Forever Minus a Day? Some Theory and Empirics of Optimal Copyright

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Unprecedented Level of Change and Debate

- Massive, rapid technological change
- Term Extension in Many Countries in Last 15 Years
  - US (CTEA) 1998
  - EU (Term Directive) 1995
  - EU: Extension for recordings currently under consideration
- Unauthorised Copying and TPMs
  - WIPO 1996, US (DMCA) 1998, EU (EUCD) 2001
  - EU (Term Directive) 1995
  - Nevertheless continuing wide-scale unauthorised reproduction

Basic Question: How do we regulate copyright to maximize welfare?

Our Focus Here

- What's the impact of technological change?
  - Does a digital environment require stronger or weaker copyright?
- Should the optimal level of copyright fall or rise over time?
- How long should copyright term be?
  - The 'Forever Minus a Day' of Jack Valenti
  - The original 14 years of the UK and US
  - Less? More? ...

Framework and Results

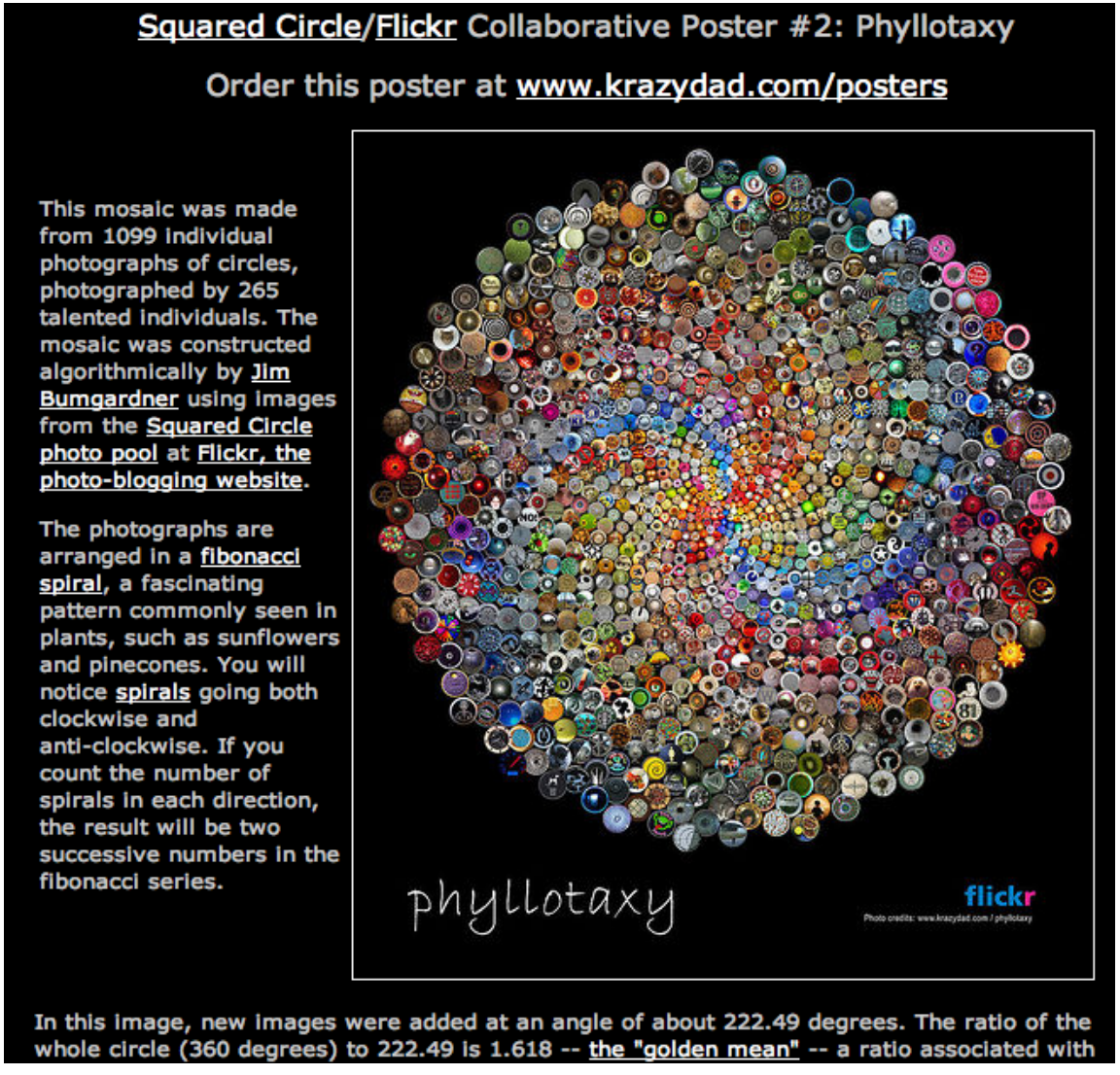
Framework

- Copyright level/strength: S
  - Breadth (narrowness of exceptions)
  - Length
  - Enforcement
- Number of Works: N
  - Function of copyright level: $N = N(S)$
  - Increasing copyright increases works: $N' = N_S > 0$
  - (At least up to some level)

Framework

- Total welfare W, a function of N, S: $W = W(N, S)$
- S affects welfare we get from a given number of works
  - More copyright (N constant) reduces welfare: $W_S < 0$
- $W'(S)$: marginal change in welfare with increase in copyright:
  - (+) Extra welfare from new works: $W_N N_S$
  - (-) Lower welfare from existing works: W_S
- The classic copyright trade-off
- Optimal S where $W'(S) = 0$

Technological Change and Costs of Production


Squared Circle/Flickr Collaborative Poster #2: Phyllotaxy
Order this poster at www.krazydad.com/posters
This mosaic was made from 1099 individual photographs of circles, photographed by 265 talented individuals. The mosaic was constructed algorithmically by Jim Bumgardner using images from the Squared Circle photo pool at Flickr, the photo-blogging website.
