

SOFTWARE RELEVANCE

This document is an appendix to *Pedagogical Outlook and Research Plan*, concerned narrowly with alternative software for the project. **Data** is provided to explain:

- **Why** my code is relevant in view of freely available alternatives.
 - **How** it is comparatively efficient, with a greater scope:
 - ✓ **including** alternatives materialising virtually *ex nihilo* in terms of online accessibility/visibility recently.

In summary, emphasis of my pedagogical project is on learning Game Theory, and related principles, by constructing software. It distinguishes itself from use of a 'complete-package' – as a manner of speaking – by engaging backend, but with 'frontend' applications. Accessible free online software has been of limited scope until one project appeared virtually *ex nihilo*, quite recently, in terms of visibility on the web (see Data below). Notwithstanding, my code stands firm also in view of this commensurable software, which may readily be seen as complementary. Indeed, it is a windfall gain advancing my project. The Data section below provides figures and graphs. Please visit my [homepage](#) for additional information.

Supply-side conditions have so far been favourable for embarkment on a pedagogical outlook based on universal solvers for Game Theory. Although *free and accessible online software* is a generous contribution to the community, their *scope has mostly centred on 2-person games or other special cases over the years*. Moreover, leading mathematical software have not included Nash-equilibrium modules in their Economics packages.

In addition, fresh theoretical contributions on Nash-Equilibria computation in mathematical journals underscore foundational research appeal. Furthermore, social-science curriculums in Sweden and elsewhere, are not by any means known to be satiated with pedagogy based on coding universal solvers or anything similar. Data below is not in conflict with this latter assertion, especially regarding Swedish curriculums.

THE EX-NIHILO ALTERNATIVES

Algorithms for computing Nash Equilibria have been around for decades (Lemke, 1964; Halpern, 2008), curriculums based on such software usually have not. Recently, n-player m-strategy Excel-software¹, by Sugiyama and Leoneti (2021), was advertised but it is not available online. However, their software assessment underscores the actuality of a project based on universal solvers. The most ambitious one on their list is *GamePlan* by *Langlois* which solves a wide variety of games under different information settings². As such it serves as delimitation benchmark to 'complete-package' software.

Although presumably decades old with capabilities comparable to the rest of the alternatives combined, data indicates that it is a recent phenomenon in terms of online accessibility and visibility. Data in the next section shows that this ambitious software (*GamePlan*) is conspicuously invisible on the most frequently used engines of the web, and so is its associated developer who appears to be missing, in important regards.

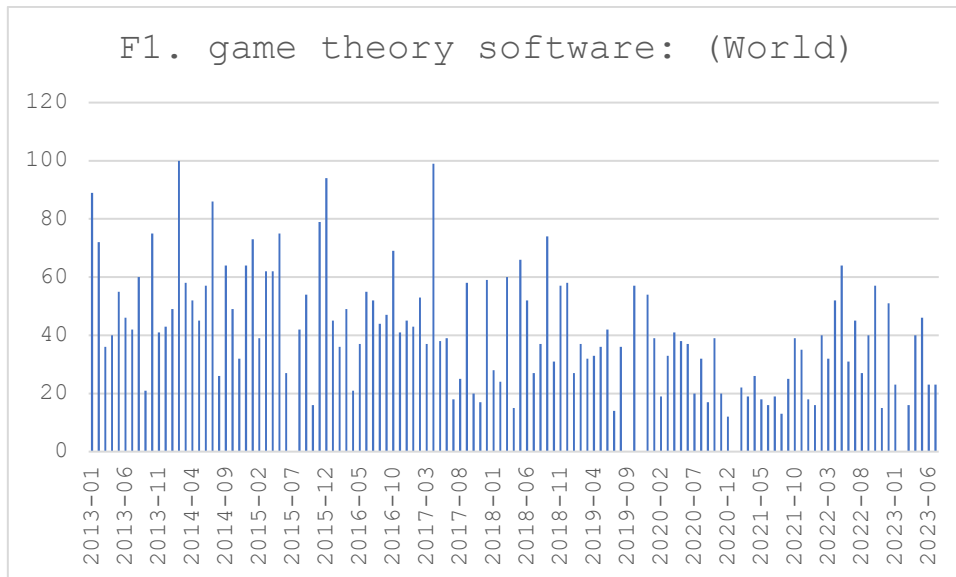
Moreover, its user-friendly interface has some disadvantages. Pointing-and-clicking is required both when constructing extensive and normal-form games. Such software cannot readily be used to e.g. generate and solve hundreds of games from heterogenous distributions (not necessarily independent, obviously), at its current state. Furthermore, there are associated practical restrictions on the number of players and strategies; and it currently is unclear how to integrate it with other platforms to make use of a more general set of mathematical procedures. To appreciate how these points diverge from my Pedagogical Outlook, and constrain research, please consult [Footnotes on The Foundations of Game Theory](#).

