Using Markov Chain Simulation to Measure the Eternal Impact of Personal Evangelism

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Jesus' parting words to His disciples

"You will receive power when the Holy Spirit has come upon you; and you shall be My witnesses both in Jerusalem, and in all Judea and Samaria, and even to the remotest part of the earth."

Acts 1:8 (NASB)

Are we greatly committed?

- Between 3 and 5 percent of all Christians share their faith, or the Gospel message, with non-Christians. (McRaney, 2003)

- What eternal difference does our collective disobedience make?

- How much would it help if we increased the intensity of our evangelism efforts?

Basic Markov chain model of a person's spiritual condition

Transient states : L, RG

Absorbing states : CH, HV

One - step transition probability matrix :

$$\mathbf{P} = \begin{pmatrix} 1 - p_{L,RG} - p_{L,CH} & p_{L,RG} & p_{L,CH} & 0 \\ 0 & 1 - p_{RG,HV} & 0 & p_{RG,HV} \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

Evaluation of the basic model

◆ Can the supernatural work of the Holy Spirit by represented by a simple mathematical model of chance?

◆ Assumptions:

■ Markov assumption: The next state depends only on the current state. (*One's spiritual history is not considered.*)

■ Stationarity (time invariance) assumption: The one-step transition probabilities do not change over time. (*A senior is just as likely to convert as a pre-adolescent is.*)

State transitions over time

The rows of $\mathbf{P}^{(k)}$ give the probabilities of being in each state after k time periods (months), given an initial state.

What is the probability that a lost person is converted in 5 years (60 months) or less?

Hell-to-heaven odds ratio

After k months : $\dfrac{p_{L,CH}^{(k)}}{p_{L,HV}^{(k)}}$

Best (limiting) case : $\dfrac{p_{L,CH}}{p_{L,RG}}$

God's desire : 0 (2 Peter 3:9)

Spiritual condition finality measure

$$p_{L,L}^{(k)} = 1 - p_{L,RG}^{(k)} - p_{L,CH}^{(k)} - p_{L,HV}^{(k)}$$

$p_{L,L}^{(k)}$ indicates how likely it is that a person's eternal destiny may still be impacted by personal evangelism efforts.

(This is an indirect measure of finality.)

Markov chain simulation

- An Excel® spreadsheet was developed to simulate spiritual-condition transitions in the Markov chain model over time.

- A simulated time period is one month.

- Results (transition matrix, odds ratio, spiritual condition finality measure) are reported for:
  - Selected numbers of months, up to 100 years.
  - An infinite number of months.

Purely hypothetical example: Case 1

$$p_{L,RG} < p_{L,CH}$$

$$\mathbf{P} = \begin{pmatrix} 1 - 2000^{-1} - 800^{-1} & 2000^{-1} & 800^{-1} & 0 \\ 0 & 1 - 800^{-1} & 0 & 800^{-1} \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

Simulation results – Case 1

Months	Pr(CH)	Odds ratio	Finality
2	0.00250	3996.50	0.99650
6	0.00747	799.70	0.98955
12	0.01486	363.78	0.97920
24	0.02940	174.25	0.95883
60	0.07126	68.25	0.90024
180	0.19315	22.87	0.72959
600	0.46456	7.34	0.34962
1200	0.62698	4.18	0.12223
∞	0.71429	2.50	0

Purely hypothetical example: Case 2

$$p_{L,RG} > p_{L,CH}$$

$$\mathbf{P} = \begin{pmatrix} 1 - 780^{-1} - 800^{-1} & 780^{-1} & 800^{-1} & 0 \\ 0 & 1 - 800^{-1} & 0 & 800^{-1} \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

Simulation results – Case 2

Months	Pr(CH)	Odds ratio	Finality
2	0.00250	1558.03	0.99494
6	0.00745	311.60	0.98490
12	0.01479	141.63	0.97003
24	0.02914	67.74	0.94097
60	0.06966	26.41	0.85889
180	0.18088	8.73	0.63359
600	0.38582	2.72	0.21846
1200	0.47011	1.53	0.04772
∞	0.49367	0.975	0

Modeling the intensity of personal evangelism efforts

α is a measure of evangelistic intensity.