The photographs are arranged in a fibonacci spiral, a fascinating pattern commonly seen in plants, such as sunflowers and pinecones. You will notice spirals going both clockwise and anti-clockwise. If you count the number of spirals in each direction, the result will be two successive numbers in the fibonacci series.
phyllotaxy
flickr
In this image, new images were added at an angle of about 222.49 degrees. The ratio of the whole circle (360 degrees) to 222.49 is 1.618 -- the "golden mean" -- a ratio associated with

- Introduce 'production' costs
- Number of works produced now: $N = N(C, U, S)$
  - C: cost of 'originals' (includes first copy, authorised reproductions and distribution)
  - U: cost of 'copies' (unauthorised reproductions)
  - $N_C < 0, N_U > 0$
  - Note: v. general – no explicit functional forms needed
- Existing work tends to focus on U
- However changes in C often as significant as those in U

Change in Cost of Originals Only

- First: look at changes in C with U unchanged
- Basic result (Prop 9): (usually) increase in costs implies increase in copyright level
- Conversely, drop in costs imply reduction in copyright level
- Why?

- Increase in production costs results in:
  - Reduction in costs of copyright (d/w losses lower)
  - Fewer works so marginal value of new work rises
- But need to be careful:
  - Increase in costs also reduces welfare value of a new work
- Usually expect first two effects to outweigh last
  - An increase in costs has more (relative) impact on production than on welfare
  - But can construct examples going other way

Technological Change

- Changes in cost of 'originals' only half the story
- Usually changes in C correlated with changes in cost of producing unauthorised copies
- 'Technological Change': $T, C_T < 0, U_T < 0$
- Does technological change imply increase or decrease in copyright level?