¹ **Please note** that although I provide some data in Excel-format along with Footnotes on *the Foundations of Game Theory*, my code has nothing to do with it.

² The games I have checked were successfully solved with *GamePlan*, no objections so far.

DATA

This section provides data for evaluation of online supply and demand as part of a routine market assessment; including quality and authenticity. Game-Theory software has a rather stable search-history cycle over the past decade around the world. However, corresponding searches on Swedish sites are too few to register on Google Trends. ³

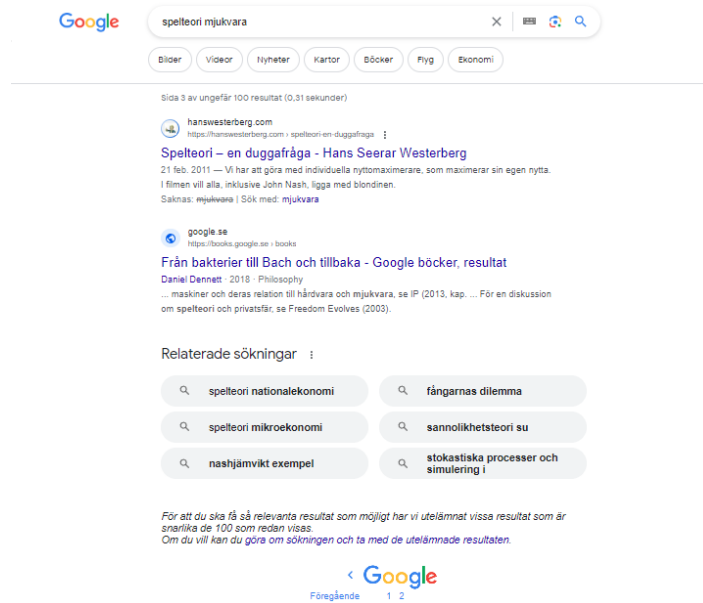


Typically, only introductory courses are in Swedish at the Economics departments. There are no traces of a separate domestic pedagogical culture generating associated traffic which would upset the lasting impression of its absence over the years.

This is consistent with supply-side indicators, such as Swedish sites associated with game-theory software over the years. According to Google, ~86.9 billion searchers are made per month; 9/10 internet users depend on it; for demand of goods and services especially.