The status quo is $\alpha = 0$.

$$\mathbf{P} = \begin{pmatrix} 1 - p_{L,RG}(1+\alpha) - p_{L,CH} & p_{L,RG}(1+\alpha) & p_{L,CH} & 0 \\ 0 & 1 - p_{RG,HV} & 0 & p_{RG,HV} \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

Simulation results – Pr(CH) – Case 1

Months	α = 0	α = 0.25	α = 1	α = 19
12	0.01486	0.01485	0.01482	0.01411
24	0.02940	0.02936	0.02924	0.02642
60	0.07126	0.07100	0.07023	0.05475
120	0.13540	0.13443	0.13158	0.08253
240	0.24514	0.24176	0.23200	0.10376
600	0.46456	0.45046	0.41175	0.11099
900	0.56663	0.54354	0.48239	0.11111
1200	0.62698	0.59655	0.51833	0.11111
∞	0.71429	0.66667	0.55556	0.11111

The spiritual decision process and the Engel scale

Stage	Description
-8	Awareness of Supreme Being only.
-7	Initial awareness of the Gospel.
-6	Awareness of Gospel basics.
-5	Understand Gospel implications.
-4	Positive attitude toward Gospel.
-3	Recognition of personal problem with sin.
-2	Decision to act.
-1	Repentance and faith in Christ.
0	Regeneration.
+1, etc.	Spiritual growth to maturity.

A more interesting model?

- Rainer's faith stages of the unchurched (2003):
  - U5: Antagonistic toward the Gospel/church. (5%)
  - U4: Resistant toward the Gospel/church. (21%)
  - U3: Neutral toward the Gospel/church. (36%)
  - U2: Receptive toward the Gospel/church. (27%)
  - U1: Very receptive toward the Gospel/church. (11%)
- Rainer estimates that there are 160 million unchurched persons in the U.S.
- Time is measured in Gospel encounters.

MC matrix for Rainer scale example (U5,…,U1, RG, CH, HV)

0.949	0.0008	0.0002	0	0	**0**	0.05	0
0.0015	0.9765	0.0015	0.0005	0	**0**	0.02	0
0.0005	0.0025	0.984	0.0025	0.0005	**0**	0.01	0
0	0.005	0.025	0.937	0.025	**0.005**	0.003	0
0	0	0.001	0.002	0.746	**0.25**	0.001	0
0	**0**	**0**	**0**	**0**	**0.999**	**0**	**0.001**
0	0	0	0	0	**0**	1	0
0	0	0	0	0	**0**	0	1

Hell-to-heaven odds ratios for example based on Rainer scale

Times	U5	U4	U3	U2	U1
2	undefined	undefined	undefined	1237	7.05
4	6.282 E9	5929408	74488	252	2.22
10	73061973	250078	7310	57.4	0.672
20	6293116	39506	1894	26.6	0.319
50	363682	5365	418	13.7	0.155
100	58455	1499	156	9.01	0.0994
500	4185	160	22.8	2.46	0.0290
1000	2293	89.5	12.9	1.49	0.0180
∞	1352	53.3	7.71	0.928	0.0113

Conclusions

- A Markov chain model helps quantify the urgency, not the outcome, for personal evangelism.

- Estimating the transition probabilities in such a model is a challenge that can be addressed.

- A substantial increase in evangelistic intensity is needed to make a significant eternal difference, and it would.

- Extensions and embellishments of the basic model are possible. (More spiritual states; discipleship.)

Conclusions (cont'd.)

- There is much greater urgency to reach U5s than there is to reach U1s and there is much less "time" to do so.

- The Apostle Peter's words have never been more appropriate:

  - *Sanctify Christ as Lord in your hearts, always being ready to make a defense to everyone who asks you to give an account for the hope that is in you, yet with gentleness and reverence.*

    1 Peter 3:15 (NASB)