Technological Change (contd)

- More ambiguous as production may go up or down:
  - (+) $T \uparrow \Rightarrow C \downarrow \Rightarrow N \uparrow$
  - (-) $T \uparrow \Rightarrow U \downarrow \Rightarrow N \downarrow$
  - N_T: ??
- BUT: appears N has increased over last 15-20 years
- So may assume: $N_T > 0$
- Then back to similar situation as with pure changes in C
- Prop 10: Technological change which reduces costs implies reduction in level of copyright

Copyright Term

Copyright Term: Theory

- Aim: get a formal expression for marginal welfare in terms of variables we can estimate
- Optimal term S given by $W'(S) = 0$
- Introduce discount factor $d(t)$ and cultural decay $b(t)$
  - Cultural decay governs how demand for a work evolves from release
  - Revenue in year t after release = $b(t)r(0)$
  - PV of that revenue at point of creation = $d(t)b(t)r(0)$

Copyright Term: Theory

- Recall basic trade-off when increasing copyright:
  - (+) Extra welfare from new works
  - (-) Lower welfare from existing works
- Working through the analysis (details in paper)
- $W'(S) \propto \underbrace{y(n)s(n)d(S)C_1}_{\text{Extra welfare from new works}} - \underbrace{\overline{z}(n)}_{\text{Extra d/w loss}}$
  - $n =$ works produced per year
  - $y(n) =$ welfare from nth work (marginal welfare per work)
  - $\overline{z}(n) =$ Average deadweight-loss on works $1 \cdots n$
  - $s(n) =$ Elasticity of supply wrt revenue when n works
  - $C_1 =$ a constant (dependent on d, b but not S)

Copyright Term: Empirics

- $\theta(n) =$ Ratio of avg. d/w loss to marginal welfare $= \frac{\overline{z}(n)}{s(n)y(n)}$
- Then optimal term S is solution of $d(S)C_1 = \theta(n)$
- Discount rate: 4-9% with default of 6%
- Cultural decay: 2-9% with default of 5%
  - Source: data from UK recording industry cited by Gowers
  - Source: Nielsen sales data for books in UK
  - More discussion in paper

Copyright Term: Empirics

- $\theta(n)$ usually the problem because demand data is scarce
- Use following strategy:
  - Ratio of d/w loss to welfare under copyright *on a given work* is constant $= \alpha$
    - Literature: $\alpha \in [0.05, 0.2]$ (use 0.12)
  - Assume welfare distbn over works follows sales distbn
  - Existing literature suggest sales distbn for copyright goods follows a power law (total sales of top j works $\propto j^{\gamma}$)
    - Literature: $\gamma \in [0.048, 0.166]$ (best est. 0.129)
  - $\Rightarrow \theta(n)$ is scale-free $= \frac{\alpha}{\gamma}$

Copyright Term: Empirics

- Solve for optimal term S using $d(S)C_1 = \theta \Rightarrow$
- **Optimal Term of just over 14 years**
- Check robustness to varying parameter values

Cultural Decay Rate (%)	**Discount Rate (%)**	α	**Optimal Term**
2	4	0.05	51.51
3.5	5	0.07	30.13
5	6	0.1	17.36
6.5	7	0.15	8.06
8	8	0.2	2.82

Concluding Remarks

Review of Results

- Simple framework to address optimal copyright questions
- Look at two main applications
- What happens as technological change reduces costs
  - Highlight that tech change affects costs of both ‘originals’ and ‘copies’
  - In general will be ambiguous due to contrary effects from ‘originals’ and ‘copies’
  - However given that output has gone up implies reduction in copyright level more likely

Review of Results (2): Copyright Term

- Simple analytical expression that is empirically estimable
- Using plausible parameters optimal term was 14 years
- Reasonably robust to varying parameters
  - Obviously (optimal) term did vary with input variables
  - But: most potential terms substantially below current levels

Policy Implications

- Technological change
  - General: danger of partial analysis
  - Not clear digital environment requires stronger copyright
  - Implications for debate about merit of TPMs
- Copyright term
  - Current terms are too long
  - Should be extremely wary about extending term
- Clear need for more work to obtain/improve parameter estimates