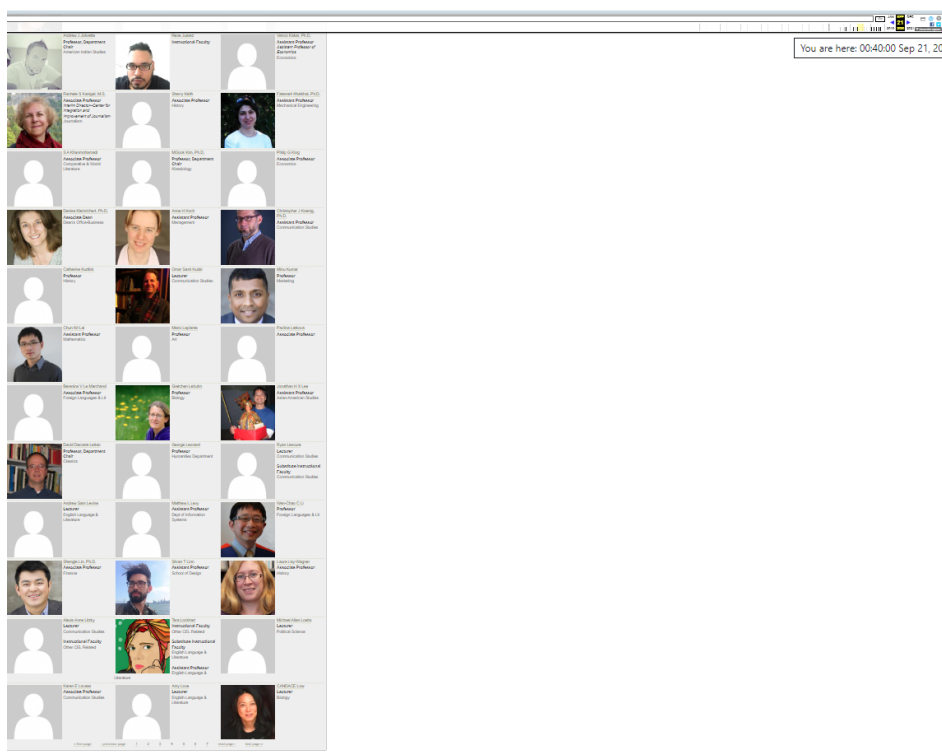
Only a handful results have anything to do with Economics.

³ Data to all graphs and other empirical assertions are downloadable [here](#).



Only two courses with code related to Economics were found with alternative searches. Their scope resembles what is to be found at the international scene, commonly revolving around 2-player games.

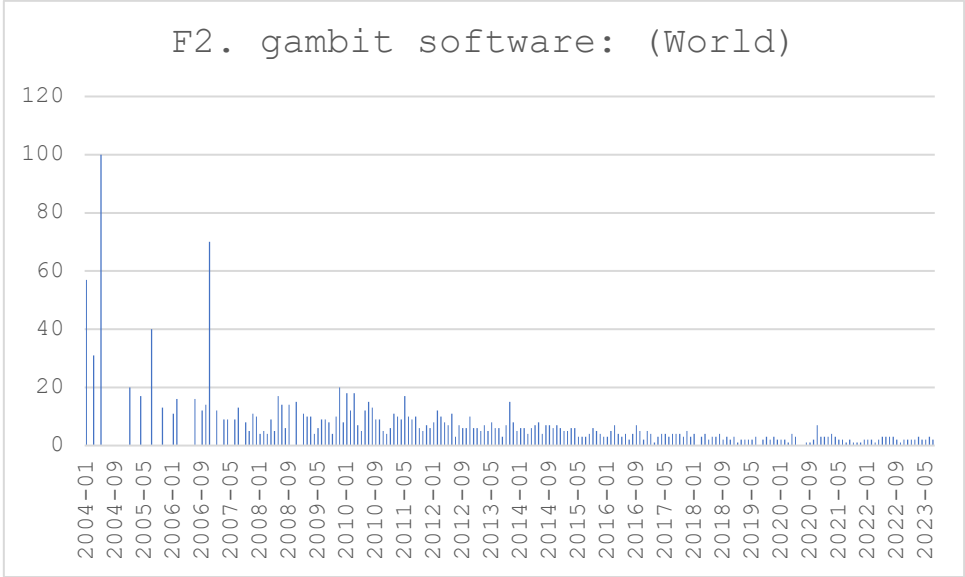
Online interest on specific software entails similar contrasts. The *GamePlan* software is invisible on the supply side. To begin with, its author Jean-Pierre Langlois is absent from historical records of San Francisco State University staff, where he supposedly has been active over the years.



