(Intercept)	-1.7983755246	0.074911	.
s	2.4166724012	0.017339	*
p	0.9644124169	0.336994	
e	7.6484812878	9e-11	***
c	0.6092526555	0.543637	
i	1.9626433352	0.052260	.
a	1.0647793211	0.289351	
l	-5.9440869849	3e-7	***
start.level	12.3797838804	<2e-16	***
start.damage	4.1308435539	7e-4	***
level.increase	6.4636998849	3e-8	***
caps	6.2586709017	8e-8	***
death.damage	0.7153117136	0.475960	

Survival: Tested Models

- The best p-values among the controllable variables belong to endurance, luck, level, and starting damage.
- Selected models
 - ▶ Linear model over all four
 - ▶ Higher order polynomial models over (exactly) one predictor
 - ▶ Random forest

Survival: Performance

- Since we only have limited data, error values vary, but the order is largely consistent.
- We used squared logarithmic errors.
 - ▶ Linear : 0.02197829
 - ▶ E-squared : 0.02410209
 - ▶ L-squared : 0.02410209
 - ▶ Level-squared : 0.02410209
 - ▶ E-cubed : 0.02469169
 - ▶ L-cubed : 0.02469169
 - ▶ Level-cubed : 0.02469169
 - ▶ Random forest : 0.04621143

Survival: Performance

- Linear data summary

Table: Coefficients

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	-0.666776	0.423767	-1.573	0.120256	
e	0.152480	0.042116	3.621	0.000561	***
l	0.067931	0.041358	1.642	0.105105	
start.level	0.144418	0.009735	14.834	< 2e-16	***
start.damage	0.374476	0.056063	6.680	5.33e-09	***

Survival: Conclusions

- A rough guess for the survival time of a given scout appears to be $(0.15(e + level) + 0.4 \cdot damage)$ hours.
- More research might be useful, especially into why starting damage apparently increases survival time.
-

Any questions?