In contrast, Gambit’s history is well-documented since 2010, with numerous relevant results at regular search engines.



Searches have been recorded since 2004. Notice that this is a focused search, e.g. not displaying a recent spike attributable to a certain popular chess-series. Both software have intersecting keywords with unrelated things, GamePlan in particular.




The findings so far: The perhaps most comprehensive and ambitious project appears to have emerged virtually ex nihilo, on the web, according to the most used engine. Robustness checks do not alter the picture.

Historical archive searches indicate GamePlan is visible for most people in the 20s, not earlier. Moreover, associated developer name and homepage is absent historically until recently. The exact reason of this elusiveness remains an equally evasive question, but assuredly is remarkable. However, the implications for my enterprise are straightforward. It is a windfall gain which secures the viability of my project at all levels, as GamePlan is an excellent tool for beginners with its colourful pedagogical interface. Notwithstanding, its usefulness for more advanced students cannot be overlooked, especially now that it has become open source. Time will tell if it relies on code suitable for learning theoretical principles, or if it is an application of common algorithms leaning towards the brute-force side.

As a corollary, Carbon dating of related papers point in a similar direction (see data online). I would also like to assert searches were made on a comprehensive academic engine (Lund University's LUBsearch), with similar meagre results. But considering the popup character of certain software, the intrusiveness of mine and perhaps others lately, may induce evident perturbations of the picture. The essence of the web is interactive after all, which naturally renders it suspectable to more or less discernible and not exclusively intentional alterations, influencing perceptions over time.

Discovery ePublications Databases A-Z Settings My Folder Folder My Loans Help Library chat

Press F11 to exit full screen

 **LUBsearch** Discovery
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Langlois GamePlan Search

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No results were found.

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SUMMARY: INVISIBLE SUPPLY & DEMAND

Starting with the supply side, searches on *GamePlan* AND *Langlois*, and related Google searches, give a meagre number of actual results, but only a handful are relevant. This remains true when omissions are included, as these either are irrelevant or mirrors.

The only direct references in university sites found were a San Francisco State University homepage, and one LSE document. The former supposedly is Jean-Pierre Langlois' mathematics course employing *GamePlan*. However, this homepage cannot be found at the Internet Archive before the 20s when searching the staff homepage – Langlois is simply missing (see pictures). A link to the actual software cannot be found at the IT-Archive before July 22. Game Theory Society is however an honourable mention with a link, unclear from when.

The demand side was checked with *Google Trends*. Overall, Game Theory software was much more searched in the 00s, but with quite stable cycles over the past years. This may partly reflect diffusion of knowledge of a set of novelties with dampening cycles which stabilise eventually, in contrast to e.g. holidays exhibiting exploding cycles with network growth over the decades. *Gambit* AND *software* is visible on Google Trends in a manner consistent with results on Google searches. In contrast, Trend-searches on *GamePlan* And *software* (and similar) yield no observable results⁴.

These and other findings below are in line with more informal perceptions of the social-science curriculums around the world over the years, Economics in particular. As stated above, also indicative of the online *invisibility* of more ambitious Game Theory software, commensurable with my project, until recently. This is in sharp contrast to software such as *Gambit*, with plenty of results and historical entries at the Internet Archive.

⁴ *Software* is a fairly international term, also common in other European languages. *Logiciel* was used to cover French demand. Variations of search terms and browsers were used and repeated on different days to check robustness, with invariant results.

In summary, there is one software freely available online with rather ambitious scope, namely *GamePlan*. It works, is a good complement for my purposes, but has been *conspicuously invisible* online. It has some limitations at its current state, but became open source recently.

Finally, it is important to underscore that alternatives reviewed so far do not emphasize code particularly suitable for pedagogical purposes backend, to learn principles, before 'frontend' applications of theory.

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